Greater Wellington
Te Pane Matua Taiao

9 July 2026

File Ref: OIAPR-1274023063-53309

[redacted]
By email: [redacted]

Tēnā koe [redacted]

Request for information 2026-284

I refer to your request for information dated 1 July 2026 which was received by Greater Wellington Regional Council (Greater Wellington) on July 2026. You have requested the following:

"*Has there been any monitoring of migratory fish passing through the Geoffrey Blundell Barrage Gates at Lake Wairarapa since 2000? f the e has, can you tell me where I can find more information on these?"*

"*Has there been any monitoring or surveys of migratory fish in Wairarapa Moana since 2000*?

"*Have any fish passages o her than the original one, been constructed at the Geoffrey Blundell Barrage Gates since they were constructed?*

Are there set times during the day and throughout the year when the Geoffrey Blundell Barrage Gates are open?"

Greater Wellington's response follows:

Your equest has been assessed under the Local Government Official Information and Meetings Act 1987 (the Act).

Has there been any monitoring of migratory fish passing through the Geoffrey Blundell Barrage Gates at Lake Wairarapa since 2000? If there has, can you tell me where I can find more information on these?"

Yes. Monitoring of fish passage at the Barrage Gates was undertaken in 2001 and 2002 and reported on by NIWA (now Earth Sciences New Zealand) in 2003. The report "*Monitoring of fish movements at the Lake Wairarapa Barrage Gates*" is provided with this response.

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Has there been any monitoring or surveys of migratory fish in Wairarapa Moana since 2000?

Yes. There have been several fish surveys undertaken in environments within Wairarapa Moana for a variety of purposes since 2000. Example reports of these surveys can be found https://www.waiwetlands.org.nz/fish-research. Note some surveys have targeted non-migratory fish.

Additional fish survey information can be found in NIWA's National Freshwater Fish Database: https://niwa.co.nz/freshwater/nz-freshwater-fish-database

Have any fish passages other than the original one, been constructed at the Geoffrey Blundell Barrage Gates since they were constructed?

No.

Are there set times during the day and throughout the year when the Geoffrey Blundell Barrage Gates are open?

Yes. When all of the six Barrage Gates are closed, to help facilitate passage of migratory fish species during key migratory periods, two seasonal gate opening regimes are implemented, summarised as:

- During Spring (1 September to 30 November) each lateral gate is opened for one hour at high tide to help facilitate upstream fish passage
- During Summer/early autumn (15 December to 31 March) each lateral gate is opened for one hour at low tide to help facilitate downstream fish passage.

However, the above openings for fish passage may be overridden if there is a risk of flood.

Ultimately, the operation of the Barrage Gates is largely driven by the water levels in Lake Wairarapa, the Ruamāhanga River immediately downstream of the Barrage Gates, the Ruamāhanga River at Waihenga bridge, Lake Ōnoke and the state of the Lake Ōnoke opening.

A copy of the Barrage Gates operation regime is provided with this response.

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If you have any concerns with the decision(s) referred to in this letter, you have the right to request an investigation and review by the Ombudsman under section 27(3) of the Act.

Please note that it is our policy to proactively release our responses to official information requests where appropriate. Our response to your request will be published shortly on Greater Wellington's website with your personal information removed.

Nāku iti noa, nā

Jack Mace
Kaiwhakahaere Matua Taiao | Acting Group Manager Environment

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NIWA

Taihoro Nukurangi

Monitoring of fish movements at the Lake Wairarapa barrage gates

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NIWA Client Report: CHC2002-038
March 2003

NIWA Project: WRC03502

NIWA

Taihoro Nukurangi

Monitoring of fish movements at the Lake Wairarapa barrage gates

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Prepared for

Wellington Regional Council

NIWA Client Report: CHC2002- 038
March 2003

NIWA Project: WRC03502

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Reviewed by

Paul Sagar

Approved for release by:

Gavin James

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Executive Summary

Fish movements at the Lake Wairarapa barrage gates were monitored once weekly with trap nets set on either side of the channel both upstream and downstream of the gates for approximately one hour during high tide conditions for 12-weeks in spring (August-October 2001) and 8 weeks in summer (January-March 2002).

A summary of the results is as follows:

- For 10 species combined, a total of 4629 and 1964 fish and shrimp was captured during spring and summer, respectively, with galaxiids (*Galaxias* spp.), common smelt (*Retropinna retropinna*) and the common bully (*Gobiomorphus cotidianus*) comprising the bulk of the catch.

- Whitebait comprised a major proportion of the catch during spring, whereas smelt, followed by bullies, were the main species caught during summer.

- The monthly mean catch rates were highest for bullies in August and March, whitebait, glass eels, and mullet in September, rudd in October, and smelt in January and February.

- The mean catch rates were considerably greater downstream than upstream of the barrage gates, and also they were appreciably greater on the true right than the true left side of the outflowing channel; the catch rates increased when the gates were open (including the downstream positions), most probably because of the increased movement of fish.

- The movements of fish and shrimp were influenced by water clarity, with the catch per unit effort for most species generally being greater when the water was milky rather than dirty or clear; however, because of the high variability in the data, the differences in the catch with water clarity were not significant – the exceptions to this were those of smelt and galaxiids during summer.

Although sampling was limited to spring and summer, it is likely that fish movement in this system occurs year round, with the peak in spring and the low in winter. To allow for the seasonal movements of the diadromous complex of fish moving in and out of the lake, it is recommended that when lake levels and flows in the Ruamahanga River are appropriate, both lateral gates be open once weekly for approximately one hour (night or day) during high tide between 1 August and 31 May. To comply with the seasonal target levels set for the lake by the Lake Wairarapa Coordinating Committee, it may be necessary at times to restrict opening to one lateral (preferably the true right as it is preferred by fish) during 1 November to 31 May, the period of intermediate intensity of fish movement.

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1. Introduction

Lake Wairarapa provides extensive and diversified habitat for a variety of fish. Some 20 species of fish have been recorded from this wetland complex (Hicks 1993), with many of them being obligatorily diadromous and migrating between fresh water and the sea at certain times of the year to complete their life cycles. The lake supports valuable fisheries, including a commercial eel fishery and recreational whitebait, flounder, mullet and perch fisheries.

Since the diversion of the Ruamahanga River in the 1960s, which formerly flowed into Lake Wairarapa but now bypasses the lake, it is likely that fish recruitment into Lake Wairarapa has declined (Pike 1970). The water level in Lake Wairarapa is controlled through mechanical operation of six radial gates located in a barrage structure positioned across the lake outlet (Anonymous 1998). Although there is an orifice for fish passage under Gate No. 1, it is suspected that the opening is ineffective and the barrage, when all the gates are closed, is a barrier to fish movements.

To assess the effects of the barrage gates on fish movements into the lake, the Wellington Regional Council undertook to monitor fish movements both downstream and upstream of the gates when they were either open or closed or 50/50 during spring 2001 and summer 2002. The sampling of fish movements was coordinated and carried out by Dave Sim of the Wellington Regional Council, with assistance from the Department of Conservation. Upon completion of the monitoring phase of the study, the information gathered was handed over to NIWA for data analysis and preparation of a report on the findings.

2. Methods

2.1. Sampling nets

Four modified whitebait nets supplied by NIWA under contract to the Wellington Regional Council were used to monitor fish movements both downstream and upstream of the barrage gates. Each net was made of 1.5 mm mesh Nybolt netting, and was suspended in a galvanised steel frame approximately 1 m long and tapered, with the front end being 600 mm wide by 800 mm high and the back end 400 mm square. The funnelled entrance of each net tapered to a 100 mm diameter opening, set 400 mm back from the front face and 100 mm off the bottom. The cod end of the net extended beyond the steel frame and was tied to prevent fish from getting out. Each net had a short side panel ("wing") on either side at the front (200 mm long at 135° to the face of the net) covered with Nybolt netting to direct the fish into the net. A variable length

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leader (1-4 m long) made with the same Nybolt netting was usually attached to the side of the net nearest the bank so that the depth of the net fished on each occasion was roughly the same, as the water depth in the channel varied with the level of the tide and flow in the Ruamahanga River.

2.2. Fish monitoring procedures

The trap nets were set below and above the barrage gates on both sides of the channel at approximately high tide conditions for about one hour (during the day) once weekly during spring (between 2 August and 31 October 2001) and summer (between 24 January and 13 March 2002). It was assumed that incoming (high) tides would provide optimal catch, as fish tend to move upstream during these conditions. The number of times when the nets were set that the gates were open, closed, or 50/50 over both sampling seasons is summarised in Table 1; the number of occasions that the gates were open and closed amounted to 52% and 43% respectively, whereas for the remaining 5% the gates were open for approximately half of the sampling period. The opening and closing of the gates applies to the radial gates on the true left and true right side of the barrage.

At the end of each sampling period the nets were lifted in the order that they were set, with the first net in being the first net out. The fish in each net were emptied into a bucket with water, after which they were anaesthetised, identified to species, counted, and released, with the exception of minor samples of small fish that were preserved in formalin for identification in the laboratory. On one occasion, a large catch of whitebait was weighed and the number caught was estimated by dividing by the approximate average weight of an individual fish. Any galaxiid caught beyond the whitebait stage but less than about 40 mm in body length was recorded as a galaxiid because of the difficulty in identifying them to species in the field, whereas those greater than this size were exclusively inanga (*Galaxias maculatus*). Glass eels were not identified to species. The length of the common species of fish was not measured, but rather the size range of each species was estimated, whereas the length of the less common species (rudd – *Scardinius erythrophthalmus*, mullet – *Aldrichetta forsteri* and *Mugil cephalus*, perch – *Perca fluviatilis*) was usually measured.

Other information recorded at each sampling time included length of leader attached to the nets (range 1-4 m), water clarity (clear, milky, dirty), tide conditions (rising, falling, full), water level readings both above and below the barrage gates, and weather conditions (clear, cloudy, rain, wind conditions).

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2.3. Collation and analysis of data

The information of the fish caught and other details on the field survey sheets were entered on to a spreadsheet for data analysis. Firstly, the number of fish caught by species for the spring and summer sampling period was tallied for all positions of the barrage gates (open, closed, and 50/50) combined. Secondly, the catch data for each species were adjusted to account for the variable leader length used on the fyke nets, producing a standardised measure of catch per unit effort (CPUE) for subsequent analyses – i.e., fish/net/metre of leader/hour. Thirdly, for comparisons of the catch between seasons and locations of the nets, the mean catch by species was computed for sets both downstream and upstream of the barrage gates on the true left and true right sides of the channel for all positions of the gates (i.e., open, closed, and 50/50) combined. Finally, the mean catch by species was computed separately for the barrage gates open and closed for sets both downstream and upstream of the gates on the true left and true right sides of the channel. The catch data were not analysed separately for when the gates were in the 50/50 position as this only occurred on one occasion (for occurrence see Appendix Table).

The results were statistically analysed with the two-sample Mann-Whitney U test in Systat, first by testing for differences in the catch by species between downstream and upstream locations with the barrage gates open and closed, but separately for the spring and summer period; in the second series of tests, season was ignored and the above exercise was repeated (see Table 9 for details). Differences in the catch rates for the main species of fish in relation to water clarity by season were tested by the Krukal-Wallis one-way analysis of variance (see Table 11 for details).

