Further Information

MITCHELL DAYSH

PO Box 489, Dunedin 9054
New Zealand
+64 3 477 7884

Reference: 9047

31 July 2017

Environment Southland
Private Bag 90116
Invercargill

Attention: Stephen West

Dear Stephen

RE: APP-20169987 – REQUEST FOR FURTHER INFORMATION

Thank you for your letter dated 26 January 2017 regarding Alliance Group Limited's (Alliance) application to dam, divert and use water from the Mataura River and to discharge water from the hydro-electric power plant, and water and sediment from the hydro-race into the Mataura River. Within this letter you have requested additional information in order to continue to process the applications. A response to this request is set out below. For ease of reference we have extracted the requests and provided a response to each as follows.

1. *A description of how the effectiveness of the proposed mitigations measures for the downstream passage of native fish and eels could be monitored*

Several native fish species have been observed within the Mataura River upstream of the weir. A proportion of these must undertake diadromous migration and may be potentially vulnerable to being caught within the hydro scheme during downstream migration events. Investigations have identified that silver eels are the key species of concern in this regard. As part of the application Alliance proposed to mitigate these potential effects by closing the plant at night during freshes/flood events during the typical downstream migration period (March – April). However, it is acknowledged that it is difficult to monitor the effectiveness of this proposed mitigation due to the high flows and therefore Alliance has sought further advice from PDP to determine the most effective way of monitoring and providing suitable mitigation for any potential effects on silver eels. The advice received from PDP is attached as **Appendix A** to this response and a summary is provided here.

PDP have considered whether this mitigation is necessary and are of the view that monitoring should be undertaken to determine whether the hydro scheme canal is being used by eels during

migration times, and assist in better refining or determining the most appropriate mitigation method. In this regard PDP propose the following adaptive management and monitoring regime:

- Modifying the existing trash screen by reducing the size of the bar spacing's to capture any downstream migrating eels.
- Eels that are caught on the screen will be retained once screen cleaning is undertaken. Trash screen cleaning is undertaken by a scraper bar, which will operate at specific intervals with the captured eels being retained in a modified trash chute. The modified trash chute will be checked and cleaned in the early morning (e.g., approx. 7:00 am) every week day during the full migration period. During critical migration times (i.e., during elevated flow events) the trash chute will be checked at night time (e.g., approx. 8:00 pm) and early morning (e.g., approx. 7:00 am), including weekends.
- The retained eels will be sorted into migrant and non-migrant eels on the basis of coloration (silver ventral zone) and morphological features (e.g., enlarged eyes and pointed head). Length (mm) and weight (g) will be measured, and eels will be sexed on the basis of length.
- It is expected that there will be some mortality and the potential for injury (both internal and external) of the eels that are captured on the trash screen and for those individuals that may end up in the modified trash chute. This is likely to occur due to the eel becoming pressed against the screen, due to the high approach velocity, and having no chance of escaping. The severity of the injuries is expected to be related to the length of time the eel is pressed against the screen and the velocity of the approaching water. This is an unfortunate consequence of the monitoring. However, if this size of eel was to enter the hydro scheme/turbines there is likely to be a poor survival rate.
- Deceased and severely injured eels will be frozen and/ or culled and frozen and retained on site to allow further investigation if it is required. Eels that appear uninjured will be released to the Mataura River downstream of the hydro scheme.

It is considered that the proposed monitoring is a practical way to assess the potential mortality of downstream migrating silver eels within the hydro scheme. The concerns about potential eel mortality and injury/suffering that have been highlighted are important to consider but are unavoidable. It is important to note that this may be the existing situation and would also occur with DIDSON monitoring.

After the completion of monitoring a technical report will be produced detailing the findings, the outcomes of the monitoring and the likely success of the proposed mitigation (including the need for any mitigation). If required, improvements will be recommended, including whether an alternative mitigation measure should be considered.

It is considered appropriate to secure this monitoring and response regime by way of a condition of the consent. A proposed condition is set out below. Given the advice from PDP, an adaptive management response is preferable as adherence to a strict shut down period may not, in the long term, be the best way to mitigate effects and there are inherent difficulties in monitoring the effectiveness of this during operation. The condition that is set out below is more sophisticated and

better suited to the circumstances whereby close monitoring can be undertaken and that there is flexibility in response as a result[1].

Native Eel Downstream Migration Management

a. *Prior to the migration period commencing (1st March), the consent holder shall be required to modify the existing trash screen which forms part of the hydroelectric power plant by reducing the size of the bar spacings to less than 30mm in order to capture downstream migrating eels. This modification shall be a temporary fixture during the following migration period (1st March – 30th April) and shall be removed following this period.*

b. *During the full migration period (1st March – 30th April), the screen and trash chute will be checked and cleared for debris and eels at approximately 7am every weekday. During this same period and elevated flow events (events when the flow increases by 50% from pre-flood flow) the screen and trash chute will be checked and cleared twice daily once at approximately 7am and again at approximately 8pm. Any eels retained by the screen and/or chute will be sorted, and the number, species and other physical and morphological characteristics (appearance, length, weight, sex) will be recorded after each clearance period. The purpose of this monitoring will be to identify how many eels and of what species are entering the hydro scheme during the migration period in order to determine what if any adverse effects the hydro scheme is likely to be having on native eel downstream migration.*

c. *Following the monitoring period described in condition b, the consent holder shall engage a suitably qualified and experienced expert to prepare a report summarising the findings of the monitoring, assessing the actual effects on silver eels on migration and providing a recommendation as to the necessary mitigation or further monitoring that should be undertaken in order to manage any actual adverse effects arising on silver eel migration. This report shall be submitted to the Consent Manager within 30 working days of monitoring being completed. If the analysis of the monitoring indicates that mitigation, monitoring or remedial action is required then the consent holder shall be required to implement these measures in accordance with the recommendations of the report.*

2. *An assessment of alternative mitigation systems that could be utilised if monitoring shows that the proposed mitigation measures had been insufficient to minimize adverse effects on the downstream passage of native fish and eels.*

The application proposed a shut down period to assist in managing the potential adverse effects of the hydro scheme on downstream silver eel migration in particular. As discussed above, monitoring is now proposed to more accurately determine whether the scheme is having an adverse effect on eel migration and if so, a further investigation into the necessary mitigation will be undertaken and implemented by Alliance in accordance with the conditions proposed above. Alternative mitigation strategies have been investigated by PDP and include:

[1] This condition would replace proposed condition 14 in Appendix I to the AEE.

- Amendments to the shut-down period;
- Positive barrier screens;
- Behavioural screens.

These systems are described in the document attached as **Appendix A**. In order to ensure the proposed method is the most appropriate, a better understanding of the scheme's effects (if any) on eel migration is required. As discussed above, an adaptive management regime is therefore being proposed whereby detailed monitoring is to be undertaken and this will assist in better understanding the actual effects on eel migration and refining the necessary response in order to mitigate any such effects. It may therefore be that one or a combination of these, or other mitigation responses is considered necessary.

3. *An assessment of the effects of the weir and diversion on the passage of brown trout and salmon, including a description of the existing fish passes and how they are maintained.*

A fish ladder has been installed and is maintained within the weir. For successful passage over a fish ladder to occur the ladder's water velocity, turbulence and depth in the take-off pool, ratio of pool depth to fall height need to be considered. Passage attempts will increase as flow increases, until flow is greater than the fishes swimming capabilities. In New Zealand, the main fish species that are able to make passage over a fish ladder by jumping include trout (brown and rainbow) and salmon.

The fish ladder that is located on the Mataura River weir consists of three V drop structures plus the weir itself. The entrance, exit and middle drop structures are likely to allow passage to adult trout and salmon, and only if there is sufficient resting pool depth and size. Generally, the passable fall height for salmonids is around 0.30 m. However, the maximum jumping ability of adult salmonids is greater than this. The weir fall heights all appear to be outside of the jumping range of smaller juvenile salmonids. The Mataura River Falls (downstream of the weir) are noted as being a complete barrier to salmonids (Golder Associates, 2016). However, at certain times when conditions are adequate (both in terms of environmental conditions and fish fitness) adult salmonids may have some minimal success in passing the Mataura River falls. Therefore, designing the fish ladder for adult salmonid passage was appropriate.

4. *Clarification of a comment in section 4.1.1.1 of the application that the weir does not present a hazard to navigation. Did you mean that the weir or that use of the weir does not present such a hazard? Please also clarify how that has been determined or by whom.*

The existing environment is heavily modified and given the presence of the weir in this location for 100+ years this particular stretch of river is likely to have had limited recreational use. The ongoing use of the weir will therefore not generate an additional hazard to navigation. The presence of the weir is well known as part of the existing environment and the operation of the weir does not pose an additional hazard in this regard.

5. *If the applicant's plant was to close, shift or otherwise cease to utilise the weir, what plans are in place to remediate the site occupied by the weir? What would be the approximate cost of removing the weir?*

The applicant is seeking to renew the consents necessary to continue to utilise the weir in order to generate hydroelectricity to the plant. In the event that the Plant were to close, shift or otherwise cease to utilise the weir, an appropriate investigation into the ongoing operation and use of the weir would need to be undertaken at that time, also acknowledging that there are other parties who currently use the weir and have consent to do so. It may also be that additional consents are necessary in order to authorise the removal of the weir, so it would be inappropriate to speculate as to what might be undertaken (or what might be required as an outcome of a resource consent process) in order to mitigate or remediate any potential effects arising from this and the associated costs.

6. *An explanation why the various activities should not be bundled as non-complying activities and an assessment of the activities in terms of the s104D considerations if they were to be bundled.*

It is agreed that the general practice is that when resource consents are required for more than one activity and those activities and their effects are inextricably linked (one affects the other), the activities should be bundled. There are exceptions to this:

- Controlled and restricted discretionary activities
- Where the scope and control of Council's decision is otherwise relatively defined (e.g. a rule precluding notification of a discretionary activity)
- The effects of exercising the two consents would not overlap, impact or have flow-on effects on each other.

In this case, it is the discharge of sediment from the hydro race which triggers the non-complying activity status. The ongoing use of the weir, diversion and discharge of water via the hydroelectric power plant is (bundled together) a discretionary activity. The discharge of sediment is considered to be a minor ancillary activity. The proposed discharge of sediment occurs sporadically and although consent for a 25 year term had been issued for this activity in 2008, this consent has lapsed because it has not been given effect to. While the discharge is necessary to ensure the efficient operation of the hydrorace, it is not an activity which occurs on a regular basis and as such it might be that it occurs as a one off during the life of a 25 year consent term. The effects of the sediment discharge are also temporary and will have less than minor effects on the receiving downstream environment. It is also not in itself an activity which triggers significant interest from stakeholders and likely if applied for separately would be assessed on a non-notified basis given the minor and temporary nature of the effects. While it seemed efficient to apply for the activities simultaneously it seemed unnecessarily onerous to apply a non-complying activity status to the entirety of the application given the sporadic and minor nature of the sediment discharge.

If the Council is of the view that the applications need to be bundled and processed as a non-complying activity, Alliance would appreciate early notification of this as it will need to consider further whether consent for the sediment discharge is pursued at this time.

We trust that this response is sufficient for you to continue to process the application. It would be appreciated if you could please advise what the next steps are in this regard.

Yours sincerely,

Claire Hunter
Mitchell Daysh Ltd

claire.hunter@mitchelldaysh.co.nz

Enc

Submissions

SUBMISSION ON A LIMITED NOTIFICATION RESOURCE CONSENT APPLICATION

To:	The General Manager Environment Southland Private Bag 90166 Invercargill 9840
Consents Officer:	Stephen West – Principal Consents Officer
Name of Submitter:	Hokonui Rūnaka and Te Rūnanga o Ngāi Tahu (collectively referred to as Ngāi Tahu in this submission).
Prepared by:	Te Ao Marama Inc PO Box 7078 South Invercargill Invercargill 9844
Name of applicant:	Alliance Group Limited
Application:	APP-20171566
Proposal:	Environment Southland has received an application from Alliance Group Ltd, Mataura. This submission relates to the whole application.
Our position:	Ngāi Tahu are **opposing** this application and wish to be heard in support of this submission If others are making a similar submission, Ngāi Tahu will consider present a joint case with them at the hearing.
Trade Competition:	Ngāi Tahu is not a trade competitor for the purposes of the Resource Management Act.