3. Results of fish monitoring

3.1. Summary of overall catch

The total number of fish and shrimp caught in the nets was more than twofold greater in spring than summer (Table 2), although sampling effort was greater in spring with nine more sampling occasions than in summer (see Table 1). With the exceptions of a single perch (*Perca fluviatilis*) and two grey mullet (*Mugil cephalus* - ~70 mm long) captured in spring, but none in summer, the species composition of the catch was similar between seasons and consisted of inanga (*Galaxias maculatus*), common smelt (*Retropinna retropinna*), common bully (*Gobiomorphus cotidianus*), shortfin eel (*Anguilla australis*), longfin eel (*A. dieffenbachii*), yelloweye mullet (*Aldrichetta forsteri*), and rudd (*Scardinius erythrophthalmus*). Also captured were small numbers of the shrimp, *Paratya curvirostris*, during summer, but only a single specimen in

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spring. With the exception of inanga whitebait, which were common in the spring, the common smelt and common bully (>10 mm body length) were the most frequently caught species in both seasons. A small number of glass eels were captured in September, with all but one of them upstream of the barrage gates; the glass eels were probably holding in slack water immediately above the gates. The small number of glass eels caught is not considered to be indicative of the level of eel recruitment to the lake.

Of the fish measured, smelt ranged in body length from 60-140 mm, shortfin eel from 50-570 mm, mullet from 70-140 mm, and rudd from 20-65 mm; the single specimens of the longfin eel and perch were 250 mm and 126 mm, respectively. The large shortfin (570 mm long) was captured in the downstream net on the true right side in late afternoon on 24 January when the gates were open and the water was dirty.

3.2. Comparison of catches downstream and upstream of the barrage gates

Irrespective of the barrage gate positions (i.e., open, closed or 50/50) and with the exception of glass eels, the overall mean catch rates of all migratory species or life stages of fish were greater downstream than upstream of the gates (Tables 3, 4). This result is not unexpected as the fish would have been moving upstream into the lake and would have encountered the downstream net first. The overall mean catch rates were greatest for whitebait, smelt and bullies during both spring and summer (Fig. 1). For most species, the catches were greater on the true right side, probably because the fish preferred the flow and habitat characteristics of this side of the channel.

In terms of timing of upstream movement, the monthly mean catch rates were highest for bullies in August and March, whitebait, glass eels and mullet in September, rudd in October, and smelt in January and February (Tables 3, 4).

3.3. Comparison of catches with barrage gates open and closed

A comparison of the catch rates with the barrage gates open and closed is presented (Tables 5-8) to assess the effects of the barrage on fish movements. In addition, the mean hourly catches of the main species are plotted by season with the gates open and closed (Fig. 2). If the gates are having an effect one would expect the catch rates downstream to be significantly greater than those upstream when the gates are closed rather than open. This in fact is evident in the overall mean catch rates of the more common species caught on the true left of the channel (Tables 5, 7), but not so for the catches on the true right (Tables 6, 8). As examples of this for the true left side, the overall mean catches of whitebait, smelt and bullies, respectively, were 69-, 18- and

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20-fold greater downstream than upstream with the gates closed, but only 5-, 6- and 1.4-fold greater with the gates open. On the other hand, on the true right side, with the exception of bullies, the downstream catches were considerably greater than those upstream with the gates open rather than closed. This was probably due to the greater movement of fish on the true right side when the gates were open.

The results of statistical tests of differences in the catch rates between downstream and upstream sites with the barrage gates open and closed are summarised in Table 9. The analyses show that whether the gates were open or closed, the differences in the catch rates for all species, except those of smelt and inanga in some instances, were non-significant; however, the differences in the catch rates for these two species were not as expected, being significant when the gates were open, not closed.

3.4. Catches in relation to water clarity

Since freshes and floods result in changes in water clarity and are known to have an effect on fish movements (Davis et al. 1983; Glova & Washbourne 1990), it was decided to investigate if the catches at the barrage were influenced by water clarity. The combined catch of all species in relation to water clarity is summarised in Table 10. The catch was least when the water was clear, intermediate when dirty, and highest when milky, and is consistent with our knowledge of the increased movement of fish with the onset of freshes and floods and water discolouration. This pattern of effects existed for each of the main species of fish (whitebait, galaxiids, smelt, bullies), but not for shrimp whose catch rates were similar for all three levels of water clarity during spring, whereas during summer they were highest when the water was dirty. However, because of the large variability in the data, when tested statistically the differences in the catch with water clarity were not significant in most instances, except that of smelt and galaxiids in summer (Table 11).

4. Conclusion

The catch data indicate that whitebait, smelt and bullies are the main recruits, with eels, mullet, and others comprising a minor proportion of fish moving into the lake. This species composition is similar to that reported by Hicks (1993) for samples taken by trap nets set above and below the barrage gates during November 1991. Other diadromous species that are known to occur in minor numbers in the catchment above the barrage (Hicks 1993), which were not recorded in the present study are torrentfish (*Cheimarrichthys fosteri*) and bluegill bully (*G. hubbsi*), although it is possible that juvenile bluegills were present in low numbers and misidentified among the "bullies" sampled. Additional species, mainly koaro (*Galaxias brevipinnis*), banded kokopu (*G.*

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fasciatus), and redfin bully (*G.huttoni*) have been recorded by Hicks from the catchment downstream of the barrage gates, which are likely to penetrate into tributaries of the catchment upstream of the barrage if access is available; juvenile redfins may have been present in minor numbers and misidentified among the "bullies" sampled in the present study. Clearly, access across the barrage may need to cater for a wide range of diadromous species requiring access to and from the sea to complete their life cycles.

With the diversion of the Ruamahanga River, the bulk of the fish movement is probably upriver, as suggested by Pyke (1970). Although sampling was limited to spring and summer, fish movement for some species occurs year round, with the peak generally in spring, although in some instances later, and the low in winter. For example, Jellyman and Ryan (1983) found that peak movement of juvenile shortfin eel into Lake Pounui over a four-year period varied from November to April (related to rainfall), with some recruitment occurring year-round. The general migration periods for the main species of native diadromous fish are summarised in Figure 3, with spring being the primary period of recruitment for eels, smelt, whitebait, bullies, and others, but summer also important for several species.

The findings of this study indicate trends of increased upstream movement of fish with the lateral gates of the barrage open. However, owing to the large variability in the catch rates, only those of smelt were significant. From a statistical standpoint, with the exception of smelt, recommendations for gate openings to allow for passage of fish are not strongly supported. However, on the basis of knowledge of the diversity of diadromous fish species present in the catchment and timing of their migrations, in principle, it would be prudent to consider opening of the laterals coinciding with the timing of the main movement of fish generally, which includes that of smelt.

5. Recommendations

The following recommendations are made:

- Open both lateral gates of the barrage weekly for approximately one hour during high tide from 1 August to 31 October to allow access during the main period of fish recruitment into the lake;

- Open at least one lateral gate (preferably the true right as it is preferred by fish) weekly for approximately one hour during high tide from 1 November to 31 May to allow for fish movement in and out of the lake from late spring

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through to autumn - the migration periods for the main species of native diadromous fish are summarised in Figure 3;

- Conduct monitoring of fish movement across the barrage during 1 April to 31 May employing the same methodology as in the present study to determine the extent of fish migratory activity during that period – if relatively minor, then the opening of gates during that period could cease.

It is acknowledged that opening of the laterals for the benefit of diadromous fish is largely dependent on lake levels and flows in the Ruamahanga River, but when these conditions are appropriate during the seasonal intervals specified above, then the gates should be periodically open for fish passage. For some species (e.g., eels), movement occurs mainly between dusk and dawn, so some opening of the laterals should coincide with high tides during the night as well as the day.

6. References

Anonymous 1998. Geoffrey Blundell Barrage – assessment of environmental effects. Wellington Regional Council. 19 p., plus Appendices.

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Jellyman, D.J.; Ryan, C.M. 1983. Seasonal migration of elvers (*Anguilla* spp.) into Lake Pounui, New Zealand, 1974-1978. *New Zealand Journal of Marine and Freshwater Research 17*: 1-15.

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Table 1: **Number of sampling occasions that the Lake Wairarapa barrage gates was open, closed, or 50/50 (i.e., open for 50% of the sampling occasion) during the 2001-2002 sampling period.**

	Open	Closed	50/50	Totals
August	10	2	-	12
September	12	3	-	15
October	4	6	4	14
January	8	-	-	8
February	4	12	-	16
March	-	8	-	8

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Table 2: **Numbers of fish by species/life stage and shrimp caught for all sampling occasions combined monthly, Lake Wairarapa barrage gates, 2001-2002.**

Month	White bait	Inanga	Galaxiids	Smelt	Bully (<10 mm)	Bully (>10 mm)	SF eel	LF eel	Glass eel	Yelloweye Mullet	Grey Mullet	Perch	Rudd	Shrimp
August	192	2	-	138	-	186	-	-	-	1	-	-	5	-
September	2596	4	-	330	-	261	-	-	15	3	2	1	1	1
October	398	42	-	62	-	354	-	-	-	-	-	-	35	-
Σ = 4629	3186	48	-	530	-	801	-	-	15	4	2	1	41	1
								-			-			
January	17	20	-	225	240	114	5	-	-	-	-	-	3	3
February	-	7	5	582	-	28	-	-	-	2	-	-	7	24
March	6	40	-	122	-	509	-	1	-	1	-	-	3	-
Σ = 1964	23	67	5	929	240	651	5	1	-	3	-	-	13	27

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Table 3: Mean catches of fish by species/life stage and shrimp per sampling occasion monthly, downstream and upstream of the Lake Wairarapa barrage gates (open, closed and 50/50 combined), true left side.

Month	White bait	Inanga	Galaxiids	Smelt	Bully (<10 mm)	Bully (>10 mm)	SF eel	LF eel	Glass eel	Mullet	Perch	Rudd	Shrimp
						Downstream							
August	6.9	0.1	0.0	5.4	0.0	1.8	0.0	0.0	0.0	0.1	0.0	0.1	0.0
September	16.5	0.1	0.0	13.6	0.0	6.1	0.0	0.0	0.0	0.3	0.1	0.0	0.0
October	16.6	0.1	0.0	1.6	0.0	7.5	0.0	0.0	0.0	0.0	0.0	0.1	0.0
January	1.7	0.0	0.0	16.3	24.0	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
February	0.0	0.1	0.1	3.7	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	1.0
March	0.0	3.5	0.0	13.1	0.0	38.3	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Grand mean	8.2	0.4	0.0	7.8	2.4	7.3	0.0	0.0	0.0	0.1	0.0	0.1	0.2
						Upstream							
August	0.8	0.1	0.0	0.9	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.1	0.0
September	3.7	0.0	0.0	0.3	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
October	0.6	0.2	0.0	0.6	0.0	1.9	0.0	0.0	0.0	0.0	0.0	0.2	0.0
January	0.0	0.0	0.0	0.1	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.2
February	0	0.0	0.0	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
March	0.3	0.1	0.0	0.6	0.0	1.4	0.0	0.0	0.0	0.1	0.0	0.3	0.0
Grand Mean	1.0	0.1	0.0	1.1	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0

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Table 4: Mean catches of fish by species/life stage and shrimp per sampling occasion monthly, downstream and upstream of the Lake Wairarapa barrage gates (open, closed and 50/50 combined), true right side.