A copy of this submission **has been sent** to the applicant.

INTRODUCTION

1. This submission is made on behalf of Hokonui Rūnaka and Te Rūnanga o Ngai Tahu (collectively referred to as Ngāi Tahu).

Papatipu Rūnaka

2. The Te Rūnanga o Ngāi Tahu Act 1996 (the TRoNT Act) and the Ngāi Tahu Claims Settlement Act 1998 (the Settlement Act) give recognition to the status of Papatipu Rūnanga as kaitiaki and manawhenua of the natural resources within their takiwā boundaries.

3. The consent application proposals relate to the renewal of resource consent to dam, divert, use and discharge water within the takiwā of Hokonui Rūnaka.

Te Rūnanga o Ngāi Tahu

4. Te Rūnanga o Ngāi Tahu is the tribal representative body of Ngāi Tahu Whānui. It is a body corporate established under section 16 of the TRoNT Act. Section 15(1) of the TRoNT Act states:

   Te Rūnanga o Ngai Tahu shall be recognised for all purposes as the representative of Ngāi Tahu Whānui.

5. In paragraph 7 of section 6 of the Settlement Act (recording the Crown's apology) Ngāi Tahu is recognised "as the tangata whenua of, and as holding rangatiratanga within, the takiwā of Ngāi Tahu Whānui." It has therefore been clearly affirmed in statute that Te Rūnanga o Ngāi Tahu is the sole representative of Ngāi Tahu Whānui, the iwi that is tangata whenua within the Ngāi Tahu Takiwā.

6. The attention of Environment Southland is respectfully drawn to the special status of Te Rūnanga o Ngāi Tahu. Te Rūnanga o Ngāi Tahu notes that this submission should not be treated as a single submission, in the manner customarily adopted, but should be accorded the status and weight due to the tribal collective, Ngāi Tahu Whānui, which it represents.

7. There are currently over 54,000 members of Ngāi Tahu Whānui whose names are registered on the roll in accordance with section 8 of the TRoNT Act and this number continues to grow.

8. Notwithstanding its statutory status as the representative voice of Ngāi Tahu Whānui "for all purposes", Te Rūnanga o Ngāi Tahu accepts and respects the right of individuals and Papatipu Rūnanga to make their own submissions.

Mātaitai

9. Mātaitai reserves can be established over traditional fishing grounds to help ensure fisheries resources are available for customary food gathering purposes. These are under the Fisheries (South Island Customary Fishing) Regulations, 1999 and enable tangata tiaki/ kaitiaki to manage the fisheries resources in particular areas.

REASONS FOR SUBMISSION

10. Ngāi Tahu is supportive of development within its takiwā, provided activities are undertaken in a way that respects the environment where the activity is to be

undertaken and do not adversely affect Ngāi Tahu cultural values, customs and their traditional relationship with land and water.

11. Ngāi Tahu understands that Alliance Group Limited wishes to renew their consent to dam and divert water, to use water for hydroelectric power generation and to discharge water to the Mataura River. Ngāi Tahu understand that this is an existing use within the Mataura River.

12. The Mataura Awa is of cultural significance and an important mahinga kai area for Ngāi Tahu. The significance of the river to tangata whenua has been recognised by the Crown and is now a Statutory Acknowledgment under the Settlement Act. It was also the first freshwater Mātaitai gazetted in New Zealand under the Fisheries (South Island Customary Fishing) Regulations 1999.

13. Kanakana (*Geotria australis*) and Tuna (Long fin eel, *Anguilla dieffenbachia)* are considered taonga species by Ngāi Tahu whānau, these taonga have been gathered at Te Au Nui (Mataura Falls) both historically and contemporarily, amongst other mahinga kai species in the surrounds. There is also many pūrākau (stories) that have been passed down through generations describing the events that happen at Te Au Nui.

14. In regard to the current application the following are concerns of Ngāi Tahu:

    a. The effects of the application on in-stream ecology,(particularly taonga and mahinga kai species), and cultural values associated with Te Au Nui and the Mataura Awa.

    b. There is concern that there has been no previous monitoring of the effects of the activity on in-stream values, including migrating fish species.

    c. The effects of the hydro-electric power turbine and proposed mitigation on fish species (including fish populations and migrating fish).

    d. Whānau have raised the matter of the efficacy of the monitoring period (being March-April). This may not correlate with the migrating patterns of fish species.

    e. There is a concern that the flow over the weir and the configuration of the lip of the weir may not be adequate for fish passage.

    f. The trap and transfer system that is currently being undertaken and proposed may not be capturing the elver upstream migration period.

    g. The lack of consideration of the effects of climate change and its influence on the lifecycles of aquatic species particularly the timing of migration.

    h. Ngāi Tahu are concerned with the proposed duration of the application.

DECISISONS SOUGHT

15. Ngāi Tahu is opposed to the application in its current form and seek for the application to be declined.

16. However, if a short duration (e.g. 5 years) and methods are developed which will alleviate the concerns of Ngāi Tahu around the effects of the activity on cultural and in-stream values we may be able to reconsider our position.

CONCLUSION

17. We acknowledge that the Alliance Group, Mataura (Alliance) has undertaken pre-application hui and throughout the development of the application.

18. As a result of these hui, various methods have been discussed (*please find attached a full letter)*. This includes:

    a. Returning live tuna to the river if caught during monitoring and data collected to be provided to TAMI for Hokonui Rūnaka. This data was to include the date, species, length, weight and number of tuna.
    b. To keep the carcasses of any dead Tuna for Hokonui Rūnanka, especially the head so that we may be able to age the fish and to be able to identify the cause of death.
    c. TAMI to be provided with all data that is collected from this consent.
    d. For a representative from Hokonui Rūnaka to observe the monitoring of the trash screen and chute.
    e. Once the monitoring has been completed a suitable person with specialist expertise is engaged to implement any mitigations specific to the site.

    It should be noted that these methods of mitigation have been offered up by Alliance as a means of understanding tuna mortality. There may however be a more appropriate solution to understanding those that should be considered.

19. We wish to be heard in support of our submission.

20. Ngāi Tahu wish to be a part of any pre-hearing meeting that may be held for this application and in the development of appropriate potential mitigation that may occur.

Nāhaku noa nā

SRB

Stevie-Rae Blair
Te Ao Marama Inc.
Junior Māori Environmental Officer

Form 13: Submission on publicly notified application concerning resource consent

Resource Management Act 1991

To:	Southland Regional Council
Name of submitter:	Lewis Vernon Sanson, Director-General of Conservation
Applicant:	Alliance Group Limited
Description of activity:	Dam and divert water, to use water for hydro-electric power generation, and to discharge water into the west bank of the Mataura River, upstream of Bridge Street, Mataura, Southland.
Application numbers:	APP-20171566: Alliance Group Limited
My submission relates to:	The provisions relating to fish passage and screening
My submission is:	I oppose in part the granting of resource consents for the Alliance Group Mataura hydro-electric generation plant (HEP) and

The reasons for my submission are:

1. The Department of Conservation has statutory functions under the Conservation Act 1987 to protect recreational freshwater fisheries and freshwater fish habitats and preserve as far as practicable indigenous freshwater fisheries (including specific powers for the Director-General under section 53(3)(d)), and to advocate for the conservation of natural resources generally under section 6(ab) and 6(b).

2. The Mataura River is:

- Subject to the Water Conservation (Mataura River) Order 1997 to protect its nationally outstanding freshwater values, including its outstanding fisheries and angling amenity features, whilst recognising existing uses including the Alliance HEP; and
- A Statutory Acknowledgement area under the Ngai Tahu Claims Settlement Act 1998; and
- Subject to a Mātaitai Reserve (2006) to enable Ngai Tahu to exercise their non-commercial fishing rights, situated upstream and downstream of the Mataura Falls.

3. As currently configured the applications are inconsistent with the following Objectives and Policies:

- National Policy Statement for Freshwater Management 2017 Objectives A1 and A2 and Objective B1, and the national values of Mahinga kai; and
- Southland Regional Policy Statement 2017 Objectives WQUAL .1, .2, .3, ENG .2, .3, and .7, WQUAN .1 and Bio .1, .2, .3 Policies TW.1, WQUAN.1, .2, .5, .7, .8 and BIO .1, .2, .4-.9; and
- Southland Regional Plan (Water) Objectives 3, 5, 10, 11 and 13, and Policies 1, 1A, 14, 14A, 14B, 15, 16, 17, 19A, 21, 23 and 32; and
- Proposed Southland Water and Land Plan Objectives 1, 2, 3, 4, 5, 9, 9A, 14, 15, 17, 18 and Policies 1, 2, 3, and 20, 22, 26, 28, 32, 40, 41, 42, 47; and
- Ngai Tahu ki Murihuku Natural Resource and Environmental Management Plan (2008); and
- The Southland /Murihuku Conservation Management Strategy (2016) Policies 2.6.3, 2.6.10, 2.6.17, 3.13.2 and 3.14.1, and

With regard to the existing Alliance HEP operations at Mataura:

- The fish population effects of the Alliance HEP turbine strike on fish migration downstream on species such as long fin eel/ *tuna* and lamprey/*kanakana* are unquantified. This includes the effects of turbine strike outside of the March and April evening shutdown period under the previous resource consent conditions. The overall effectiveness of this shut down period is not known, and it is not clear if the seasonal timing, flow trigger, and shut down period for each event enables optimal fish passage for a range of fish species and the extent of the turbine strike on fish populations, and
- The existing HEP plant does not have an adequate modern fish screen or fish by-pass structure to remove freshwater fish from the canal and return them to the Mataura River unharmed. The existing 60 mm screen does not provide for fit for purpose fish screening and alternatives may exist to deploy to deter fish from entering the canal, and
- Alternatives to Francis turbines now exist that better provide for fish passage and that would allow unimpeded hydro-electric power generation, and
- The lip of the existing weir on the Mataura River restricts fish passage and may require reconfiguration to better provide for fish passage, and
- Mataura Industrial Estates Limited (MIE) and Alliance Group Limited are required under their existing consents to maintain a fish ladder for upstream fish movement. This consent proposes a trap and transfer system for eels/ *tuna* as outlined in Appendix F of the AEE. However, the existing trap and transfer system does not address eel/tuna passage when flows are above 80 cumecs, nor does it address passage outside the elver migration season as specified by the existing consents.

Decisions sought:

1. That resource consents for the Mataura Alliance Group Ltd be granted for a term of no longer than five years, subject to appropriate conditions to address the adverse effects of the hydro-electric powerplant on fish passage for long fin eel/ *tuna* or lamprey/ *kanakana*.

2. Conditions that require the applicant to undertake Mataura River specific research and evaluation to address and remediate the following fish screening and fish passage matters associated with the operation of the existing hydro-electric power plant:

    i) Assess the extent of loss of fish from turbine strike from the hydro-electric turbine and investigation of more appropriate fish screening and by-pass design including suitable sweep and approach velocities to avoid entrainment of fish into the canal and turbine, and
    ii) Assessing the triggers for eel migration by undertaking acoustic tagging in the upper Mataura catchment, and
    iii) Investigate the installation of a replacement fish passage friendly vertical HEP turbine design, and
    iv) Investigate and test the deployment of appropriate technology which could be effective into deterring downstream migrating fish from entering the HEP canal, and
    v) Alter the configuration/shape of the weir lip, including consideration of alternative weir shapes to remediate the configuration to improve fish passage, and
    vi) Investigate improvements to or more effective alternatives, to improve upstream fish passage to the current trap and transfer fish passage undertaken, including options outside of the elver migration season or when flows are above 80 cumecs, and

3. That the applicant's proposed consent conditions be amended to:

    i) Replicate Mataura Industrial Estates (ES consent number 203311) conditions 2, 3, and 7.
    ii) Amend the applicant's proposed conditions to better provide for freshwater fish passage and protection in general, and specifically

iii) Alter the species, dates, timing, trap design, and trigger amounts of the trap and transfer in proposed conditions 6-12, and reporting matters prepared under proposed condition 13, and

iv) Alter the dates, timing, and trigger amounts and conditions for the proposed "cease generation" condition 14, and

v) Insert a more specific review condition to give effect to knowledge gained under the proposed reporting condition 13 and/or any other specific research condition imposed by Council.