Month	White bait	Inanga	Galaxiids	Smelt	Bully (<10 mm)	Bully (>10 mm)	SF eel	LF eel	Glass eel	Mullet	Perch	Rudd	Shrimp
						Downstream							
August	0.7	0.0	0.0	2.0	0.0	21.4	0.0	0.0	0.0	0.0	0.0	0.2	0.0
September	219.5	0.3	0.0	9.3	0.0	6.2	0.0	0.0	0.1	0.0	0.0	0.1	0.0
October	2.8	1.8	0.0	0.6	0.0	7.9	0.0	0.0	0.0	0.0	0.0	1.5	0.0
January	0.0	2.9	0.0	22.3	0.0	2.1	2.5	0.0	0.0	0.0	0.0	0.4	0.0
February	0.0	0.3	0.0	22.2	0.0	0.5	0.0	0.0	0.0	0.1	0.0	0.0	0.2
March	1.0	2.5	0.3	1.7	0.0	24.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grand Mean	49.6	1.1	0.1	10.0	0.0	8.5	0.3	0.0	0.0	0.0	0.0	0.4	0.0
						Upstream							
August	6.7	0.0	0.0	0.3	0.0	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
September	25.7	0.0	0.0	0.3	0.0	13.0	0.0	0.0	1.9	0.0	0.0	0.0	0.2
October	0.0	0.0	0.0	0.6	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
January	0.0	0.0	0.0	0.0	0.0	14.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
February	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	1.3	0.0
March	0.0	0.3	0.0	0.5	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
Grand mean	6.0	0.0	0.0	0.3	0.0	5.7	0.0	0.0	0.4	0.0	0.0	0.3	0.0

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Table 5: Mean catches of fish by species/life stage and shrimp per sampling occasion monthly, downstream and upstream of the Lake Wairarapa barrage gates (open), true left side.

Month	White bait	Inanga	Galaxiids	Smelt	Bully (<10 mm)	Bully (>10 mm)	SF eel	LF eel	Glass eel	Mullet	Perch	Rudd	Shrimp
						Downstream							
August	6.3	0.1	0.0	7.2	0.0	2.3	0.0	0.0	0.0	0.1	0.0	0.1	0.0
September	17.1	0.1	0.0	17.0	0.0	0.9	0.0	0.0	0.0	0.4	0.1	0.0	0.0
October	26.6	0.4	0.0	0.6	0.0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
January	1.7	0.0	0.0	16.3	24.0	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
February	0.0	0.0	0.0	14.4	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	3.8
March	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand mean	10.0	0.1	0.0	12.0	4.8	2.0	0.0	0.0	0.0	0.1	0.0	0.0	0.4
						Upstream							
August	1.1	0.1	0.0	1.2	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.1	0.0
September	4.9	0.0	0.0	0.4	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
October	1.8	0.8	0.0	1.0	0.0	3.4	0.0	0.0	0.0	0.0	0.0	0.6	0.0
January	0.0	0.0	0.0	0.1	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.2
February	0.0	0.0	0.0	13.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4
March	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand mean	2.0	0.1	0.0	1.9	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.1	0.1

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Table 6: **Mean catches of fish by species/life stage per sampling occasion monthly, downstream and upstream of the Lake Wairarapa barrage gates (open), true right side.**

Month	White bait	Inanga	Galaxiids	Smelt	Bully (<10 mm)	Bully (>10 mm)	SF eel	LF eel	Glass eel	Mullet	Perch	Rudd	Shrimp
						Downstream							
August	0.7	0.0	0.0	2.0	0.0	21.4	0.0	0.0	0.0	0.0	0.0	0.2	0.0
September	292.7	0.4	0.0	12.4	0.0	8.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0
October	10.6	7.2	0.0	0.0	0.0	25.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0
January	0.0	2.9	0.0	22.3	0.0	2.1	2.5	0.0	0.0	0.0	0.0	0.4	0.0
February	0.0	0.6	0.0	87.4	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.4
March	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand mean	98.9	1.6	0.0	19.2	0.0	10.7	0.6	0.0	0.0	0.0	0.0	0.8	0.0
						Upstream							
August	6.7	0.0	0.0	0.3	0.0	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
September	25.7	0.0	0.0	0.3	0.0	13.0	0.0	0.0	1.9	0.0	0.0	0.0	0.2
October	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
January	0.0	0.0	0.0	0.0	0.0	14.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
February	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
March	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand mean	10.1	0.0	0.0	0.2	0.0	8.7	0.0	0.0	0.6	0.0	0.0	0.0	0.1

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Table 7: **Mean catches of fish by species/life stage and shrimp per sampling occasion monthly, downstream and upstream of the Lake Wairarapa barrage gates (closed), true left side.**

Month	White bait	Inanga	Galaxiids	Smelt	Bully (<10 mm)	Bully (>10 mm)	SF eel	LF eel	Glass eel	Mullet	Perch	Rudd	Shrimp
						Downstream							
August	8.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
September	14.6	0.0	0.0	3.4	0.0	21.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
October	19.4	0.0	0.0	1.0	0.0	11.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
January	-	-	-	-	-	-	-	-	-	-	-	-	-
February	0.0	0.1	0.1	0.1	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
March	0.0	3.5	0.0	13.1	0.0	38.3	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Grand mean	6.9	0.8	0.0	3.5	0.0	13.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
						Upstream							
August	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
September	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
October	0.3	0.0	0.0	0.1	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
January	-	-	-	-	-	-	-	-	-	-	-	-	-
February	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
March	0.3	0.1	0.0	0.6	0.0	1.4	0.0	0.0	0.0	0.1	0.0	0.3	0.0
Grand mean	0.1	0.0	0.0	0.2	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.1	0.0

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Table 8: Mean catches of fish by species/life stage and shrimp per sampling occasion monthly, downstream and upstream of the Lake Wairarapa barrage gates (closed), true right side.

Month	White bait	Inanga	Galaxiids	Smelt	Bully (<10 mm)	Bully (>10 mm)	SF eel	LF eel	Glass eel	Mullet	Perch	Rudd	Shrimp
						Downstream							
August	-	-	-	-	-	-	-	-	-	-	-	-	-
September	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
October	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
January	-	-	-	-	-	-	-	-	-	-	-	-	-
February	0.0	0.2	0.3	0.4	0.0	0.5	0.0	0.0	0.0	0.2	0.0	0.0	0.1
March	1.0	2.5	0.0	1.7	0.0	24.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grand mean	0.3	0.7	0.1	0.6	0.0	6.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0
						Upstream							
August	-	-	-	-	-	-	-	-	-	-	-	-	-
September	-	-	-	-	-	-	-	-	-	-	-	-	-
October	-	-	-	-	-	-	-	-	-	-	-	-	-
January	-	-	-	-	-	-	-	-	-	-	-	-	-
February	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.0	0.0	1.7	0.0
March	0.0	0.3	0.0	0.5	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
Grand mean	0.0	0.1	0.0	0.2	0.0	1.4	0.0	0.1	0.0	0.0	0.0	1.0	0.0

Table 9: **Summary of probability values of two-sample Mann-Whitney U tests of the differences in the catch of fish and shrimp between downstream and upstream locations with the barrage gates open and closed during spring and summer and with the seasons combined. Sample size *N* refers to downstream and upstream locations.**

	Spring	
	Open (*N*=13 down, 13 up)	**Closed** (*N*= 7 down, 4 up)
Whitebait	0.328	0.381
Inanga	0.168	-
Smelt	0.072	0.718
Bullies	0.521	0.705
Shrimp	-	-

	Summer	
	Open (*N* = 6 down, 6 up)	**Closed** (*N* =10 down, 10 up)
Whitebait	-	0.942
Inanga	-	0.155
Smelt	0.009	0.125
Bullies	0.589	0.085
Shrimp	0.195	-

	Seasons combined	
	Open (*N* = 19 down, 19 up)	**Closed** (*N*=17 down, 14 up)
Whitebait	0.252	0.388
Inanga	0.023	0.303
Smelt	0.002	0.148
Bullies	0.317	0.106
Shrimp	0.982	-

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Table 10: **Total catch and mean catch (bracketed) of fish and shrimp combined in relation to water clarity during spring 2001 and summer 2002, Lake Wairarapa barrage gates.**

Water Clarity	Spring	Summer	Totals
Clear	356(14.2)	37(2.2)	393(6.8)
Milky	2949(58.2)	1060(22.7)	4009(44.4)
Dirty	1324(21.9)	867(17.7)	2191(20.2)

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Table 11: **Summary of Kruskal-Wallis analysis (H-statistic and probability values) of differences in the catch for the main fish species in relation to water clarity by season at the barrage gates.**

	Spring		Summer	
Species	**H**	**P**	**H**	**P**
Common bully	2.75	0.253	5.55	0.062
Smelt	5.22	0.074	6.06	0.048
Galaxiids	-	-	6.19	0.045
Whitebait	3.43	0.180	2.67	0.263
Shrimp	1.16	0.560	3.41	0.182

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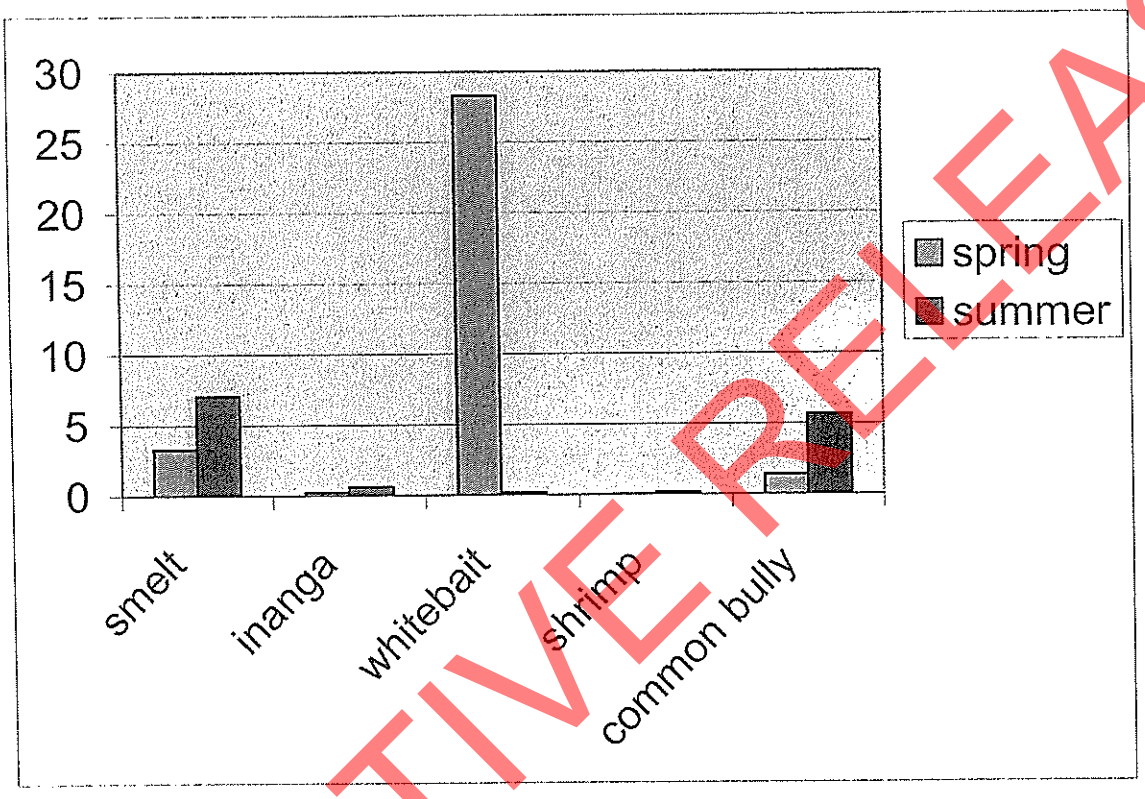

Figure 1: **Mean hourly catches of main species by season (ignoring position of barrage gates i.e. whether open, closed, 50/50)**

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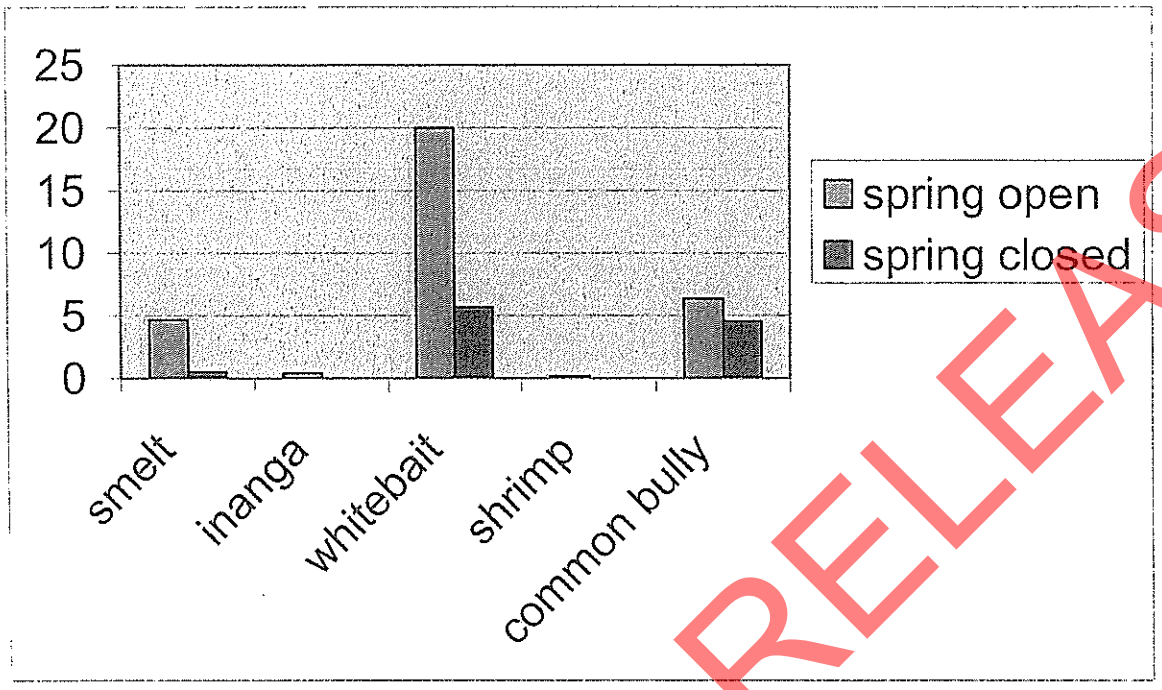

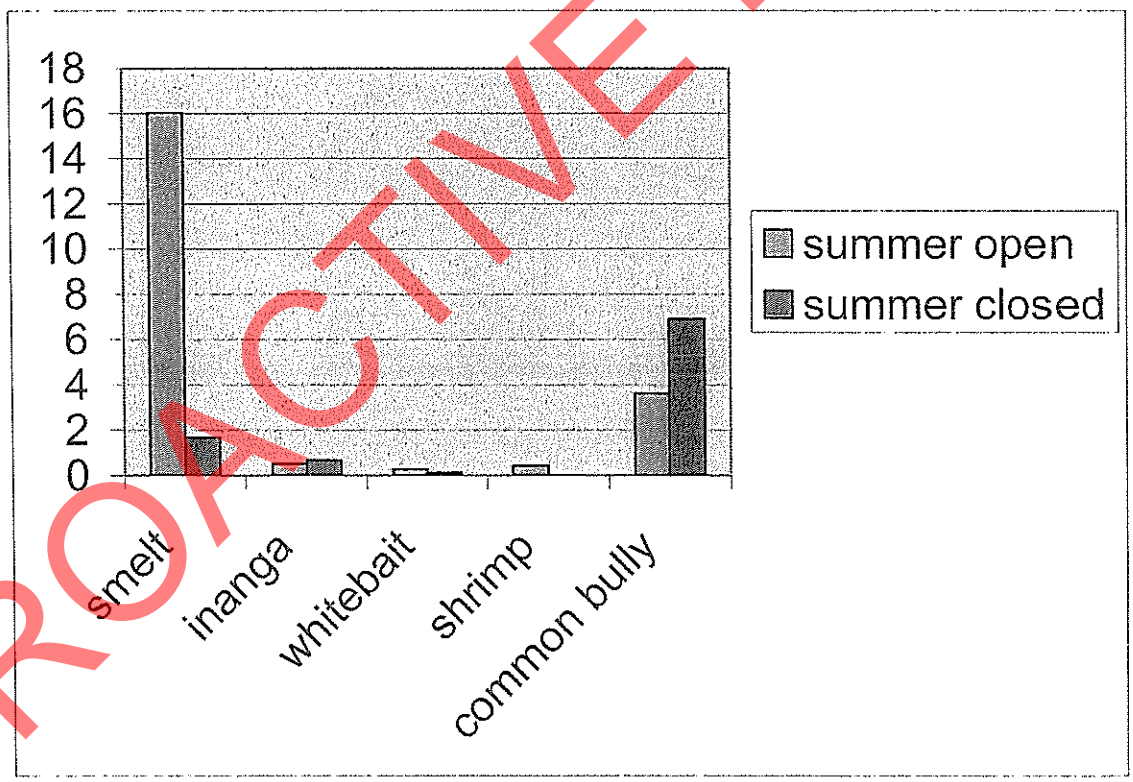

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Figure 2: **Mean hourly catches of main species, by season and whether barrage gates were open or closed**

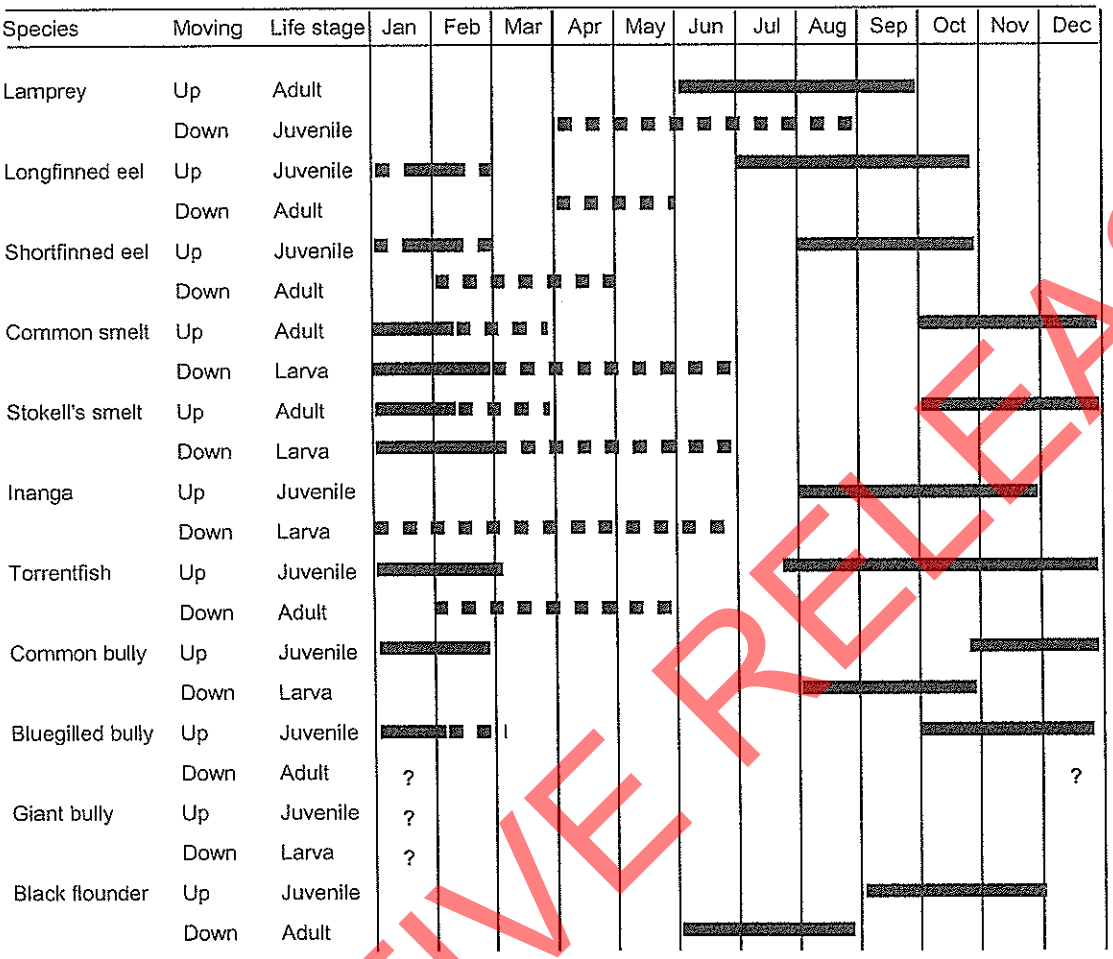

Figure 3: **Summary of migration periods of the main species of native migratory fish (including some species not recorded at Lake Wairarapa barrage gates)**

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Appendix: Raw data of fish and shrimp catches in the fyke nets and other information recorded during the Lake Wairarapa barrage gates sampling programme, spring 2001 and summer 2002.