4. Any consequential amendments to any consent conditions required to give effect to the above submission.

I have attached a possible set of consent conditions at Appendix 1 to address some of the concerns I raise in this submission. Further, these do not reflect the Applicant's additional s92 information and new proposed condition 14, which was only provided to the Director-General on 20 November 2017.

I **wish to be heard** in support of my submission.

I would support a pre-hearing meeting to discuss (among other matters) fish passage/ fish screening conditions for the proposed dam, divert, discharge, and use resource consents (APP-20171566).

If others make a similar submission, I will consider presenting a joint case with them at a hearing.

Tony Preston
Operations Manager, Southland
Invercargill
Acting under delegated authority from the Director-General of Conservation

24th November 2017

Note: A copy of the Instrument of Delegation may be inspected at the Director-General's office at Conservation House *Whare Kaupapa Atawhai*, 18 - 32 Manners Street, Wellington 6011

Address for service:
RMA Shared Services
Department of Conservation
Private Bag 4715
Christchurch Mail Centre 8140
Attn: Herb Familton
Email: hfamilton@doc.govt.nz
Phone: (027) 2906025

Appendix 1
Possible Conditions

i) That the maximum take rate, and the locations of the take and discharge be specified in condition 1, as per MIE consent condition 2, and

ii) That condition 2 replicate MIE condition 3, and

iii) That "Council's Environmental Compliance Manager" be added to condition 3.

iv) Condition 4 and 5 is supported.

v) Condition 6 is altered as follows:

- Delete "15th January" and replace with "1st December"
- Add lamprey /*kanakana* as a species to be inspected.
- Include the Alliance side of the Mataura Falls as an area requiring inspection

vi) Condition 7 alter as follows;

- Delete "30" and add "10"
- Add "at the trap site or on the Alliance Group bank side"
- Insert MIE condition 7, with the addition of "Mataura Industrial Estates" instead of "Alliance Group Limited".

vii) Condition 8 alter as follows:

Delete the first sentence and replace it with:

- " when the twice weekly inspections identify more than 10 elvers and the Mataura River flows are below 80 m^3/sec the consent holder shall install a fish trap at the location marked "trap site" above".

Insert a consultation requirement as follows:

- "The consent holder shall consult to Te Ao Marama / Ngai Tahu, Fish and Game and Department of Conservation on the design of a fish trap prior to installation".

viii) Condition 9

Delete the first sentence and replace it with:

- "When the twice weekly inspections identify more than 10 elvers and the Mataura River flows are below 80 m^3/sec, then the consent holder shall be obligated to continue twice weekly inspections to at least the end of February and until there have been no catches for 10 consecutive days. Once there have been no elver catches for 10 consecutive days, the consent holder shall be able to cease weekly inspections until the following 1 December."

ix) Condition 10

Alter so that all fish species caught should be transferred upstream.

x) Condition 11

Alter to "The consent holder shall ensure that the trap and transfer process remains operational there have been no catches for 10 consecutive days. Due to the risk of the trap being washed away, it shall be removed at flows above 75 m^3/s".

Add an additional sub condition regarding the fish trap: "The applicant shall keep a spare trap available for redeployment at the trap site if the installed trap malfunctions, breaks, or is washed away in a flood."

xi) Condition 12 is supported

xii) Condition 13

The reporting should also include:

- The numbers and species of galaxiids/ other native species caught in the trap and transferred, and
- Recommendations on improvement of the trap design in the report to the consent authority, and
- The report should also be supplied to Te Ao Marama/ Ngai Tahu, DOC and Fish and Game

xiii) Condition 14 [N.B. the applicant's s 92 response and proposed condition 14 has not been considered]

Delete:

- "During the months of March and April each year.", and replace with "During the months of March to May each year"

Add:

- "The cease generation requirement shall cease on the earlier of the 30th of April or when the Mataura River water temperatures fall below 11 degrees centigrade for consecutive 3 days at 4 pm at the Tuturau flow recording site".

ix) Conditions 15 and 16 are supported.

x) Review Condition 17

Add a new iv)

- "Altering the species, dates, timing, trap design, and trigger amounts of the trap and transfer in conditions 6-12, based on reports prepared under condition 13, and
- Altering the dates, timing, and trigger amounts for the cease generation condition 14".

Submission on a Limited Notified Application for Resource Consent

To: Environment Southland
Private Bag 90116
Invercargill 9840

Name of submitter: Fish & Game New Zealand – Southland Region ('Fish & Game')
PO Box 159
Invercargill 9825

Attention: Stephen West – Consents Officer

Name of Applicant: Alliance Group Ltd ('the Applicant')

Application: APP-20171566

Description of activity: The Applicant has applied for the following consents of 25 years duration to generate hydro-electricity:

- Dam and divert within the Mataura River;
- Use water for hydro-electric power generation; and
- Discharge water to the Mataura River.

Location: Mataura River, adjacent to 18-30 McQueen Avenue, Mataura at about co-ordinates 1,281,405E 4,876,540N NZTM. The site is on the true right bank of the Mataura River approximately 400-800m upstream of Bridge Street, Matauara.

Our submission relates to: The whole application.

Our submission is: We oppose the application.

Our reasons for comments are:

Fish and Game is responsible for the management of sports fish and game birds within the Southland region. Fish and Game has an interest in hydro-electric power generation, particularly where they may affect water quality, quantity and aquatic ecosystems.

The environment for the hydro-electric generation proposed by the Applicant is the Lower Mataura River in the vicinity of the Mataura Falls. Specifically:

1. A large U shaped weir is located in the bed of the Lower Mataura River approximately 250m upstream of the Mataura Falls. The weir structure diverts 6 – 10m3/s of water into the Applicant's 300m long intake raceway on the true right bank of the Mataura River. In turn, the intake raceway conveys water into the Applicant's meat processing plant; and

2. Water diverted into Applicant's meat processing plant via the raceway structure is in part abstracted by the Applicant for its plant operations and the remainder is conveyed through its vertical aligned 'Francis' hydro-electric turbine unit. Water exiting the race structure and

hydro-electric turbine unit is subsequently returned to the main stem of the Lower Mataura River approximately 125m downstream of the Mataura Falls.

The Lower Mataura River has significant sportsfish and game values, including recreational hunting and fishing opportunities, for the following reasons:

1. It is a significant habitat of indigenous and introduced birds, including game species which have been hunted since the late 19th century during the annual game bird hunting season.

2. It supports a nationally significant brown trout fishery and angling amenity features which are recognized pursuant to the Water Conservation (Mataura River) Order 1997 ('Mataura WCO') as including:

    a. The Mataura River from its source (approximate map reference NZMS 260 E42: 502333) to its confluence with the sea (approximate map reference NZMS 260 F47: 877946); and

    b. The Waikaia River and its tributaries, the Otamita Stream, and all other tributaries of the Mataura River upstream of its confluence with the Otamita Stream (approximate map reference NZMS 260 F45: 881582).

    The Mataura River is one of the most heavily fished brown trout rivers in New Zealand and provides habitat for a self-sustaining population of wild brown trout. The 2014 / 2015 National Angling Survey[1] provides that 36,100 ± 3,470 angler days were spent in the Mataura catchment during the 2014 / 2015 angling season, of which 30,690 ± 3,330 angler days were spent on the main stem of the Mataura River including:

    a. 10,500 ± 3,020 angler days above Gore; and

    b. 20,180 ± 3,330 angler days below Gore.

    The Lower Mataura River can be fished using a range of techniques, including bait fishing, spin fishing and fly fishing. Hence, the Lower Mataura River provides a range of angling opportunities to inexperienced and experienced trout anglers alike. Anglers fishing the Mataura River below Gore are permitted to catch up to four sports fish per day, including 1 salmon per day.

3. The Lower Mataura River provides important passage for brown trout and Chinook salmon moving between the freshwater, estuarine and sea environment. In this case, approximately 65km of freshwater habitat exist in the main stem of the Mataura River, including its estuarine waters, downstream of the Mataura Falls.

    Some form of seaward migration at some stage of the life cycle is a common feature of salmonid populations.[2] Specifically:

    a. Brown trout spawn in freshwater and move extensively within freshwater. Reasons for juvenile and adult brown trout movement within freshwater include for example:

---

[1] Unwin M. (July 2016), *Angler usage of New Zealand lake and river fisheries - Results from the 20014 / 15 National Angling Survey*, NIWA, Appendix 1.

[2] Hayes J. and Hill L., *'The Artful Science of Trout Fishing'*, Canterbury University Press, 2005, p. 50.

seeking spawning habitat, seeking better food resources and feeding habitat, water temperature, flood flow conditions and low flow conditions. In addition, some, but not all, brown trout migrate to the estuary or sea at various times for various periods during their life history;[3] and

b. Chinook salmon spawn in freshwater and migrate to sea as juveniles where they grow into adults (2 – 5 years) and subsequently return to freshwater to spawn.[4]

Whilst at sea or in estuarine / tidal waters brown trout can grow extremely fast by feeding on marine derived food sources, such as smelt. Accordingly, some seagoing or estuarine brown trout reach large sizes.[5] Much of the best 'sea-run' brown trout fishing is to be had in New Zealand's most southern rivers.

4. In addition to the brown trout fishery, a small number of wild Chinook salmon annually make their way into the Mataura catchment from the sea via the main stem of the Mataura River. Chinook salmon are not prevalent in Southland. As such, the lower Mataura River provides wild salmon angling opportunities, which are very limited in Southland, and are fished for by a small number of passionate salmon anglers. In this case, the bulk of salmon angling in the Mataura catchment occurs in the deep and incised pools located immediately downstream of the Mataura Falls, principally when flows recede during the summer low flow period.

5. Great diversity of wildlife is associated with the lower Mataura River, including waterfowl, and other bird species such as heron, gulls, oyster-catcher and dotterels.

6. The Lower Mataura River, including its estuarine waters and tributaries, provide important spawning grounds and habitat for a number of indigenous fish species, including: varieties of flat fish, eels, lamprey and whitebait.

7. The Lower Mataura River is popular for other recreational pursuits such as boating / kayaking, fishing for flat fish, eels and whitebait and amenity appeal.

The Lower Mataura River is the also the receiving environment for a number of industrial / municipal discharges, including treated wastewater discharges from the Applicant's meat processing plant at Mataura and the Gore District Council wastewater treatment sites at Gore and Mataura.

The significance of the Mataura catchment is recognised insofar as:

1. The Mataura River has a statutory acknowledgement under the Ngāi Tahu Claims Settlement Act 1998 which recognises Ngāi Tahu's cultural, spiritual, historic and traditional association to the Mataura River.[6] Specifically, Schedule 42 of the Ngāi Tahu Claims Settlement Act recognises that:

---

[3] McDowell, R. M. (1980). *Freshwater Fish in New Zealand*. A. H. & A. W. Reed Ltd. Wellington.
[4] Ibid.
[5] Ibid.
[6] Refer to sections 205 and 206 and Schedule 42 – Statutory Acknowledgement for Mataura River of the Ngāi Tahu Claims Settlement Act 1998.

a. The Mataura River was an important source of mahinga kai, noted for its indigenous fishery;

b. The Mataura Falls were particularly associated with the taking of kanakana (lamprey); and

c. The mauri of the Mataura represents the essence that binds the physical and spiritual elements of all things together, generating and upholding all life. All elements of the natural environment possess a life force, and all forms of life are related. Mauri is a critical element of the spiritual relationship of Ngāi Tahu Whanau with the river.

2. The Mataura River in the vicinity of the Applicant's site is Mātaitai Reserve established under the Fisheries Act 1996. Mātaitai Reserve Areas are designed to give effect to the obligations stated in the Treaty of Waitangi Fisheries Claims Settlement Act 1992 to develop policies to help recognise use and management practices of Māori in the exercise of non-commercial fishing rights.

   The Mātaitai Reserve encompasses the waters of the Mataura River for approximately 10.5km as follows:

   a. The northern boundary is about 500m upstream of the Mataura tannery; and

   b. The southern boundary is at a bend in the Mataura River about 1km downstream of Shanks Road.

Position on the Application

Fish & Game acknowledges that:

1. The weir structure, raceway and hydro-electric turbine unit is existing infrastructure, which allows the Applicant to generate up to 25% of the electricity requirement of its Mataura meat processing plant; and

2. Clause 6(1) of the Mataura WCO prohibits damming of the main stem of the Mataura River from its source to the sea, with the exception of the existing weir structure upstream of the Mataura Falls if the water permits are granted or renewed subject to similar terms and conditions to which the former permits were subject.[7]

However, neither of the above negate the requirement for the Applicant under s 5(2) of the Resource Management Act 1991 ('the RMA') to:

1. Safeguard the life-supporting capacity of water and ecosystems; and

2. Avoid, remedy or mitigate the effects of its hydro-electric scheme on the environment.

In this case, the Applicant's AEE provides that:

1. The weir structure diverts approximately 6 – 10m3/s of water into a 300m long intake race;

[7] Clause 6(3) of the Mataura WCO.

2. The Applicant proposes to alter the existing trash screen on the hydro turbine unit intake from 60mm bar spacing to 30mm bar spacing. The diagram of the hydro turbine unit shows that the trash screen is located at the point where water physically enters the hydro turbine unit as opposed to at the point where water is diverted by the weir structure from the main stem of the Mataura River and into the 300m long intake race. No other physical alterations to the existing hydro-electric structure are proposed.

In response, Fish & Game has the following concerns about the proposal:

1. Background

The AEE provides that the following indigenous species are found in the Mataura catchment.

Table 1 – Native fish species in the Mataura River

Common name	Scientific name	Threat classification (2013)[8]
Diadromous species		
Longfin eel	*Anguilla dieffenbachii*	At risk
Shortfin eel	*Anguilla australis*	Not threatened
Torrentfish	*Aldrichetta forsteri*	At risk
Giant kokopu	*Galaxias argentus*	At risk
Inanga	*Galaxias maculatus*	At risk
Lamprey	*Geotria australis*	Nationally vulnerable
Common bully	*Gobiomorphus cotidianus*	Not threatened
Redfin bully	Cobiomorphus cotidianus	At risk
Common smelt	*Retropinna*	
Non-diadromous species		
Gollum galaxias	*Galaxias gollumoides*	Nationally vulnerable
Alpine galaxias	*Galaxias* aff. *paucispondylus* "Southland"	Natioanlly vulnerable
Southern flathead	*Galaxias* "southern"	Declining
Upland bully	*Gobiomorphus breviceps*	Not threatened

In addition, the Mataura River provides habitat for two introduces species of sportsfish, namely brown trout and Chinook salmon.

[8] Allibone, R.M.; David, B.O.; Dunn, N.: Goodman, J.; Hitchmough, R.; Jacques, A.; Ling, N.; D.J.; Ravenscroft, P.; Rolfe, J: *New Zealand Threat Classification Series 7 - Conservation status of New Zealand freshwater fish, 2013* New Zealand Department of Conservation, 2013.

Table 2 – Introduced and naturalised species in the Mataura River

Common name	Scientific name	Threat classification (2013)[9]
Diadromous species		
Chinook salmon	*Oncorhynchus tshawytscha*	Introduced and naturalised
Non-diadromous species		
Brown trout[10]	*Salmo trutta*	Introduced and naturalised

Many of the species described above are diadromous, meaning that they migrate between freshwater and marine habitats as part of their life cycle. In addition, brown trout move extensively within freshwater and some have a marine phase to their life cycle. This behaviour makes these species potentially vulnerable to being caught up in water intakes, particularly when their life cycle involves migrations up or down the Mataura River or they move extensively within freshwater.

2. Rate of diversion

The Applicant's diversion of 6 – 10m3/s of water from the Mataura River into the intake structure represents a significant diversion, particularly as flows in the Mataura River recede during the low period. Environment Southland flow records provide that:

a. The Mataura River at the nearest upstream gauging site at Gore has a 7-day MALF of 17.572m3/s and median flow of 49.284m3/s; and

b. The Mataura River at the nearest downstream gauging site at Tuturau (approximately 7.5km downstream) has a 7-day MALF of 18.942m3/s and median flow of 55.754m3/s.[11]

The Applicant's diversion occurs irrespective of whether the hydro-electric turbine is in use and represents:

a. Approximately 31.67 – 52.8% of the 7-day MALF at Tuturau; and

b. Approximately 10.7 – 18% of the median flow at Tuturau.

Despite the significance of the flow diversion from the main stem of the Mataura River the AEE provides no information about the likely incidence of sportsfish, including brown trout,

---

[9] Allibone, R.M.; David, B.O.; Dunn, N.: Goodman, J.; Hitchmough, R.; Jacques, A.; Ling, N.; D.J.; Ravenscroft, P.; Rolfe, J: *New Zealand Threat Classification Series 7 - Conservation status of New Zealand freshwater fish, 2013* New Zealand Department of Conservation, 2013. Available at: http://doc.org.nz/documents/science-and-technical/nztcs7entire.pdf

[10] As noted earlier in this submission, brown trout move extensively within freshwater and some have a marine phase to their life cycle.

[11] http://envdata.es.govt.nz/index.aspx?tab=table – Accessed 23 November 2017.

entering the intake raceway. This is a significant issue, particularly in light of issues with regarding the inadequacy of proposed fish screening.

3. Fish screening

Fish exclusion devices ('fish screens'), and have several core functions as follows:

a. To prevent fish from becoming entrained within diversion systems;

b. To prevent or minimise exposure of fish to increased risk of physical harm or predation near the diversion;

c. To safely divert fish away from diversion systems, and / or "bypass" fish back into the river downstream of the diversion; and

d. To protect infrastructure.

Fish & Game is concerned that there is a risk that fish, including indigenous fish and sports fish, may become entrained within the intake race. Whether or not fish will be entrained into the intake race depends on a number of factors, including the location of intake and associated screen, screening size, approach velocities and the availability of a suitable fish bypass facility. In this case:

a. The intake and existing 'trash' screen is not installed at the point of water diversion from the main stem of the Mataura River.

b. The existing intake structure does not comply with NIWA recommendations for effective screening of juvenile fish, including sportsfish. Specifically, NIWA recommendations ('2007 Guidelines') to effectively screen juvenile fish, including juvenile brown trout and Chinook salmon, provide that:

   i. Approach water velocity shall not exceed 0.12m/s;

   ii. Sweeping velocity shall be equal or greater than approach velocity; and

   iii. Maximum screening material opening size shall not exceed 3mm for woven mesh screens, 2mm for profile bar screens and 3.2mm for perforated plate screens.[12]

   For the avoidance of doubt, the 2007 guidelines for the design and operation of fish screens were designed for takes up to 10m3/s of surface water, i.e. within the range of the Applicant's diversion, and 500l/s pumped, however no reference is made to them in the AEE.

   Research recommends screen mesh sizes of 20mm and approach velocities of less than or equal to 0.5m/s to exclude the majority of female migrant eels.[13] That said,

[12] Jamieson D., Bonnett M., Jellyman D., Unwin M., (October 2007), *Fish screening: good practice guidelines for Canterbury*, NIWA client report: CHC2007-092, National Institute of Water & Atmospheric Research Ltd
[13] Charteris, S. J (July 2006), *'Native fish requirements for water intakes in Canterbury'*, Department of Conservation – Canterbury Conservancy, p.33.

based upon the 2007 Guidelines screen mesh sizes of 20mm and approach velocities of less than or equal to 0.5m/s will not be sufficient to exclude juvenile indigenous and sportsfish and are only two of a suite of factors required to provide effective fish screening.

c. The AEE does not provide any comment on the following matters, which are necessary to assess the likely effectiveness of the proposed screen:

i. Whether the existing 'trash' screen, which the Applicant proposes to alter, is located as close as practical to the point of water diversion to limit fish diverted away from the main stem of the Mataura River;

ii. Whether the proposed 30mm bar spacing in the 'trash' screen are small enough to physically prevent indigenous and sportsfish species found in the Lower Mataura River, including juvenile fish, from entering the hydro turbine unit. In contrast, the 2007 Guidelines recommend a bar gap of 2 mm or mesh / plate aperture size of 3 mm to effectively screen juvenile fish, including juvenile sportsfish. No detail is provided in the AEE regarding what the proposed alterations to the bar spacing on the 'trash' screen from 60mm to 30mm are designed to achieve from an environmental point of view and how it has been determined that 30mm bar spacing is appropriate;

iii. Whether the water velocity onto and through the screen (the approach velocity) is low enough so that fish can escape by swimming upstream against the flow. This is an important consideration because:

- Severity of fish injuries is likely to be influenced by the velocity of the approaching water and time spent pressed against the screen; and
- The existing structure does not have any fish bypass facility providing return to the main channel of the Mataura River.

The 2007 Guidelines recommend approach velocities of no more than 0.12 m/s for juvenile fish, including juvenile sportsfish;

iv. Whether fish will be diverted away from the screen by a flow moving across the screen and toward a diversion. The 2007 Guidelines recommend a sweep velocity greater than the approach velocity;

v. Whether an effective fish bypass is provided and positioned to allow fish to avoid or escape the screen;

vi. Whether any fish bypass is connected for fish to return safely to an actively flowing section of the Mataura River. Physically screening fish from the intake is pointless if the fish are not subsequently returned to the Mataura River; and

vii. Whether the facility is constructed, operated and / or maintained in a manner that ensures its effectiveness at excluding fish 24 hours a day.

d. Previous correspondence from the Applicant[14] provides that it has received a preliminary cost estimate of $1.5 million for a screen that would meet "the required standards". In response, it is difficult to know how much, if any, weight to attach to this figure in the absence of information about:

   i. What 'standards' the Applicant is referring to;

   ii. How the figure of $1.5 million has been calculated;

   iii. What is the annual commercial value of the electricity, which supplies 25% of the Applicant's electricity at its Mataura plant;

   iv. What is the projected economic life of the Applicant's hydro-electric infrastructure; and

   v. What, if any, alternative screening options have been investigated and costed, such as behavioural screening or fish friendly turbines, or other alternatives, such as biodiversity offset or environmental compensation.

4. Turbine mortality

Fish mortality due to hydro-electric turbines is well documented; as have results from impact or 'strike', pressure changes (associated with passing through high, then low pressure zones across the runner) and high shear stresses (close to fixed and moving surfaces and in the turbulent wake of the blade and in the draft tube).

Passage through the existing hydro-electric turbine is likely to result in injury and / or mortality for some fish, particularly for larger individuals, which includes threatened native species found in the Lower Mataura River (for example, adult longfin eels). However, the AEE does not provide any comment on:

a. What rate of injury and / or mortality is likely for different classes / sizes of sportsfish in the Mataura River, particularly brown trout; and

b. What, if any, monitoring is proposed to assess the injury and mortality of sportsfish within the hydro scheme.

Fish & Game monitoring shows that the bulk of adult brown trout (approximately 67%) in the Mataura River are 'large' brown trout, i.e. 40 – 60cm body length. Based upon the predicted mortalities for fish passaging through the Applicant's turbine in the AEE it is likely that there will be significant mortality of 'large' brown trout entering it, the incidence of which increases with body length.[15] This is significant in light of the fact that the Applicant's diversion through the turbine of 6 – 10m3/s of flow represents approximately 31.67 – 52.8% of the 7-day MALF and approximately 10.7 – 18% of median recorded at Tuturau.

[14] E-mail from Doyle Richardson of Alliance Group Ltd - dated 6 September 2017.

[15] Based upon turbine mortality figures in the AEE there will be a mortality rate of approximately 49.3 – 72.9% for 'large' brown trout (40-60cm) entering the turbine unit. However, this figure does not take into account any fish mortality associated with physical impingement upon the screen.