Observer	Location	set	lifted	date	month	Net	leader length	tide	clarity	weather	barrage	level bt	level ab	galaxiids	bully cb < 10 cb	unid fr smelt	inanga	wbait	yem	gm	shrimp	lfe	ste	glass eel	rudd	perch	all bully
T. Silberg / D. Sim	true right upstream	8/29/01 15:10 a.8./p.8.	8/29/01 15:10 a.8./p.8.	29/Aug	August		1.5	full	milky	fine, calm, some cloud	open	10.2	10.2		21	1		32								21
T. Silberg / D. Sim	true right downstream	8/29/01 15:03 a.8./p.8.	8/29/01 15:03 a.8./p.8.	29/Aug	August		1.5	full	milky	fine, calm, some cloud	open	10.2	10.2		101	9		1							1	101
T. Silberg / D. Sim	true left upstream	8/29/01 14:58 a.8./p.8.	8/29/01 14:58 a.8./p.8.	29/Aug	August	full		full	milky	fine, calm, some cloud	open	10.2	10.2		16	4										16
T. Silberg / D. Sim	true left downstream	8/29/01 14:53 a.8./p.8.	8/29/01 15:53 a.8./p.8.	29/Aug	August	full		full	milky	fine, calm, some cloud	open	10.2	10.2		33		1	7							1	33
T. Silberg / D. Sim	true right upstream	8/22/01 9:00 a.8./p.8	8/22/01 10:00 a.8./p.8.	22/Aug	August	full		full	dirty	cloudy, light NW	open	10.5	10.5		2	1		1								2
T. Silberg / D. Sim	true right downstream	8/22/01 8.55 a.8./p.8.	8/22/01 9:55 a.8./p.8.	22/Aug	August	full		full	dirty	cloudy, light NW	open	10.5	10.5		4	1		5								4
T. Silberg / D. Sim	true left upstream	8/22/01 8.50 a.8./p.8	8/22/01 9:50 a.8./p.8.	22/Aug	August	full		full	dirty	cloudy, light NW	open	10.5	10.5		3		1	1							2	3
T. Silberg / D. Sim	true left downstream	8/22/01 8:45 a.8./p.8.	8/22/01 9:45 a.8./p.8.	22/Aug	August	full		full	dirty	cloudy, light NW	open	10.5	10.5		2	2		5								2
T. Silberg / D. Sim	true left downstream	8/8/01 9:30 a.8./p.8.	8/8/01 10:30 a.8./p.8.	8/Aug	August	full		full	dirty	cloudy, light NW	open					106		83	1						1	0
T. Silberg / D. Sim	true left upstream	8/8/01 9:40 a.8./p.8.	8/8/01 9:45 a.8./p.8.	8/Aug	August	full		full	dirty	cloudy, light NW	open				2	14		15								2
A. Riebergen / T. Silberg / D. Sim	true left upstream	8/2/01 10:50 a.8./p.8	8/2/01 10:43 a.8./p.8.	2/Aug	August	full		full	clear	brisk NW, part cloud	closed				2											2
A. Riebergen / T. Silberg / D. Sim	true left downstream	8/2/01 11:50 a.8./p.8.	8/2/01 11:43 a.8./p.8.	2/Aug	August	full		full	clear	brisk NW, part cloud	closed							42								0
B. Dix / D. Sim	true left downstream	2/20/02 13:39 a.2./p.2.	2/20/02 14:39 a.2./p.2.	20/Feb	February	1	3	rising	clear	cloudy, SE	closed	10.19	10.16	1											1	0
B. Dix / D. Sim	true left upstream	2/20/02 13:44 a.2./p.2.	2/20/02 14:44 a.2./p.2.	20/Feb	February	2	3	full	clear	cloudy, SE	closed	10.19	10.16													0
B. Dix / D. Sim	true right downstream	2/20/02 13:50 a.2./p.2	2/20/02 15:00 a.2./p.2	20/Feb	February	3	3	full	clear	cloudy, SE	closed	10.19	10.16	4		5				2						0
B. Dix / D. Sim	true right upstream	2/20/02 13:55 a.2./p.2.	2/20/02 15:10 a.2./p.2.	20/Feb	February	4	0	full	clear	cloudy, SE	closed	10.19	10.16		5										5	5
T. Silberg / D.sim	true left downstream	2/28/02 8:10 a.2./p.2.	2/28/02 9:10 a.2./p.2.	28/Feb	February	full		full	dirty	cloudy, NW	open	10.19	10.19		4	72					19					4
T. Silberg / D.sim	true left upstream	2/28/02 8:15 a.2./p.2.	2/28/02 9:15 a.2./p.2.	28/Feb	February	full		full	dirty	cloudy, NW	open	10.19	10.19			66					2				1	0
T. Silberg / D.sim	true right downstream	2/28/02 8:20 a.2./p.2.	2/28/02 9:20 a.2./p.2.	28/Feb	February	full		full	dirty	cloudy, NW	open	10.19	10.19		3	437	3				2					3
T. Silberg / D.sim	true right upstream	2/28/02 8:25 a.2./p.2.	2/28/02 9:25 a.2./p.2.	28/Feb	February			full	dirty	cloudy, NW	open	10.19	10.19													0
T. Silberg / D.sim	true left downstream	2/13/02 8:40 a.2./p.2	2/13/02 9:40 a.2./p.2.	13/Feb	February	full		full	dirty	rain, strong S	closed	10.4	9.87		2		1									2
T. Silberg / D.sim	true left upstream	2/13/02 8:45 a.2./p.2	2/13/02 9:45 a.2./p.2.	13/Feb	February		2.5	full	dirty	rain, strong S	closed	10.4	9.87			1										0
T. Silberg / D.sim	true right downstream	2/13/02 8:50 a.2./p.2	2/13/02 9:50 a.2./p.2.	13/Feb	February	full		full	dirty	rain, strong S	closed	10.4	9.87		2		2									2
T. Silberg / D.sim	true right upstream	2/13/02 8:55 a.2./p.2	2/13/02 9:55 a.2./p.2.	13/Feb	February		0	full	dirty	rain, strong S	closed	10.4	9.87		1											1
Bruce / Dion	true left downstream	2/7/02 15:55 a.2./p.2.	2/7/02 16:55 a.2./p.2.	7/Feb	February	1	3	full	clear	clear, SW	closed	10.5	9.8		5		1									5
Bruce / Dion	true left upstream	2/7/02 16:10 a.2./p.2.	2/7/02 17:20 a.2./p.2.	7/Feb	February	2	1	full	clear	clear, SW	closed	10.5	9.8													0
Bruce / Dion	true right upstream	2/7/02 16:15 a.2./p.2.	2/7/02 17:30 a.2./p.2	7/Feb	February	3	1	full	clear	clear, SW	closed	10.5	9.8													0
Bruce / Dion	true right downstream	2/7/02 16:25 a.2./p.2.	2/7/02 17:35 a.2./p.2.	7/Feb	February	4	3	full	clear	clear, SW	closed	10.5	9.8		4		1				1					4
T. Silberg / D.sim	true left downstream	1/31/02 9:40 a.1./p.1.	1/31/02 22:40 a.1./p.1.	31/Jan	January			full	milky	fine, light N	open					240	12	2			1					252
T. Silberg / D.sim	true left upstream	1/31/02 9:45 a.1./p.1.	1/31/02 22:45 a.1./p.1.	31/Jan	January	full		full	milky	fine, light N	open						10	1								10
T. Silberg / D.sim	true right downstream	1/31/02 9:45 a.1./p.1.	1/31/02 22:45 a.1./p.1.	31/Jan	January		3	full	milky	fine, light N	open						9	22	19						3	9
T. Silberg / D.sim	true right upstream	1/31/02 9:50 a.1./p.1	1/31/02 22:50 a.1./p.1.	31/Jan	January		1	full	milky	fine, light N	open						58									58
T. Silberg / D.sim	true left downstream	1/24/02 15:30 a.1./p.1.	1/24/02 16:30 a.1./p.1.	24/Jan	January	full		full	dirty	fine, light NW	open	9.96	10.1				19	161		16						19
T. Silberg / D.sim	true left upstream	1/24/02 15:35 a.1./p.1.	1/24/02 16:35 a.1./p.1.	24/Jan	January	full		full	dirty	fine, light NW	open	9.96	10.1				4				2					4
T. Silberg / D.sim	true right downstream	1/24/02 15:45 a.1./p.1.	1/24/02 16:45 a.1./p.1.	24/Jan	January			full	dirty	fine, light NW	open	9.96	10.1				2	39	1				5			2
T. Silberg / D.sim	true right upstream	1/24/02 15:40 a.1./p.1.	1/24/02 16:40 a.1./p.1.	24/Jan	January		0	full	dirty	fine, light NW	open	9.96	10.1													0
Dion & Bruce	true left downstream	3/6/02 13:59 a.3./p.3.	3/6/02 15:00 a.3./p.3.	6/Mar	March	1	3	full	milky	cloudy, SE	closed	10.4	10.1		1			93	28							1
Dion & Bruce	true left upstream	3/6/02 14:04 a.3./p.3.	3/6/02 15:25 a.3./p.3.	6/Mar	March	2	3	full	milky	cloudy, SE	closed	10.4	10.1		10			5	1	2					2	10
Dion & Bruce	true right upstream	3/6/02 14:11 a.3./p.3.	3/6/02 15:40 a.3./p.3.	6/Mar	March	3	1	full	milky	cloudy, SE	closed	10.4	10.1						1			1				0
Dion & Bruce	true right downstream	3/6/02 14:16 a.3./p.3.	3/6/02 15:48 a.3./p.3.	6/Mar	March	4		full	milky	cloudy, SE	closed	10.4	10.1		85		6	10	4							85
T. Silberg / D.sim	true left downstream	3/13/02 8:20 a.3./p.3	3/13/02 9:20 a.3./p.3	13/Mar	March		full	falling	milky	fine, light N	closed	9.8	10		382		15								1	382
T. Silberg / D.sim	true left upstream	3/13/02 8:25 a.3./p.3	3/13/02 9:25 a.3./p.3.	13/Mar	March		full	falling	milky	fine, light N	closed	9.8	10		1				1							1
T. Silberg / D.sim	true right downstream	3/13/02 8:30 a.3./p.3	3/13/02 9:30 a.3./p.3.	13/Mar	March		full	falling	milky	fine, light N	closed	9.8	10		30		2									30
T. Silberg / D.sim	true right upstream	3/13/02 8:35 a.3./p.3.	3/13/02 9:35 a.3./p.3.	13/Mar	March		0	falling	milky	fine, light N	closed	9.8	10				1									0
T. Silberg	true left downstream	10/31/01 6:20 a.10./p.10.	10/31/01 7:20 a.10./p.10.	31/Oct	October	full		full	milky	cloudy, light NW	50/50	10.2	10.2				13	19		4					2	13
T. Silberg	true left upstream	10/31/01 6:25 a.10./p.10.	10/31/01 7:25 a.10./p.10.	31/Oct	October	full		full	milky	cloudy, light NW	50/50	10.2	10.2				8	6								8
T. Silberg	true right downstream	10/31/01 6:30 a.10./p.10	10/31/01 7:30 a.10./p.10.	31/Oct	October		4	full	milky	cloudy, light NW	50/50	10.2	10.2				29	12		3						29
T. Silberg	true right upstream	10/31/01 6:35 a.10./p.10.	10/31/01 7:35 a.10./p.10.	31/Oct	October			full	milky	cloudy, light NW	50/50	10.2	10.2				1	6								1
T. Silberg / B. Dix	true left downstream	10/24/01 13:20 a.10./p.10.	10/24/01 14:20 a.10./p.10.	24/Oct	October	full		full	dirty	strong S	closed	10.5	9.8				13	10								13
T. Silberg / B. Dix	true left upstream	10/24/01 13:30 a.10./p.10.	10/24/01 14:30 a.10./p.10.	24/Oct	October		3	full	dirty	strong S	closed	10.5	9.8				5			2						5
T. Silberg / B. Dix	true right downstream	10/24/01 13:25 a.10./p.10.	10/24/01 14:25 a.10./p.10	24/Oct	October	full		full	dirty	strong S	closed	10.5	9.8													0
T. Silberg / D. Sim	true left downstream	10/17/01 7:10 a.10./p.10.	10/17/01 8:10 a.10./p.10.	17/Oct	October	full		full	dirty	fine, calm	open	10.38	10.38				18	3	2	133						18
T. Silberg / D. Sim	true left upstream	10/17/01 7:15 a.10./p.10.	10/17/01 8:15 a.10./p.10.	17/Oct	October	full		full	dirty	fine, calm	open	10.38	10.38				17	5	4	9					3	17
T. Silberg / D. Sim	true right downstream	10/17/01 7:20 a.10./p.10.	10/17/01 8:20 a.10./p.10.	17/Oct	October	full		full	dirty	fine, calm	open	10.38	10.38				125		36	53					30	125
T. Silberg / D. Sim	true right upstream	10/17/01 7:25 a.10./p.10.	10/17/01 8:25 a.10./p.10.	17/Oct	October		4	full	dirty	fine, calm	open	10.38	10.38				8									8
T. Silberg / D. Sim	true left downstream	10/3/01 9:55 a.10./p.10.	10/3/01 9:55 a.10./p.10.	3/Oct	October	full		full	clear	fine, calm	closed	10.5	10.15				106			194						106
T. Silberg / D. Sim	true left upstream	10/3/01 9:00 a.10./p.10	10/3/01 10:00 a.10./p.10.	3/Oct	October	full		full	clear	fine, calm	closed	10.5	10.15				7	1								7
T. Silberg / D. Sim	true right downstream	10/3/01 9:05 a.10./p.10.	10/3/01 10:05 a.10./p.10.	3/Oct	October	full		full	clear	fine, calm	closed	10.5	10.15				4									4
Dix / Sim	true left downstream	9/26/01 14:14 a.9./p.9.	9/26/01 15:14 a.9./p.9.	26/Sep	September		3	rising	milky	fine, NW	open				8	180	1		3	2					1	8
Dix / Sim	true left upstream	9/26/01 14:19 a.9./p.9	9/26/01 15:19 a.9./p.9.	26/Sep	September		3	rising	milky	fine, NW	open				3	1		1								3
Dix / Sim	true right downstream	9/26/01 14:24 a.9./p.9	9/26/01 15:24 a.9./p.9.	26/Sep	September		3	rising	milky	fine, NW	open				23	15		1								23
Dix / Sim	true right upstream	9/26/01 14:29 a.9./p.9	9/26/01 15:29 a.9./p.9.	26/Sep	September		1	rising	milky	fine, NW	open				3	2					1					3
D. Sim	true left downstream	9/19/01 7:50 a.9./p.9.	9/19/01 8:50 a.9./p.9.	19/Sep	September			full	milky	calm	open															0
D. Sim	true left upstream	9/19/01 7:50 a.9./p.9.	9/19/01 8:50 a.9./p.9.	19/Sep	September			full	milky	calm	open						6			6						6
D. Sim	true right downstream	9/19/01 7:50 a.9./p.9.	9/19/01 8:50 a.9./p.9.	19/Sep	September			full	milky	calm	open						30	64	3	2000				1	1	30
D. Sim	true right upstream	9/19/01 7:50 a.9./p.9.	9/19/01 8:50 a.9./p.9.	19/Sep	September			full	milky	calm	open						35			10				14		35
T. Silberg / D. Sim	true left downstream	9/12/01 13:40 a.9./p.9	9/12/01 14:40 a.9./p.9	12/Sep	September	full		full	milky	fine, light wind	closed	9.8	10				108	17		73						108
T. Silberg / D. Sim	true left upstream	9/12/01 13:45 a.9./p.9.	9/12/01 14:45 a.9./p.9.	12/Sep	September	full		full	milky	fine, light wind	closed	9.8	10				1									1
T. Silberg / D. Sim	true right downstream	9/12/01 13:50 a.9./p.9.	9/12/01 14:50 a.9./p.9.	12/Sep	September	full		full	milky	fine, light wind	closed	9.8	10				3									3
T. Silberg / D. Sim	true right upstream	9/5/01 8:25 a.9./p.9	9/5/01 9:25 a.9./p.9.	5/Sep	September		0	full	dirty	cloudy, calm, showers	open	9.1	9.1				23			73						23
T. Silberg / D. Sim	true right downstream	9/5/01 8:20 a.9./p.9	9/5/01 9:20 a.9./p.9.	5/Sep	September		1.5	full	dirty	cloudy, calm, showers	open	9.1	9.1				14			115						14
T. Silberg / D. Sim	true left upstream	9/5/01 8:13 a.9./p.9.	9/5/01 9:14 a.9./p.9.	5/Sep	September	full		full	dirty	cloudy, calm, showers	open	9.1	9.1					4		60						0
T. Silberg / D. Sim	true left downstream	9/5/01 8:08 a.9./p.9.	9/5/01 9:08 a.9./p.9.	5/Sep	September	full		full	dirty	cloudy, calm, showers	open	9.1	9.1				4	30		257						4
														5	571	240	881	0	1458	116	3209	7	2	28	1	5	15	54	1	1692