5. Monitoring

Current consent conditions do not require any monitoring of the adverse effects of the hydro-electric scheme on downstream fish passage. Previous investigation by the Applicant has focused on an assessment of effects of the weir structure on upstream passage of indigenous fish species. In response, Fish & Game does not consider that the current absence of evidence with respect to adverse effects of the hydro-electric scheme on downstream fish passage should be used to draw an inference that there are no observed adverse effects on downstream fish passage, including fish mortality.

Fish & Game is concerned that no monitoring is proposed to accurately determine the adverse effects of the hydro scheme on sportsfish, including brown trout. Fish & Game considers that monitoring should address:

a. Effectiveness of the screen system in prevent fish entrainment (including approach velocity, sweep velocity, screen angle, screen mesh size and bypass system);

b. Monitoring of numbers, size and species of fish impinged, including during peak migration periods; and

c. Ensuring unimpeded fish passage where required.

Further, proposed consent conditions do not require the Applicant to meet any specific objectives and / or measurable standards to avoid, remedy or mitigate any potential adverse associated with the hydro-electric scheme, including fish mortality.

6. Consent duration

Fish & Game considers that the proposed 25 year consent duration is too long in circumstances where:

a. There are significant cultural and recreational values associated with fish species, including brown trout, found in the Lower Mataura River;

b. There is a lack of certainty about the scale, duration and frequency of adverse effects of the hydro-electric scheme on indigenous fish species and sportsfish, including brown trout;

c. The proposed fish screening is inconsistent with the 2007 Guidelines and considers bar spacing size in isolation, which is only one of a suite of factors to be considered. No consideration is given to:

    i. Fish mortality associated with the alteration in bar spacing nor is it clear what the objective of the reduction in spacing is; and

    ii. Other factors that are necessary to assess the effectiveness of the proposed screening, such as approach and sweep velocity.

d. The Applicant's proposed monitoring conditions are inadequate and do not address the adverse effects of the diversion and hydro-electricity scheme on sportsfish, including brown trout;

e. The Applicant's proposed condition 14 does not avoid, remedy or mitigate the adverse effects of fish passage loss. Instead, condition 14 defers the decision to a science consultant without input from affected parties, including Fish & Game. Further, condition 14 is not linked to any specific review condition nor a time frame for implementation of any recommended improvement(s);

f. Very little information is available to support the Applicant's proposed fish screening, which appears to be primarily influenced by cost considerations rather than likely effectiveness; and

g. To date, the Applicant has not adopted a 2007 recommendation to round the lip of the diversion weir to remove the 90 degree angle on it to significantly reduce issues associated with longfin and shortfin eel elvers climbing it.

Fish & Game considers that a 'fresh look' at the situation is required following completion of adequate monitoring and receipt of a technical review, including recommendations with respect to mitigation, ongoing monitoring and / or remedial action required to address any adverse effects. A short term consent is required to avoid a repeat of the current situation, i.e. a replacement consent being applied for in circumstances where there is uncertainty with respects to the adverse effects of the activity.

Planning assessment

As presented, the application is contrary to:

1. The purpose of sustainable management defined in Part 2 of the RMA. Consent conditions proposed by the Applicant do not:

   a. Safeguard the life-supporting capacity of water and ecosystems; or

   b. Avoid, remedy or mitigate adverse effects;

2. Matters of national importance outlined in s 6 of the RMA, including: 6(c);

3. Other matters outlined in s 7 of the RMA, including: 7 (aa), 7(d), 7(f) and 7(h) of the RMA;

4. The objectives and policies of the National Policy Statement for Freshwater (2014)[16], including: Objectives A1, A2, B1, and B4;

5. The objectives and policies of the Regional Water Plan ('the RWP'), including: Objectives 3, 5, 10 and 13 and Policies 1, 1A, 14, 14A, 14B, 15, 16, 21, 23 and 32 of the RWP;

6. The objectives and policies of the Proposed Water and Land Plan ('the Proposed WLP'), including Objectives 1, 2, 3, 4, 5, 6, 9, 14, 15, 17 and 18 and Policies 1, 2, 3, 20, 22, 28, 32, 40, 41 and 44. In addition, the fish screen is not designed to comply with fish screening

[16] As amended in August 2017 to incorporate amendments from the National Policy Statement for Freshwater Amendment Order 2017.

standards and guidelines that are recommended by Environment Southland staff for inclusion in the Proposed WLP[17]; and

7. The objectives and policies of the Regional Policy Statement for Southland (2017) ('the RPs'), including: Issues WQUAN.1 and BRL.1, Objectives WQUAL. 1 - .3 and. 7, WQUAN.1, BRL.1, BENG .2 - . 3 and .7, and Policies WQUAL. 1, 2, 5, 7 and 8, WQUAN. 3, BIO. 1, 2, 4 and 9, BRL.1 and .2 and ENG.6.

Decision we wish the Council to make

That the application be declined, unless the following consent conditions are imposed:

1. The consent duration is reduced to a maximum of 5 years;

2. Robust monitoring shall be imposed for the duration of the consent to accurately determine whether the hydro-electric scheme is having an adverse effect on indigenous and sports fish species, including brown trout, at a variety of flows. Monitoring should include, but not be limited to:

    a. Effectiveness of the screen system in prevent fish entrainment (including approach velocity, sweep velocity, screen angle, screen mesh size and bypass system);

    b. Monitoring of numbers, size and species of fish impinged, including during peak migration periods; and

    c. Ensuring unimpeded fish passage where required;

    Results of monitoring shall be reviewed by suitably qualified fisheries biologist with knowledge of sportsfish and indigenous fish and shall be shared with affected parties, including Fish & Game;

3. The Applicant shall investigate the installation of a 'fish friendly' turbine; and

4. The hydro-electric turbine shall be shut down in the event that effective fish screening is not maintained. Records shall be maintained of inspections and maintenance carried out.

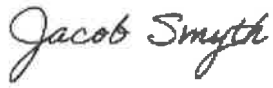
Fish & Game wishes to be heard in support of its submission at a hearing if needed.

Fish & Game wishes to be involved in any pre-hearing meeting that may be held for this application.

If others make a similar submission, Fish & Game will consider presenting a joint case with them at a hearing.

Fish & Game has served a copy of its submission on the Applicant.

[17] See Appendix R – Fish Screen Standards and Guidelines of the Proposed WLP as set out at pages 260 – 261 of the Reply Report - November 2017.



Jacob Smyth
Resource Management Officer
Fish & Game New Zealand – Southland Region

Date: Friday, 24 November 2017

Cc: Alliance Group Ltd
C/- Mitchell Daysh Limited
PO Box 489
Dunedin 9054

Attention: Claire Hunter

Pre-hearing Meeting Report

Report on pre-hearing meetings

Section 99 of the Resource Management Act 1991

From: Stephen West, Principal Consents Officer, Environment Southland

To: Hearing Panel

Date: 21 October 2018

Pre-hearing meeting

1. On 30 January and 16 August 2018 the Environment Southland (ES), conducting its function as consent authority under the Resource Management Act 1991 invited Alliance Group Ltd, who has applied for resource consent, and Te Ao Marama Inc, the Department of Conservation and Fish & Game New Zealand, who are submitters on the application, to meet.

2. The meetings were pre-hearing meetings held under section 99 of the RMA.

3. In this case the applicant requested the meetings to be held and for submitters to attend. ES agreed this was appropriate and requested attendance of the applicant and submitters at each of the meetings.

4. If attendance is requested, as opposed to required, the attendance of the applicant and submitters is optional and their decision to attend can be made without prejudice. In this case, all the requested parties attended.

First meeting

5. The **30 January 2018** meeting:
   a. Was held in the Kea meeting room at the Environment Southland office, Waikiwi, Invercargill
   b. Present:

i.	Danny Hailes	Alliance Group Ltd
ii.	Doyle Richardson	Alliance Group Ltd
iii.	Mark James	Aquatic Environmental Sciences Ltd, for Alliance Group Ltd
iv.	Claire Hunter	Mitchell Daysh, for Alliance Group Ltd
v.	Stevei-Rae Blair	Te Ao Marama Inc
vi.	Lisa McKenzie	Te Rūnanga o Ngāi Tahu
vii.	Jacob Smyth	Fish & Game New Zealand, Southland Region
viii.	Herb Familton	Department of Conservation
ix.	Amy Evans	Department of Conservation
x.	Donna Shepard	Department of Conservation
xi.	Emily Funnell	Department of Conservation
xii.	Stephen West	Environment Southland

6. The key issues for discussion at the meeting were:
   A. Adverse effects eels, particularly downstream movement
   B. Effects on other species
   C. Mitigation measures, particularly the screen for the hydro turbine intake
   D. Review condition

E. Consent duration

7. The matters agreed at the meeting were:
   a. Retention of condition requiring at least 50 mm flow over centre of weir
   b. Retention of a elver trap and transfer system
   c. The applicant to provide a draft elver trap and transfer plan
   d. The applicant to provide a draft monitoring programme for eel movement downstream
   e. The applicant to look at triggers for consultation about further monitoring and mitigation (e.g. plans to be referred to submitters prior to submission to consent authority)

8. Matters in dispute:
   a. Details of the elver trap and transfer plan
   b. Mitigation of effects on eel movement downstream, particularly the screen
   c. Methods to monitor effects on eel movement downstream
   d. Inclusion of monitoring for effects of hydro system on other species, particularly trout
   e. Inclusion of a working party in the resource consent
   f. Wording of review condition
   g. Consent duration

9. Although the discussion focussed on mitigation, monitoring and possible conditions, there was no explicit agreement that the application should be approved.

10. Following the meeting:
    a. the applicant requested that the application be placed on hold under s91A of the RMA
    b. the following documents were circulated:
       I. A draft elver trap and transfer plan (*Vaipuhi Freshwater Consulting, for Alliance Group Ltd*)
       II. A draft downstream eel migration plan (*Vaipuhi Freshwater Consulting, for Alliance Group Ltd*)
       III. A review of fish screening monitoring for the applicant's hydro plant intake (*Cawthron Institute for Department of Conservation, Ngāi Tahu and Fish & Game New Zealand*)
    c. the applicant and submitters carried out discussions and negotiations amongst themselves over draft conditions.

Second meeting

11. The **6 August 2018** meeting:
    a. Was held at the Alliance Group Ltd office at McQueen Avenue, Mataura
    b. Present:

i.	Doyle Richardson	Alliance Group Ltd
ii.	Tere Ngu	Alliance Group Ltd
iii.	John Kyle	Mitchell Daysh, for Alliance Group Ltd
iv.	Stevei-Rae Blair	Te Ao Marama Inc
v.	Rewi Anglem	Hokonui Runaka
vi.	Lisa McKenzie	Te Rūnanga o Ngāi Tahu
vii.	Jacob Smyth	Fish & Game New Zealand, Southland Region
viii.	Herb Familton	Department of Conservation
ix.	Emily Funnell	Department of Conservation
x.	Stephen West	Environment Southland

12. The key issues for discussion at the meeting were:
    A. Adverse effects eels, particularly downstream movement
    B. Effects on other species
    C. Mitigation measures, particularly the screen for the hydro turbine intake
    D. Review condition
    E. Consent duration

13. The matters agreed at the meeting were:
    a. Retention of a system that monitors the depth of flow over the centre of the weir
    b. The applicant was to seek advice whether or not the Fisheries Regulations applied to the existing weir
    c. The applicant was to provide further information about the thresholds for triggering checks of elver accumulation and for installation of the elver trap
    d. The applicant to define "an appropriately qualified and experienced person" for the elver trap and transfer system and the downstream eel monitoring.
    e. Hokonui Runaka to be invited to view elver trap and transfer and downstream eel monitoring.
    f. Dead or euthanised eels from trash screen to preserved and offered to Hokonui Runaka
    g. That discharge onto rocks from the hydro-race is not the turbine discharge

14. Matters in dispute:
    a. Details of the elver trap and transfer plan, particularly:
        - The period when accumulation of elvers will be checked
        - Triggers for trap and transfer
    b. Mitigation of effects on eel movement downstream, particularly the screen
    c. Details about monitoring of effects on eel movement downstream
    d. Change to lip of weir to provide for lamprey
    e. How to give greater effect to Mataitai Reserve in management of hydro system
    f. Cultural monitoring
    g. Monitoring for effects of hydro system on other species, particularly trout
    h. Inclusion of a working party in the resource consent
    i. A proposed certification condition – concern that it attempted to apply a condition on the Consent Authority
    j. Consent duration

15. Although the discussion focussed on mitigation, monitoring and possible conditions, there was no explicit agreement that the application should be approved.