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Report

Barrage Gates Operations and Environmental Management Plan (OEMP)

Prepared for (GWRC Flood Protection)

By Beca Limited (Beca)

8 November 2018

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Revision History

Revision N°	Prepared By	Description	Date
A	Claire Fell		
B	Kereana Sims	Amendments to reflect WAR190233 approved conditions and resubmitted in compliance with resource consent condition 2.	6/01/22

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Document Acceptance

Action	Name	Signed	Date
Prepared by	Cl ire Fell		
Revi wed by			
Approved by			
on ehalf of	Beca Limited		

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The Operation of the Barrage Gates shall be in accordance with the operating regime as outlined within this Operations and Environmental Management Plan (OEMP).

1 Purpose of the OEMP

The purpose of the Operations and Environmental Management Plan (OEMP) is to outline the protocols and procedures for the operation of the Barrage Gates and the requirements for ongoing environmental monitoring.

Key components of the OEMP include:

- Operation protocol for the following scenarios:
    1. Operation during business as usual conditions;
    2. Operation when Lake Onoke is blocked to the Sea;
    3. Operation pre-flood, during and after flood conditions;
    4. Operation for maintenance purposes; and
    5. Operation for research purposes in accordance w th a c rtified Environmental Monitoring Plan.
- The process to establish a working group, including defining ongoing roles and responsibilities
- Ongoing monitoring requirements
- Reporting requirements
- Developing and Maintaining a complaint egiste
- Process for reviewing the OEMP

2 Purpose of the Barrage Gates

The primary purpose of the Barrage Gates is twofold; firstly, as part of the Lower Wairarapa Valley Development Scheme (LWVDS) to manage the risk of flooding to land owners within the scheme area, and secondly to control he water levels within Lake Wairarapa and Lake Onoke.

3 Objectives of the Barrages Gates

Req irements for the Operation of the Barrage Gates during normal flow conditions are as follows:

Objective 1- To achieve the following target lake levels[1]:

- *1 December to 29 February: 10.15m*
- *1 March to 31 May: 10m*

[1] **Irrigation Note:** Lake levels also have an effect on irrigation takes. Consideration may be given to the effect on enabling irrigation when making decisions regarding lake levels and barrage gate operations. See http://www.gw.govt.nz/assets/Resource-Consents/Water-restrictions/Lake-Wairarapa.pdf

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- *1 June to 30 September: 9.95m*
- *1 October to 30 November: 10m*

Objective 2- to provide and maintain a level of flood protection service for the land owners within the Lower Wairarapa Valley.

Objective 3- To allow for fish passage, by operating the gates in the following way:

The two lateral barrage gates shall be opened in the following circumstances:

a) For a period of one hour before low tide, if the head difference shows that there will be no inflow into the lake, from December to March when fish are migrating out of the lake and

b) For a period of one hour immediately before high tide if the head difference shows there will be no flow out of the lake, from September to November when fish are migrating into the lake.

c) If Lake Onoke spit becomes blocked, then the gates are not required to be opened for the purpose of providing fish passage.

Objective 4- Research and monitoring To enable alternative gate operation modes to be studied, subject to appropriate risk management assessment and approval, for the purpose of researching and assessing gate operation effects on water quality, flood risk, fish passage, and mana whenua, terrestrial and aquatic ecological values.

4 Operation management

The following five scenarios outline the different regimes for the operation of the Barrage Gates for flood protection and research purposes.

The five operation scenarios include:

1. Operation during business as usual conditions
2. Operation when Lake Onoke is blocked to the Sea
3. Operation pre-flood, during and after flood conditions
4. Operation for maintenance purposes
5. Operation for research purposes

Each of these operating regimes are outlined in further detail in the following sections.

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Table 1- Outline of the operation regimes for the Barrage Gates

Operating Regime	Barrage Gates Operation
Scenario 1 Business as usual Flows i.e. no flooding and Lake Onoke is open to the sea. Barrage gates is operating as per the conditions of the consent	The aim of the "Business as usual conditions" is to keep the levels of Lake Wairarapa as low as possible, while meeting the Lake level targets in the winter to allow for flood capacity and to keep the levels as high as possible in the summer to meet the target lake levels in dryer conditions. Under normal conditions, the Ruamahanga River flows directly into Lake Onoke. The characteristics below are present in the business as usual flows. ■ Lake Onoke open to sea, and no floods in the valley ■ Operative to achieve Lake Wairarapa Target levels and fish passage requirements ■ The aim is to keep Lake Wairarapa lake levels low a pos ible in the Winter to allow for flood capacity and as high as possib e in the Summer to provide for good environmental conditions. ■ Gate openings for fish passage are automated to open ne hour each side of the tide. The two lateral gates (and 6) open over this time. ■ Under business as usual conditions, the main flow of the Ruamahanga runs directly to Lake Onoke. The Barrages Gates shall be operated as per the "business as usual flows" unless the other circumstances as list d within the OEMP apply including the implementation of an EMP. The Barrage Gates shal be operated to achieve the following criteria: ■ **Target Lake Leve s** – The operati n of the gates will be undertaken in pursuit of the fol owing Lake Wairarapa Target Levels, as measured at the Wellington Regional Council Burlings recorder site a) Summer minimum (1 December to 28 February) 10.15m b) Au umn Minimum (1 March to 31 May) 10.00m c) Winter minimum (1 June to 30 September) 9.95m d) Spring minimum (1 October- 30 November) 10.00m. **Maximum levels** – When Lake Wairarapa exceeds 10.30m and a minimum head difference of 0.15m is evident, all gates will be opened, at least until a Lake Wairarapa Level of 10.30 metres is attained. ■ **Backflow** – Backflow of water from Lake Onoke and the Lower Ruamahanga River into Lake Wairarapa will normally be prevented. However, under climatic and hydrological conditions, including a blocked lower lake outlet, backflow into Lake Wairarapa will be permitted. ■ **Fish passage** – Between December and March, opening at least two lateral gates for a period of one hour before low tide to provide for fish passage if the head difference shows there will be no inflow into the lake. This is when fish are migrating out of Lake Wairarapa. – Between September and November, opening at least two lateral gates for a period of one hour immediately before high tide if the

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	head difference shows there will be no outflow from the Lake. This is when fish are migrating into Lake Wairarapa.
Scenario 2 Lake Onoke blocked to the sea (on average the spit blocks once per month due to high wave energy on the coast)	The Lake Onoke Spit is periodically blocked during large storm events and swells. The efficient opening of the spit is a fundamental aspect to providing for the on-going flood protection of the Lower Wairarapa Valley. Operation of the Gates: ■ The gates are closed to allow for the build-up of water in Lake Onoke to aid opening of the spit and to prevent water from going into Lake Wairarapa. During this time, water is also building up in Lake Wairar pa from the Tauherenikau and Western Streams. The Ruamahanga River is still flowing into Lake Onoke. ■ The gates are operated with the aim to achieve the highest lake level in Lake Onoke prior to the cut being made operative. This i so hat there is enough water in Lake Onoke to aid the man made opening of the spit to return to a semi natural state. ■ An opening of Lake Onoke is only attempted when the lake levels is greater than 11.4 meters and the sea sw l is les than one metre. If Lake Onoke reaches 11.7, the Barrage Gates are typically opened to allow for water to back flow int the ak reducing flood risk to the surrounding land owners. ■ Once the cut in the spit has been made using the excavators, the gates are opened once Lake Onoke is 0.15m lower than Lake Wairarapa at the barrage gates to llow the build-up of head pressure in Lake Wairarapa and Lake Onoke to semi naturally open the spit. This allows for water f om both lakes to drain to the sea. ■ Once the opening of the spit is achieved and the target level of Lake Wai arapa i reached, the Barrage Gates will then operate to achieve target lake levels within Lake Wairarapa as per scenario 1. ■ Each opening is different hydrologically. A relatively complex interaction of wind, tide, lake level, and flow in the Ruamahanga must be inte preted and managed to provide suitable water levels in both Lake Wa rarapa and Lake Onoke to enable this opening to occur. ■ Eel Harvesting: – When the spit is blocked during the months of February to May, GWRC officers in consultation with representation from Kohunui Marae may delay the mechanical opening of the spit while traditional eel harvesting is carried out. – In these circumstances the delay is not expected to be greater than five days, however if flood conditions prevail, the spit is attempted to be opened during this time.
Scenario 3 Before, during and after flood conditions	■ Once a flood event is triggered, the Barrage Gates are closed when the stage level at Waihenga reaches 3m to allow for the peak flow in the Ruamahanga River to flow into Lake Onoke. When the water levels in the Ruamahanga River reach approximately 4.6m, the Tawaha, Hikinui and Awaroa Floodways are activated, and the water enters Lake Wairarapa via the Oporua Floodway. ■ This allows for Lake Wairarapa to act as a holding area for the flood waters within the lower catchment as some of the waters within the

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	Ruamahanga River can be diverted to Lake Wairarapa. Lake Onoke is open to the sea and the peak flows can exit the catchment. ■ All surrounding landowners are warned and the wider LWVDS is in operation. ■ With the gates closed, the hydraulic efficiencies of removing the water from the catchment is optimised. Fish passage at the gates is not provided for during these events. The gates will then be re-opened on the receding of the flood levels. Once the peek flow from Lake Wairarapa has receded, the Gate are then operated to achieve target Lake Levels as per the Business as us al methodology. The Barrage Gates may be opened or closed for long r periods of time to manage the larger flows through the catchm nt.
Scenario 4 During maintenance	The main maintenance activities that occur at the Barrage Gates nclude: ■ Water blasting and sand blasting ■ Re-painting of the gates structure ■ Replacement of electrical and mechanical components that control the movement of the gates ■ Earthquake strengthening During maintenance activities, the Bar age Gates remain open. This could be for a period of up to 3 months for a large repainting activity. Up to four gates are open at any one time.
Scenario 5 **Environmental Monitoring Plan (EMP) for operational changes**	An EMP, developed w th the Working group, can be submitted to "the Manager" GWRC Envir nmental regulation for approval, to allow for alternat ve operational procedure(s) of the Barrage Gates to trial and monitor potential nvironmental effects. An EMP shall be provided to the Manager, Environmental Regulation, Wellington Regional Council, for certification, 20 working days prior to monito ing recommended by the OEMP working group commencing. Certification will not be provided if the effects of the alternative way of operating are greater than those already occurring in the existing environment. An EMP shall include, at a minimum, the following detail: a) An assessment to demonstrate the effects of operating in an alternative way are not greater than those already occurring as a result of the Barrage Gates operation b) The purpose of the proposed monitoring programme; c) Description of the environmental effect that is being monitored; d) Duration of the monitoring period; e) Methodology for undertaking the monitoring and how the operation of the Barrage Gates may differ from the protocol within the OEMP; f) Risk assessment, including how any risk will be managed; g) Identification of potentially affected parties; h) Protocol for notification of landowners.

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	If flood conditions arise when the Barrage Gates are being operated in accordance with an EMP, then regime 3 (operation of the Barrage Gates during flood conditions) will override the EMP. This is to ensure that a level of flood protection and safety is maintained to the surrounding landowners. If the Manager, Environmental Regulation, Wellington Regional Council receives an OEMP or EMP for certification , the Manager must, no later than 20 working days of receipt, certify the plan or decline to certify and give notice and reasons. If notice is not given, the plan is deemed to be certified. The consent holder may resubmit revised plans for certification. *Note: the 20 working day timeframe may be extended by written agreement from both Manager, Environmental Regulation and the Consent Holder.*

5 Working group

5.1 Purpose of the Working group

The purpose of the working group is to guide research and monitoring activities relating to the operation of the Gates and alternative Gate operation research modes approved in accordance with an Environmental Monitoring Plan (EMP);

5.2 Roles and Responsibilities

The role of the working group is to establish the EMP(s) to assist with obtaining additional information regarding the effects of the operation of the Barrage Gates on the surrounding environment and its terms of reference shall take in to account Appendix 2 - Working group process document. The working group is also required to be involved in the review process for the OEMP.

The working group is not a decision making group but a forum for the formation of the EMP, dissemination of information from the consent holder and provides the opportunity to comment on consent compliance, monitoring and research, and to provide recommendations for changes to the operation and implementation of the EMP.

5.3 Establishment of the Working Group

Within three months of the commencement of this consent, the consent holder, GRWC Flood Protection shall establish the OEMP working group.

Within three months of the commencement of this consent, GRWC Flood Protection shall establish a working group comprising as a minimum representatives from:

i. GWRC Scheme Manager;

ii. GWRC Whaitua Co-ordinator;

iii. GWRC Science representative;

iv. Ngāti Kahungunu ki Wairarapa;

v. Rangitāne o Wairarapa;

vi. The Department of Conservation;

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vii. South Wairarapa District Council;

viii. the Lower Wairarapa Valley Scheme Committee Chair person or any other elected representative and

ix. Any other persons or group as determined appropriate by the consent holder e.g. Hapū, Fish & Game and Forest & Bird.

5.4 Working group protocol

When the Working group is established, the defining of the protocol will occur in consultation with the Working Group.

Notes

- The working group is considered to be established when the consent holder has collated contact details for all group members and the group has been provided with a plan of how the working group is intended to be facilitated.
- The working group is expected to provide comments/recommendations to the consent holder within 1 month of finalising any inputs to feed into the OEMP
- Stakeholders, who wish to address the working group on any subject, will receive advice of the forth-coming meetings and will liaise with the group around opportunities to attend and address group meetings.
- The consent holder shall provide to the working group all annual reports. The group may make recommendations for additional monitoring and management regimes to guide the implementation of the OEMP.
- Recommendations may result in possible changes to the conditions of this consent. Any change will need to be authorised by Section 127 of the RMA or may require additional RMA consent(s).
- An EMP shall be provided to the Manager, Environmental Regulation, Wellington Regional Council, for certification, 20 working days prior to monitoring recommended by the OEMP working group commencing. Certification will not be provided if the effects of the alternative way of operating are greater than those already occurring in the existing environment. An EMP shall include, at a minimum, the following detail:

  a) An assessment to demonstrate the effects of operating in an alternative way are not greater than those already occurring as a result of the Barrage Gates operation

  b) The purpose of the proposed monitoring programme;

  c) Description of the environmental effect that is being monitored;

  d) Duration of the monitoring period;

  e) Methodology for undertaking the monitoring and how the operation of the Barrage Gates may differ from the protocol within the OEMP;

  f) Risk assessment, including how any risk will be managed;

  g) Identification of potentially affected parties;

  h) Protocol for notification of landowners.

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6 Complaints register

GRWC Flood Protection shall, for the duration of the consent, keep and maintain a complaints register to record any complaint received regarding the operation of the Barrage Gates, or alleged effects from the operation of the Barrage Gates. The complaints register shall include at a minimum:

a) The name and contact details of the complainant;

b) The nature of the complaint;

c) Location, date, time of the complaint and the alleged event;

d) Weather conditions at the time of the alleged event (as far as practicable);

e) Outcome of the consent holder's investigation in to the complaint;

f) Measures taken to respond to the complaint; and

g) Any other known activities in the area unrelated to the operation of the B rrage Gates that may have potentially contributed to the complaint.

The record shall be maintained on site, within the Masterton Off ce, Th complaints register shall be provided to Manager Environmental Regulation, Wellington Regional Council, as part of the annual monitoring report and also made available to Wellington Regional Council at any time upon request.

If the complaint occurs when the Barrage Gates are being operated in accordance with an EMP, then the Consent holder shall notify the Manag r GWRC Environmental Regulation within 3 working days of the complaint being brough to the att ntion of the Consent holder.

7 Monitoring and annual reporting

GWRC Flood Protection are required to submit an Annual Report back to GWRC for review on an annual basis to monitor the progres towards obtaining a greater understanding of the environmental effects on Lake Wairarapa associated with the operation of the Barrage Gates.

GWRC Flood Protection shall prepare an annual monitoring report covering the previous calendar year, to be submit ed to the Manager, Environmental Regulation, Wellington Regional Council, no later than 15 February each year (as the consent was granted after 01 December 2021, then the first annual epo t is to be submitted by 15 February 2023), unless otherwise mutually agreed by writ en agreement from both Manager, Environmental Regulation and the Consent Holder. The repo t shall in lude as a minimum:

a) Record of flood events for the past year;

b) Record of lake levels and the number of times the target lake levels were met and not met;

c) Record of the number of days the Barrage Gates were operated during BAU conditions (including the number of times the Barrage Gates were open for fish passage and/or the Gates fish pass automator was disabled);

d) Record of when each operational regime (1-5 in OEMP) came into effect;

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e) Record of the number of times Lake Onoke became blocked (as a result of no opening in the sand spit), the duration of the blockage and the weather conditions that caused the closure of the spit at the time;

f) Record of alternative operating regimes approved for research and monitoring purpose, when these were undertaken, the duration of these regimes, and the conditions under which these occurred;

g) Summary of actions taken/progress made by the OEMP Working Group;

h) Summary of any research and/or monitoring commenced and/or completed relating to the operation of the Barrage Gates under its different operational regimes, including the purpose of the research and/or monitoring, the methodology employed and the outcome/s of that work;

i) Summary of the findings of any research and/or monitoring specifically undertaken in accordance with the EMP;

j) A programme of planned/scheduled research and/or monito ing ac ivity, and any related EMP for the next 12 months;

k) An indicative programme for the next three years of pl nned scheduled research and monitoring to be undertaken;

l) Record of any complaints (in accordance with cond ion 10) regarding the operation of the Barrage Gates;

m) Record of any consultation with scheme owners, land owners, iwi and other potentially affected persons;

n) Summary of the outcome of any Kaiti ki monitoring; and

o) Summary of progress and/or actions taken to comply with condition 8;

The information within the Annu l Report will then aid the decision-making process for when the Barrage Gates consent xpires in 2027 regarding the operation of the gates and the anticipated environmental effect .

By 30 September 2026 GWRC Flood Protection must submit to Manager, Environmental Regulation, Wellington Regional Council, a comprehensive catchment wide review of the Lower Wairarapa Valley catchment to understand the level of effects the Lower Valley Development Scheme i having on the environment. This review shall include but not be limited to:

a) Review the level of flood protection provided through the Lower Wairarapa Valley Deve opment Scheme in light of climate change;

b) Review the current maintenance and operation regime of all elements of the Lower Wairarapa Valley Development Scheme;

c) Understand and monitor the level of effect the operation of the Lower Wairarapa Valley Development Scheme is having on the surrounding environment;

d) Provide options and recommendations for changes to the management of the Lower Wairarapa Valley Development Scheme to improve environmental and cultural outcomes.

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8 OEMP Review

At a minimum GWRC Flood Protection shall review the OEMP by 30 November 2023.

The purpose of the review will be to review the current OEMP procedures and the include any proposed amendments to the operational procedures through the findings of the research projects undertaken in accordance with the EMP.

The review must occur in consultation with the Working Group.

The significance of any change to the current operation will be reviewed in relation to any subsequent effects on any affected persons. Section 127 of the Resource Management Act 1991 may be required to be used should the change result in a significant deviation from the current operations as outlined in the OEMP.