16. As a general comment, the applicant is seeking an adaptive management approach, whereas the submitters are seeking detail and bottom lines.

17. The meeting concluded with an inspection of the hydro-race and existing trash screen. This also included a view of the weir and river.

18. Following the meeting the applicant and submitters carried out further discussions and negotiations amongst themselves over draft conditions. This was brought to a close without agreement at the end of the s91A suspension.

Chairperson to prepare this report

19. Section 99(5) and (6) require the chairperson of the meeting to prepare a report outlining particular matters, and to circulate that report to all of the parties and the consent authority (meaning, the commissioners or hearings panel that will hear and determine the application) no less than 5 working days before the hearing.

20. The report must, for the parties who attended the meeting:
    a. set out the issues that were agreed; and
    b. set out the issues that are outstanding

21. However, the report must not include anything communicated or made available at the meeting on a without prejudice basis.

22. Commentary on these matters can be found in paragraphs 5-17 of this report.

Status of this report and next steps

23. Section 99(6) requires the chairperson to send this report to the consent authority and all the parties so that they have it at least 5 working days before the hearing. The report was sent to the parties on 2 November 2018.

24. At the time of writing, no parties have advised that they no longer wish to be heard, and the application is scheduled to be heard on 3 December 2018.

25. Section 99(7) **requires** the consent authority (meaning, the commissioners delegated power of the consent authority by to determine the application) to **have regard to** this report in making the decision on the application.

Stephen West
Principal Consents Officer
Environment Southland

Reports Commissioned by the Applicant

APPENDIX A

PDP Response

Pattle Delamore Partners Limited

TECHNICAL MEMORANDUM

INVESTIGATION	S92 Response	**PROJECT**	Hydro Power Consenting
CLIENT	Alliance Group Limited	**PROJECT NO**	AJ903800
CLIENT CONTACT	Doyle Richardson	**PREPARED BY**	Patrick Lees
		DATE	28 July 2017

Introduction

Alliance Group Limited (AGL) is seeking a replacement consent for the operation of the mini-hydro power plant operating at their Mataura Plant. Following the application, AGL has received a S92 (RMA) Further Information Request from Southland Regional Council.

AGL has engaged Pattle Delamore Partners Limited to provide advice on various matters related to the consenting process, this includes providing a response to the S92 request from the Southland Regional Council.

In preparing a response the following is undertaken:

i. A description of how the effectiveness of the proposed mitigations measures for the downstream passage of native fish and eels could be monitored
ii. An assessment of alternative mitigation systems that could be utilised if monitoring showed that the proposed mitigation measures had been insufficient to minimize adverse effects on the downstream passage of native fish and eels.
iii. An assessment of the effects of the weir and diversion on the passage of brown trout and salmon, including a description of the existing fish passes and how they are maintained.

Monitoring effectiveness of the proposed mitigation measures

Several native species of fish have been identified from within the Mataura River upstream of the weir. A proportion of these must undertake diadromous migration (i.e., part of their life cycle must be undertaken within the marine environment) and as such are potentially vulnerable to being caught within the hydro scheme during downstream migration events. Golder Associates (2016) predicted the mortality of varying lengths of fish passing through the AGL hydro scheme. The results indicated a high mortality for large downstream migrating eels (particularly large females > 600 mm). However, smaller sized fish were predicted to have considerably lower mortality rates from passage through the turbine (Golder Associates, 2016). Therefore, AGL had proposed to mitigate the potential mortality of downstream migrating eels (silver eels) by shutting down the plant at night during freshes/flood events (detailed as events where flow increases by 50 % from pre-flood flow) during March to April (typical downstream migration period for eels). Generation would remain shut down at night until the flood peak has passed and for two consecutive nights after such an event (Golder Associates, 2016; Mitchell Daysh, 2016).

The cost of retrofitting an intake protection (i.e., through screening) is expensive and an alternative approach of management as described above is attractive and may provide appropriate benefits to the long term migration potential of eels within the Mataura River. There is some evidence that ceasing power generation at migratory times has the potential to increase the chance of successful downstream eel passage (for example see Watene and Boubeé, 2005). Even if successful passage is expected with the proposed mitigation, a monitoring programme of downstream migrating eels that try to pass through the hydro scheme should be undertaken. Monitoring should identify whether the hydro scheme canal is being used by silver eels during migration times, help in confirming the timing of silver eel migration, and to more reliably determine if mitigation is required or if alternative mitigation measures might be a better option.

Downstream migrating silver eels will be monitored within the hydro canal for a two month period for one

migration season (i.e., between March and April). Monitoring will include:

- Modifying the existing trash screen by reducing the size of the bar spacing to < 30 mm to capture downstream migrating eels.
- Eels that are caught on the screen will be retained once screen cleaning is undertaken. Trash screen cleaning is undertaken by a scraper bar, which will operate at specific intervals with the captured eels being retained in a modified trash chute. The modified trash chute will be checked and cleaned in the early morning (e.g., approx. 7:00 am) every week day during the full migration period. During critical migration times (i.e., during elevated flow events) the trash chute will be checked at night time (e.g., approx. 8:00 pm) and early morning (e.g., approx. 7:00 am), including weekends.
- The retained eels will be sorted into migrant and non-migrant eels on the basis of coloration (silver ventral zone) and morphological features (e.g., enlarged eyes and pointed head). Length (mm) and weight (g) will be measured, and eels will be sexed on the basis of length.
- It is expected that there will be some mortality and the potential for injury (both internal and external) of the eels that are captured on the trash screen and for those individuals that may end up in the modified trash chute. This is likely to occur due to the eel becoming pressed against the screen, due to the high approach velocity, and having no chance of escaping. The severity of the injuries is expected to be related to the length of time the eel is pressed against the screen and the velocity of the approaching water. This is an unfortunate consequence of the monitoring. However, if this size of eel was to enter the hydro scheme/turbines there is likely to be a poor survival rate.
- Deceased and severely injured eels will be frozen and/ or culled and frozen and retained on site to allow further investigation if it is required. Eels that appear uninjured will be released to the Mataura River downstream of the hydro scheme.

Other monitoring methods have also been considered. This includes using nets, which would present an unacceptable risk to health and safety, associated with being in the river/race at night times during elevated flow events. The use of nets would also be impractical as the nets would need to be in the race for a long time to collect the same information as a modified trash screen, increasing the risk of nets being washed away or damaged by large debris. The use of Dual frequency Identification Sonar (DIDSON) was also considered, but ruled out due to the relatively large expense associated with the use of this equipment and a similar outcome for the eels in terms of mortality.

It is considered that the proposed monitoring is a practical way to assess the potential mortality of downstream migrating silver eels within the hydro scheme. The concerns about potential eel mortality and injury/suffering that have been highlighted are important to consider but are unavoidable. It is important to note that this may be the existing situation and would also occur with DIDSON monitoring.

After the completion of monitoring a technical report will be produced detailing the findings, the outcomes of the monitoring and the likely success of the proposed mitigation (including the need for any mitigation). If required, improvements will be recommended, including whether an alternative mitigation measure should be considered.

Alternative mitigation measures

Fish species that are known to inhabit the Mataura River may enter the hydro canal and become entrained within the hydro scheme. Of the species identified, silver eels have the highest predicted mortality from the hydro scheme turbines (Golder Associates, 2016; Jellyman, 2012 and references within both). Therefore, a review of the alternative mitigation measures that will prevent the entrainment of silver eels within the hydro

scheme has been undertaken.

- **Amending the shut-down period**
  AGL proposed to cease the generation of the hydroelectric power plant during the hours of 7pm to 6am when flow conditions in the Mataura River increase by more than 50% of the preceding day's river flow. Once activated, the nightly shutdown periods would remain in place until the flow peaks, and for two consecutive nights after the flood peak has passed. This shut-down period could be amended by changing the times of day that it is shut down, or the number of nights it is shut down after the flood has peaked.
- **Positive Barrier Screens**
  Positive barrier screens are widely used to protect fish at water diversions throughout the country, the screens create a physical barrier that prevent fish species being entrained in the diversion (Jamieson *et al*, 2007). Generally, the screens consist of a series of uniquely designed screen plates with specifically designed openings that will prevent entrainment of fish in the water diversion. The opening sizes are usually specific to the type and life cycle of the fish species present in the upstream water body. If the screen is placed off river a by-pass channel is needed to return the screened fish back to the source river. Fish are screened through a combination of screen opening size (e.g., mesh, bar, slot), approach velocity and sweep velocity.
  An appropriately designed screen could minimize the entrainment of silver eels within the hydro scheme. The design would need to consider what an acceptable screen opening size is, the approach and sweep velocities specific to downstream migrating eels, and include an effective by-pass back to the source river. It should be noted, that before being understood whether a screen could be utilised, AGL would need to better understand the potential effects on eels, and then consider the suitability of a screen against other alternatives that could be used to manage the effect (for example, increasing the period were scheme shut down could be initiated).
- **Behavioural Screens**
  Behavioural screens require an action to be undertaken by the fish to successfully avoid being entrained. Behavioural screens include those that produce light, sound, compressed air, water jets, electronic fields or any combination of these. The basic premise of behavioural screens is to produce an irritant (or an attractant in the case of some lighting) that the fish detect that will cause the fish to move away from the water take.
  The efficiency of behavioural screens appears to be highly variable, where the reoccurring issue appears to be that the screen does not provide a complete barrier to fish species that were targeted (DWA Topics 2006; Jamieson *et al* 2007). Peak downstream migration of longfin eels is noted to coincide with higher flows, and as such is likely to see levels of increased turbidity. These environmental conditions may further exacerbate the variability in the success of behavioural screens. Therefore, a behavioural screen is not considered to be an effective mitigation measure for silver eels in the AGL hydro scheme.

If the monitoring demonstrates that proposed mitigation (i.e., shutting down the hydro scheme during elevated flow conditions) is not sufficient to mitigate a significant effect on silver eels, AGL should consider installing a positive barrier fish screen, or amend the proposed shutdown period. If monitoring demonstrates that that there is currently no observable impact of the downstream migrating eel population AGL will not undertake any further mitigation monitoring.

It should be noted that there may be other indirect mitigation measures available including trap and transfer programmes and habitat enhancement that could be considered if monitoring demonstrates the current

activities are having a significant impact on eels.

Salmonid passage

Golder Associates (2016) noted that due to the Mataura River Falls being considered an upstream migratory barrier to salmonids (adults and juveniles) there are likely to be two distinct populations of trout within the river. Nevertheless, a fish ladder has been installed and is maintained within the weir. For successful passage over a fish ladder to occur the ladder's water velocity, turbulence and depth in the take-off pool, ratio of pool depth to fall height need to be considered. Furthermore, successful passage over the fish ladders is primarily dependent on the ability of the fish to jump from one pool to the other, coupled with the availability of sufficient resting zones between each fall. Passage attempts will increase as flow increases, until flow is greater than the fishes swimming capabilities. Generally, the main fish species in New Zealand that are able to successfully pass over a fish ladder by jumping are trout (brown and rainbow) and salmon.

The fish ladder that is located on the Mataura River weir consists of three V drop structures plus the weir itself (Figure 1). The entrance, exit and middle drop structures are likely to allow passage to adult trout and salmon, and only if there is sufficient resting pool depth and size. Generally, the passable fall height for salmonids is around 0.30 m. However, the maximum jumping ability of adult salmonids is greater than this. The weir fall heights all appear to be outside of the jumping range of smaller juvenile salmonids. The Mataura River Falls (downstream of the weir) are noted as being a complete upstream migratory barrier to all salmonid species and life stages (Golder Associates, 2016). However, at certain times when conditions are adequate (both in terms of environmental conditions and fish fitness) adult salmonids may have some minimal success in passing the Mataura River falls. Therefore, designing the fish ladder for adult salmonid passage was appropriate.