If it is decided to change the OEMP, any amendments must be certified by the Manager, Environmental Regulation, Wellington Regional Council.

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Appendix 1- Operational Protocols for the Barrage Gates

Acronyms

Responsible staff persons:

FWO: Rostered Hydrology Flood Warning Officer

AE: Rostered Flood Protection Engineer

FS: Rostered Field Supervisor, LWVDS

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Scenario 1- Business as usual Barrage Gates Operational Regime

Operating Regime: NORMAL			Barrage Gates Operational Targets			Staff responsibilities	
Lake Onoke Condition	**Lower Wairarapa Valley Condition**	**Barrage Gates Operation**	**Lake Wairarapa Target Levels[2]**		**Fish Passage**	**Monitoring**	**Gates operation**
Lake Onoke is open to sea	Lower Wairarapa Valley Catchment is not in flood	**Lake Wairarapa Lake Levels**: Lake levels maintained in accordance with requirements of Water Conservation Order **Fish Passage:** Fish Passage maintained between Lake Wairarapa and Ruamahanga Rive	1 December to 29 February:	10.15m	*Allow fish passage by opening two g tes:* *D c mber to March- for a period of one hour before low tide if the head d fference between Lake Onoke and Lake Wairarapa shows there will be no inflow into lake Wairarapa* *September to November- for a period of one hour before high tide if the head difference shows there will be no outflow from Lake Wairarapa when fish are migrating into the lake* *Gates 1 and 6 are opened to provide for fish passage as per the requirements of the consent.*	**FWO:** *Monitor Lake Onoke and Wairarapa levels and period of time when the gates are operated to achieve fish passage.*	**FWO:** *Operate barrage gates according to target lake levels.*
			1 March to 31 May:	10m			
			1 June to 30 Sept mber:	9 9 m			
			1 October to 30 November:	10m			

[2] **Irrigation Note:** Lake levels a so have a effect on irrigation takes. Consideration may be given to the effect on enabling irrigation when making decisions regarding lake levels and barrage gate operations. See http://www.gw.govt.nz/assets/Resource-Consents/Water-restrictions/Lake-Wairarapa.pdf

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Scenario 2- LAKE ONOKE BLOCKED- Barrage Gates Operational Regime

Operating Regime: LAKE ONOKE BLOCKED			Barrage Gates Operational Targets		Staff responsibiliti s	
Lake Onoke Condition	**Lower Wairarapa Valley Condition**	**Barrage Gates Operation**	**Lake Wairarapa Target Levels[3]**	**Fish Passage**	**Monitoring**	**Gates operation**
Lake is closed to sea	Lower Wairarapa Valley Catchment not in flood	**FWO:** Close gates to build up Lake Onoke levels to aid opening, & to prevent Water going into Lake Wairarapa. Gates closed when barrage south stage level exceeds north stage level. Note: Lake Onoke limiting levels are indicative only. Always try to get directives from the **AE.** Failing which, use Lake Onoke limiting le els to operate the gate .	Levels in Lake Wairarapa will be governed by the need to limit lake Onoke levels as they are adjusted to facilitate the lake opening to the sea. The level will also depend on inflows from th western tr butaries and from the floodway in a flood situation. Once Lake Onoke is open to the sea and barrage south stage level is less than the barrage gates north stage, the gates are	*Fish passage is not required t be prov ded for during a flo d event.*	**FWO:** Advise lake shore farmers when Lake Onoke water is back flowed into Lake Wairarapa. **FWO:** Begin liaison with AE when the lake is blocked. Continue to monitor lake levels. **AE:** Give instructions to FWO regarding minimum & maximum levels to maintain. **AE/FS:** Provide instructions to the Lake opening contractors.	**Warning** **If Lake Onoke level is likely to exceed 12.00m all 6 gates of Barrage are to be opened to bring the level down immediately.** This operation is to be carried out by the FWO regardless of contact achieved with AE, SL or the FS. Lake Onoke level should not be allowed to exceed 12.00m at any stage. Two permanent alarms are to be set at 12.00 m and 12.2 m to warn the duty FWO in case the level goes beyond 12.00m.

[3] **Irrigation Note:** Lake levels a so have an effect on irrigation takes. Consideration may be given to the effect on enabling irrigation when making decisions regarding lake levels and barrage gate operations. See http://www.gw.govt.nz/assets/Resource-Consents/Water-restrictions/Lake-Wairarapa.pdf

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Operating Regime: LAKE ONOKE BLOCKED			Barrage Gates Operational Targets		Staff responsibilities	
Lake Onoke Condition	**Lower Wairarapa Valley Condition**	**Barrage Gates Operation**	**Lake Wairarapa Target Levels[3]**	**Fish Passage**	**Monitoring**	**Gates operation**
		Operate Gates to aim for highest Lake Onoke level just at the time of opening (in the morning) but within level limitations dictated by wind conditions. Once Lake Onoke is open to the sea and when the river level downstream of the Barrage Gates gets below the upstream level, operate Gates to achieve fish pass requirements required by condition of consent & target levels in ake Wairarap	opened to bring Lake Wairarapa onto its target level. Once this is achieved, the operation of Barrage Gates will revert back to norma conditions.			

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Operation procedure for opening Lake Onoke

Contractor is informed when the level reaches 10.6m. Generally, an opening is attempted only when the lake level is > 11.4 & sea swell is < 1m, unless there is an impending storm or flood.

Lake levels limitations (Wind):

Wind < 20km/h……..11.7m Lake level max

Wind 20 to 60km/h…11.4m lake level max

Wind > 60km/h……..11.0m lake level up to

Alert levels

LOW – Lake Onoke level below 11.0m. Normal attention

MEDIUM– Lake Onoke level 11.0m to 11.4m and wind < 60km/h. Monitor closely.

HIGH– Lake Onoke level over 11.4m and wind > 60km/h coupled with sea swells > 3m. Monitor very closely by alerting FWO with an alarm every 4 hours or logging every 4 hours

Emergency contact: In case both the AE and the SL are unavailable during an emergency situation please contact the Manager, Flood Protection.

Irrigation Note: Lake levels also have an effect on irrigation takes. Consideration may be given to the effect on enabling irrigation when making decisions regarding lake levels and barrage gate operations. See http://www.gw.govt.nz/assets/Resource-Consents/Water-restrictions/Lake-Wairarapa.pdf

Staff Responsibilities Summary

FWO: Monitor both lakes levels

Liaise with AE regarding blockage and when Lake Onoke reaches 10.6m.

Continue to monitor the lake levels and keep the AE informed

Advise Lake Wairarapa shore farmers when back flowing water to Lake Wairarapa.

AE: Advise FS and lake opening contractor regarding opening of the lake.

Direct FWO on the lake levels to be maintained.

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Scenario 3- DURING FLOOD AND AFTER FLOOD Barrage Gates Operational Regime

Operating Regime: DURING FLOOD/ AFTER FLOOD			Barrage Gates Operational Targets		Staff responsibilities	
Lake Onoke Condition	**Lower Wairarapa Valley Condition**	**Barrage Gates Operation**	**Lake Wairarapa Target Levels[4]**	**Fish Passage**	**Monitoring**	**Gates operation**
Lake Onoke is open to sea If the lake is blocked, then follow the guidelines as per "Scenario 3"	Lower Wairarapa Valley Catchment in flood, flood ways are in use	Close Barrage Gates to allow water to flush from the Ruamahunga Valley. One peak flows within the Ruamahunga River have passed, open the Barrage Gates to with the aim to return to normal operating procedures.	Critical level is 12.00m	*Fish passage is not required to be provided for during a flood event.*	**FWO:** Monitor Onoke and Wairarapa levels & River level at Waihenga. If Lake Wairarapa levels rise. 12.00m is very critical for lakeshore farmers. **FWO:** All land owners on flood warning system to be advised as per warning list levels. **FWO**: Advise **AE** of situation and liaise with **AE** throughout flood period.	**FWO:** Gates closed on Waihenga reaching 3.8m alarm level. **FWO:** Gates opened on recede of floods & downstream level at Barrage Gates reaching the upstream level.

[4] **Irrigation Note:** Lake levels also have an effect on irrigation takes. Consideration may be given to the effect on enabling irrigation when making decisions regarding lake levels and barrage gate operations. See http://www.gw.govt.nz/assets/Resource-Consents/Water-restrictions/Lake-Wairarapa.pdf

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In a major flood event the Manager Environmental Monitoring & Investigation will decide if the flood co-ordinating centre at the office needs to be manned 24 hours with additional flood warning staff.

Scenario 4- MAINTAINENCE- Operation regime for the Barrage Gates

Operating Regime: NORMAL			Barrage Gates Operational Targets			Staff responsibilities	
Lake Onoke Condition	**Lower Wairarapa Valley Condition**	**Barrage Gates Operation**	**Lake Wairarapa Target Levels**[5]		**Fish Passage**	**Monitoring**	**Gates operation**
Lake Onoke is open to sea	Lower Wairarapa Valley Catchment is not in flood Four gates can be raised at any one time, leaving two gates closed	**Lake Wairarapa Lake Levels**: Lake levels aimed to be maintained in accordance with requirements of Water Conservation Order	1 December to 29 February:	10.15m	*Allow fish passage where possible. The Gates will be open for the majority of the time.*	**FWO:** *Monitor Onoke and Wairarapa levels and period of time when the gates are operated*	**FWO:** *Operate barrage gates to allow for a maximum of four gates open at any one time.*
			1 March to 31 May:	10m			
			1 June to 30 September:	9.95m			
			October to 30 November:	10m			

[5] **Irrigation Note:** Lake levels also have an effect on irrigation takes. Consideration may be given to the effect on enabling irrigation when making decisions regarding lake levels and barrage gate operations. See http://www.gw.govt.nz/assets/Resource-Consents/Water-restrictions/Lake-Wairarapa.pdf

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Scenario 5- Environmental Monitoring Plan regime- Barrage Gates Operational regime

Operating Regime: NORMAL			Barrage Gates Operational Targets			Staff responsibilities	
Lake Onoke Condition	**Lower Wairarapa Valley Catchment Condition**	**Barrage Gates Operation**	**Lake Wairarapa Target Levels[6]**		**Fish Passage**	**Monitoring**	**Gates operation**
Lake Onoke is open to sea	Lower Wairarapa Valley Catchment is not in flood Should flood conditions occur or Lake Onoke become blocked during the timeframe for monitoring as outlined the EMP, implement Scenario 2 or 3 as appropriate.	**Lake Wairarapa Lake Levels**: Lake levels maintained in accordance with the target lake levels **Fish Passage:** Subject to EMP requirements	1 December to 29 February:	10.14m	*Submit details of fish passag requir ments for he research to be under taken, to the Manager, Environmental Regulation for certification.*	**FWO:** *Monitor Onoke and Wairarapa levels and period of time when the gates are operated to achieve fish passage.* *Monitor the lake levels and associated environmental effects as per the certified research methodology contained within the EMP*	**FWO:** *Operate barrage gates according to the certified EMP methodology*
			1 March to 31 May:	10m			
			1 June to 30 September:	9.95m			
			1 October to 30 November:	10m			

[6] **Irrigation Note:** Lake levels a so have a effect on irrigation takes. Consideration may be given to the effect on enabling irrigation when making decisions regarding lake levels and barrage gate operations. See http://www.gw.govt.nz/assets/Resource-Consents/Water-restrictions/Lake-Wairarapa.pdf

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