Figure 1: Mataura River weir fish ladder

References

Bejakovich, D. 2006. *Criteria for Fish Screen Design in Canterbury*. Sports Fish. New Zealand Fish and Game Council.

Department of Conservation. 2006. Native Fish Requirements for Water Intakes in Canterbury.

Doehring K, Young RG, Hay J, Quarterman AJ 2011. Suitability of Dual-frequency Identification Sonar (DIDSON) to monitor juvenile fish movement at floodgates. New Zealand Journal of Marine and Freshwater Research

45(3): 413-422.

DWA Topics. 2006. Fish Protection Technologies and Downstream Fishways: Dimensioning, design, effectiveness inspection. 226 p.

Golder Associates. 2007. Assessment of Hydro-Electric Diversion Effects on Fish Passage. On behalf of: Alliance Group Limited.

Golder Associates. 2016. Alliance Mataura: Mataura River – Ecological Summary and Assessment.

Goodman, J.M., Dunn, N.R., Ravenscroft, P.J., Allibone, R.M., Boubee, J.A.T., David, B.O., Griffiths, M., Ling, N., Hitchmough, R.A., Rolfe, J.R. 2013. *Conservation status of New Zealand Freshwater Fish. New Zealand Threat Classification Series 7*. Department of Conservation.

Jellyman, D. 2012. The Status of Longfin Eels in New Zealand – an Overview of Stocks and Harvest. Prepared for Parliamentary Commissioner for the Environment.

Jamieson, D., Bonnett, M., Jellyman, D., Unwin, M. 2007. *Fish screening: good practice guidelines for Canterbury*. NIWA Client Report: CHC2007-092. October 2007.

Watene, E.M., Boubée, J.A.T. 2005. Selective Opening of Hydroelectric Dam Spillway Gates for Downstream Migrant Eels in New Zealand. Fisheries Management and Ecology. 2005, 12, 69-75.

Vaipuhi
Consulting

Draft Elver Trap and Transfer Plan for Mataura Falls

Prepared for Alliance Group Limited

V3.0 March 2018

Draft Elver Trap and Transfer Plan for Mataura Falls

Prepared for Alliance Group Limited

Vaipuhi Freshwater Consulting Report No: 201801
V3.0 March 2018

Reviewed and approved for release by Mark James (Aquatic Environmental Sciences Ltd)

Signature: ----------
15/03/2018
Date: ----------

Cover photo: Elver trap as operated on the MIE site in 2016. [From HES 2016b].

Contents

Figures

Executive summary

Alliance Group Limited (Alliance) is in the process of reconsenting a small hydro-electric power plant that it operates at its meat processing site on the true right bank of the Mataura Falls. Revised Consent Conditions drafted on 15 February 2019 requires that a Trap and Transfer Plan for upstream elver passage be developed and submitted to the Consent Authority for certification

Several attempts to construct an elver ladder and operate elver trap and transfer operations have been carried out by Carter Holt Harvey (CHH) and its successor the Mataura Industrial Estate (MIE), who, like Alliance, operate a small hydro-electric power plant on the left bank of the River. Results of these investigations form the basis of the present Trap and Transfer Plan which will need to be reviewed on an annual basis as information is gathered.

1 Introduction

Alliance Group Limited (Alliance) is in the process of reconsenting a small hydro-electric power plant that it operates at its meat processing site on the true right bank of the Mataura Falls. Revised Consent Conditions drafted on 15 February 2019 (see Appendix A) requires that a Trap and Transfer Plan for upstream elver passage be developed and submitted to the Consent Authority for certification. The draft condition stipulates that the plan should contain the details around the design of the trap, its location, the monitoring duration and timing and reporting obligations.

Vaipuhi through Aquatic Environmental Sciences Ltd was commissioned by Alliance to draft this plan. The writer has not visited the site in recent times and to date has not been involved in the negotiations. The Plan, as drafted, is based on personal experience at other trap and transfer operations both overseas and around the country, as well as information provided by Alliance, notably a report by HES (2016a). The plan follows present best practice trap and transfer guidelines as detailed by Paterson and Boubée (2010)

Elver trap and transfer operations typically follow general guidelines but are all site and resource specific. Local knowledge and observations are a key part of these operations, notably at the start of the operation. Consequently, it is normal for operations to be modified as experience is gained not only at the site of interest but also globally. It is therefore expected that the present draft plan will be altered over the years of operation as more observations and records become available.

As such, and as stipulated by Consents, this elver trap and transfer plan for the Mataura Falls should be reviewed annually.

Several attempts to construct an elver ladder and operate elver trap and transfer operations have been carried out by Carter Holt Harvey (CHH) and its successor the Mataura Industrial Estate (MIE), who, like Alliance, operate a small hydro-electric power plant on the left bank of the River (HES 2016a). Results of these investigations form the basis of the present Plan.

2 Historical observations

The falls in their present form have always been a barrier to non-climbing fish species (e.g. smelt and flounders) and in their original state were likely to have been an impediment to climbing fish species (e.g. lampreys, and eels) at some flows. The construction of the weir and other structures for industrial purposes as well as erosion, has potentially further reduced upstream passage opportunities for elvers which have customary and commercial fisheries values.

The upper Mataura is a productive eel fishery dominated by longfins and given the long history of the existing anthropogenic in-stream and bank-side structures some periodic upstream passage of juveniles at Mataura Falls must be possible. However, at medium to low flows upstream migration of elvers is thought to be restricted (Allibone 2007, HES 2016a).

The upstream migration of elvers around the country is variable both seasonally and annually but generally occurs from about mid December through to late March. From available records, elvers and juvenile eels have only been noted congregating below the Falls in January and February.

Attempts at improving elver passage were made in the past but HES (2016a) noted that previously installed passage provisions have been considerably compromised over time (in one case flow on a ramp was provided by a pump on the paper mill site but this pump is no longer in operation, Figure 2-1, Figure 2-2). There is an old salmonid ladder at the weir (Figure 2-3) and at some flows this may facilitate passage of other fish.

Figure 2-1: The edge of the Mataura Falls on left bank showing eroded ledge and possible passage route for elvers. From Allibone2007.

Figure 2-2: Close-up photo of the cap rock with possible passage opportunities/provision for elvers. Spat ropes to facilitate upstream passage of elvers and other fish have been installed at this location. (From HES 2016a.)

Figure 2-3: Salmonid fish ladder Mataura Weir summer 2017. Photo courtesy Alliance.

2.1 Experience with trap and transfer from the MIE site

Since December 2014 MIE has commissioned Holloway Environmental Services (HES) to investigate and implement elver access requirements to comply with their resource Consent (No. 203311). MIE holds a permit from MPI to carry out trap and transfer operations at this site. This permit imposes strict conditions on operations and has reporting requirements.

In 2015 no elvers were trapped, but 100 small eels and 9.1kg of elvers (about 3200 individuals) were gathered with a hand net and transferred upstream. Only 4.4% of this catch was shortfinned eels. From this experience further observations were made in summer 2015-16 and a trap was installed (see cover photo). Accumulation of elvers in early 2016 were smaller than in the previous summer but some 8.5 kg of elvers were still gathered. A small number of galaxiids was also collected. Flow over the weir appears to be a key factor in determining if elvers congregate below the falls (HES 2016a).

In both 2017 (HES 2017) and 2018 (D Richardson, Alliance, pers. Comm.) the trap could not be set because of persisting high flows and a lack of accumulations.

Based on their experience HES (2016a, 2017) recommended that observations continue to be made at night once a week from 15 January once flow drops below 80 m^3/s and that trapping be made when elvers are observed and river conditions permit.

2.2 Permit to operate Trap and transfer operations

Before any trap and transfer operations can be undertaken, a special capture and transfer permit must be obtained from MPI. The reason for this is that the harvest of eels in New Zealand is managed under a quota management system and unless a Customary Authorisation has been granted it is currently illegal to harvest any eels under 220 g. The transfer of eels and other fish is also restricted under the Conservation Act. Prior to lodging an application, proof of consultation and support from stakeholders, notably iwi, must be provided.

Trap and transfer operations at Mataura currently operate under MPI special permits No. 592 and another associated transfer permit (file Ref.: NFT213) that were granted to MIE in February 2015. The current permits expire on 1 February 2020 and have strict recording, reporting and biosecurity requirements (see Appendix B).

3 Elver trap and transfer plan

3.1 Aims and objective

- The objective of this plan is to facilitate a trap and transfer system to maintain and enhance the upstream passage of elvers over the Mataura Falls and Weir.

3.2 Permit

- The person implementing the Mataura Elver Trap and Transfer Plan is to be suitably qualified and licensed with a special permit from MPI to take, transfer and release fish under the Fisheries Act 1996; and must also have a transfer and release permit from MPI under the Conservation Act 1987.
- Catch and transfer permits must be obtained from MPI once consultation with stakeholders is complete and the trap and transfer plan is accepted. This permit must be carried by the trap operator at all times and must be available for inspection at the trapping site.
- For compliance and reporting purposes it would be desirable for both the Alliance and MIE trap and transfer operations to be covered by one set of permits.

3.3 Health and safety

Before any monitoring work can begin, a Health and Safety plan must be drafted. This plan must be followed at all times and, at a minimum, must take account of the following:

- Operations at the respective industrial sites;
- Weather and flood risks;
- Sudden shutdown (tripping) of the turbines;
- Emergency escape procedures;
- Recovery in case of injury;
- Risk of drowning;
- Risk of tripping and slipping;
- Communication protocols
- Means of contacting emergency services;
- Operator to fully inspect the area in daylight before any attempt at night observation is made.

3.4 Observations

Although it is best to locate fish passes and trapping sites where elvers congregate, for practical reasons this is not always possible. In some cases, it is sometimes possible to attract fish to a more convenient location. The aim of the observations proposed is to locate/confirm elver accumulation points and where these are (and thus potential trapping sites), but also to try and attract elvers to locations that reduce the risk of equipment loss and potential injury to the trap operator.

- For the first two years, from 15 December to 15 March when flows are below 80 m^3/s make a once-a-week observation to all likely accumulation points at least one hour after dark.
- These observations to be made on both sides of the river, paying particular attention to areas where lamprey have been seen to accumulate earlier in the season and where the targeted elvers may also gather during their upstream run.
- Provide water flows at locations where trapping could more safely be carried out and determine if elvers can be made to accumulate at these locations.
- From these observations, determine/confirm most likely trapping location(s).
- Review need and methods of making further observations annually.

3.5 Trapping

The aim is to develop a trap that is located to minimise the chance of injury and minimises handling of equipment.

In concept, the trap should follow guidelines provided by Paterson and Boubée (2010) and in particular:

- The ramp leading to the trap should be as short as possible and must not be higher than 6 m. This ramp is to be lowered into the favoured location whenever conditions permit. If the 6 m height restriction cannot be met, a means of safely lowering and raising the trap should be contemplated or safe access to the trapping site provided. Alternatively another trapping location should be considered.
- The angle of the ramp should not be greater than 45 degrees.
- The ramp should be lined with a climbing media suitable for both elvers and juvenile eels (up to 200g) (e.g. core of Aquadrain or two densities of brush bristle).
- The ramp should end over the trap and have a flush-down lip to lead the elvers to the trap.
- The ramp and trap should be supplied with water from the river, via the head race
- The trap should have a capacity of at least 250 litres and must have a ledge to stop elvers climbing out. A lid is desirable to stop predator entry (and eels jumping out).
- Water level in the trap should be controlled by a screened outlet and be at least 150mm below the ledge of the trap. Overflow from this outlet is to be directed to the base of the ramp but always ensuring that it is inaccessible to elvers at normal river flow.
- An attraction flow may be required at the base of the ramp.
- The trap must be easily emptied without damaging the catch. (e.g. with a dog leg than can be turned into a mesh bottom bucket to collect the catch.
- A cleaning hose should be available at the trap site.
- Should elvers in the trap suffer any mortality or disease the entire trap should be emptied, thoroughly scrubbed and sanitised with salt.

3.6 Timing of trap operations

- In the first two years the trap is to be located at the site used in 2016, once more than 50 elvers and eels have been observed congregating at that location. The trap is then to remain in place until (whichever comes first):
    - flow conditions require its removal; or
    - 15th of March; or
    - until there is 7 days capturing less than 20 elvers per night .
- Should at any stage in the initial monitoring a potentially more effective trapping site be located, the trap shall be shifted to that location or (preferably) a new temporary trap ramp and trap installed at the new site.
- Should the trap(s) need to be removed before the 15th of March (due to flow conditions altering), the trap(s) shall be re-instated as soon as practically possible
- The trap(s) is to be inspected at no more than three-day intervals, and emptied and cleaned at every inspection.
- While the above operations are in progress, water flows are to be provided at locations where trapping may be more conveniently achieved. Observations are to be made at these locations at no more than weekly intervals.
- Based on the results of these two years of observations and if a suitable trapping spot is located, permanent facilities are to be devised to maximise catches and minimise labour and risk of injuries. Should more than one such trapping site be located, the site yielding the most elvers will be retained if practical (Note: it may take more than two years of trapping to determine which of the potential sites is to be favoured).
- Trap inspection and emptying of the permanent facilities will be as above.
- A review of the value of the facilities and need for any alteration in procedures etc. will be made after five years of operation.
- Unless the operator is a qualified operator with a monitoring history at the site, annual inspection of the facilities and procedures will be made by a suitably qualified person at the peak of the season (most likely mid to late January).

3.7 Predator Management

Rats are known to prey on elvers and can also cause considerable damage to trapping equipment. Birds are also known to prey on elvers.

- In preparation for each monitoring season bait stations shall be set up near the trapping site, taking care that the bait does not enter the waterway.
- Unless there are valid operational reasons for not doing so, the trap and ramp shall remain covered when the operator is not in attendance.

3.8 Recording of catch

- Recording of the catch must be made during the coolest part of the day. Processing the fish must be done as quickly as possible and handling minimised.
- The bycatch species should be separated from elvers, identified and numbers recorded. Should separation of bycatch prove impossible an estimate of each bycatch species present should be made.
- Unless the catch is small elvers are to be separated from eels using a 10 mm square mesh bag (e.g. eel holding bag).
- Each fraction is to be drained and weighed separately (using a 1.5mm mesh bottom bucket.).
- In compliance with the MPI permit, at least once a week when at least 50 elvers have been collected, up to 100 elvers in lots of no more than 20 elvers to be anaesthetised. Each elver species is to be identified, then weighed and measured. Each species is to be retained separately in a recovery bucket of aerated freshwater. When all the elvers are measured, each fraction is to be weighed. These records are to be used to determine species composition by weight and to estimate the number of each species captured based on the average weight of each species. These weekly records are to be used to estimate numbers caught between catch sampling. For further monitoring guidelines and recording forms refer to Paterson and Boubée (2010).

3.9 Transfers of catch

- Transfers must only be made within the catchment and in accordance to issued MPI permits (under the existing permit this is within 2km of the falls).
- Bycatch is to be transferred with the elvers unless pest species are observed, in which case the entire elver catch shall be returned to the point of capture, MPI notified and operation stopped until a clearance is given by MPI.
- The point of release must have cover for the elvers, and transfer locations must be varied to minimise predation at the release points.
- No more than 1 kg of elvers is to be carried in a 20l bucked at any one time for short journeys (less than 10 minutes). It is, however, recommended that all small transfers be made dry (no water) in a chilly bin with a mesh bag of ice attached to the cover.
- Transfers must be made during the coolest period of the day.
- Should more than 1 kg of elver need to be catered for and longer journeys contemplated, an aerated water tank must be used. Transfer from the trap to the transfer tank may be made in buckets.

3.10 Environmental variables

Throughout the monitoring period the following data will be collected:

- Daily rainfall
- Average daily flow

- Daily generation output of the power plant
- Average daily water level at the weir
- Average daily water temperature

3.11 Reporting

Annual reporting on catches will be as prescribed by MPI permit and Consent conditions (30 April). At a minimum the report shall cover:

- Start and finish date (including dates when traps were installed)
- Dates of inspection and summary of observations
- Biomass and estimated numbers of elvers transferred on each occasion
- Transfer location
- Flows
- Water temperature
- Operation of the hydro-turbines
- Recommendations for any changes, including trap design and timing.

4 Acknowledgements

We wish to thank James Holloway for sharing his knowledge of elver trap and transfer operations at the Mataura Falls.

5 References

HES 2016a. Elver passage at the Mataura Industrial Estate. Report by Holloways Environmental Services report to the Mataura Industrial estate. 22 pp.

HES 2016b. Elver trap and transfer at the Mataura Falls – Information for Alliance Group Limited on elver trap and transfer operations at the Mataura Falls and Report by James Holloway dated 14/12/2016. 6pp.

HES 2017. Elver trap and transfer at Mataura Falls for 2017 Report by Holloway Environmental Services dated May 2017. 3pp.

Paterson, C, Boubée, J. 2010. Best Practice Guidelines for the Passage of Fish at Hydroelectric Dams in New Zealand. Part1 – Upstream Migrants. NIWA Client Report: HAM2010-087. 48pp.

Todd, P. 1990. Lampreys – are they rare. Freshwater Catch 44: 13-14.

Note from ES reporting officer:

The draft conditions that were attached to the management/monitoring plans developed after the first pre-hearing meeting have been removed from the appendices to the hearing report. The draft conditions were proposed by the applicant as part of negotiations to resolve the application, but were not agreed by the parties to the application.

Appendix B Current Ministry of Primary Industries Special Permits issued to Mataura Industrial Estate

SPECIAL PERMIT
(592)

The Director-General of the Ministry for Primary Industries (**MPI**) acting through his or her delegated officer (**Director-General**) and pursuant to section 97(1) of the *Fisheries Act 1996* (**the Act**), hereby issues a special permit to:

Gregory John Paterson, of
Mataura Industrial Estate
PO Box 43
Dunedin

Client Number 9793381

and agents, representatives and employees of Mataura Industrial Estate (**the permit holder**), as part of their association with Mataura Industrial Estate, subject to the following conditions specified below.

Purpose

1. This special permit is issued for the following purpose specified in section 97(1)(c) of the Act:
   - remedying and/or mitigating the effects of a structure where that structure prevents aquatic life reaching an area it previously had access to prior to the installation of the structure.
2. The permit holder is permitted to take, transfer, and release eels (*Anguilla* spp.), and whitebait (*Galaxias* spp.) referred to as native fish hereafter, irrespective of size for the above purpose.

Period of Issue

3. This special permit is valid from the date of signature until 1 February 2020, unless sooner varied or revoked.

Permitted Activities

4. Native fish may only be taken pursuant to this permit from the Mataura River at or downstream of the Mataura Falls. All aquatic life must be released back into the same catchment as it was collected within 2 kilometres (**km**) from the Mataura Falls.
5. Any transfer of native fish may only be undertaken with an appropriate approval pursuant to section 26ZM(2) of the *Conservation Act 1987*, or any statutory re-enactment or amendment of that provision.

SPECIAL PERMIT
(592)

The Director-General of the Ministry for Primary Industries (**MPI**) acting through his or her delegated officer (**Director-General**) and pursuant to section 97(1) of the *Fisheries Act 1996* (**the Act**), hereby issues a special permit to:

Gregory John Paterson, of
Mataura Industrial Estate
PO Box 43
Dunedin

Client Number 9793381

and agents, representatives and employees of Mataura Industrial Estate (**the permit holder**), as part of their association with Mataura Industrial Estate, subject to the following conditions specified below.

Purpose

1. This special permit is issued for the following purpose specified in section 97(1)(c) of the Act:
   - remedying and/or mitigating the effects of a structure where that structure prevents aquatic life reaching an area it previously had access to prior to the installation of the structure.
2. The permit holder is permitted to take, transfer, and release eels (*Anguilla* spp.), and whitebait (*Galaxias* spp.) referred to as native fish hereafter, irrespective of size for the above purpose.

Period of Issue

3. This special permit is valid from the date of signature until 1 February 2020, unless sooner varied or revoked.

Permitted Activities

4. Native fish may only be taken pursuant to this permit from the Mataura River at or downstream of the Mataura Falls. All aquatic life must be released back into the same catchment as it was collected within 2 kilometres (**km**) from the Mataura Falls.
5. Any transfer of native fish may only be undertaken with an appropriate approval pursuant to section 26ZM(2) of the *Conservation Act 1987*, or any statutory re-enactment or amendment of that provision.

6. The use of the following methods and equipment are permitted for the purpose of this permit:

   a) fyke nets irrespective of mesh size (escapement tubes blocked if required);

   b) modified beach seine or set nets irrespective of mesh size, length or placement across any channel or waterway;

   c) dip nets irrespective of mesh size;

   d) mesh liners may be used on fyke nets to meet the desired net mesh size;

   e) an elver catching device consisting of a tube, pipe or ramp connected to a holding container;

   f) a fish trap;

   g) any other method approved in writing by the Spatial Allocations Manager, MPI.

7. All native fish taken pursuant to this special permit must be released immediately at sites along the Mataura River within 2 km (either upstream or downstream) of the Mataura Falls (as permitted in Fish Transfer Approval NFT213), with the exception of:

   a) any samples retained for species identification as required in the Catch Monitoring Instructions attached as Appendix One;

   b) any bycatch species taken in accordance with this special permit, these are to be released at the point of capture (ie at or directly above or below the Mataura Falls), with the exception of unwanted organisms (such as koi carp, catfish, gambusia, rudd etc) which must be destroyed upon capture and disposed of through an appropriate waste disposal system.

8. The permit holder must ensure that agents fishing under the authority of this special permit comply with all conditions of this special permit.

9. Native fish taken under the authority of this special permit must not be used for personal usage, collection or consumption, bait or for sale.

10. No explosive or toxic gas, or toxic, poisonous, or narcotic substance may be used to collect native fish under the authority of this special permit.

Biosecurity Conditions

11. In order to eliminate the risk of transferring species declared as noxious or unwanted organisms, the permit holder must ensure that all catch destined for transfer is screened prior to transportation.

12. To prevent the spread of unwanted aquatic plants and animals, all portable equipment used in the taking of native fish must be thoroughly checked, cleaned and dried before and after being used for fishing under this special permit. All stationary equipment is to be cleaned following the instructions in the Equipment Monitoring document attached to Appendix One – Catch Monitoring Instructions.

13. During the taking of native fish, the permit holder shall ensure that no aquatic plant, noxious fish, or unwanted organism, including eggs and larvae of noxious fish or unwanted organisms, is introduced into any other waterway, either from the water holding the native fish, or enmeshed in fishing gear.

14. No dead, distressed or moribund native fish are to be transferred. If any significant number of dead, distressed or moribund native fish are observed, the permit holder must contact the MPI hotline [0800 80 99 66] promptly for further guidance.

Reporting requirements

15. All persons involved in the transfer operation for the purpose of conducting work under this permit are to be notified to the District Compliance Manager, MPI, Southland (see contact details in Appendix Two) prior to the beginning of the transfer and release programme.

16. To obtain useful data for the management of native eel fisheries, the permit holder is required to:

    a) carry out the elver transfer operation from at least 1 December to 15 March and ensure traps are cleared at least once a week; and either

    b) determine the total number and total weight of shortfin and longfin elvers in a representative subsample of the catch (at least 100 elvers if available) at least once a week (as described in Appendix Three – Species Identification Instructions and Guidelines); or

    c) retain subsamples of the catch throughout the elver mitigation season (December to March) and provide them for species identification to MPI's agent (as described in Appendix One – Catch Monitoring Instructions).

17. If the permit holder undertakes analysis of species composition, as prescribed in condition 16 b) above, the permit holder must submit a report summarising the trap and transfer of native fish to the Spatial Allocations Manager and MPI's agent (details attached as Appendix Two), by 15 April 2015 and every subsequent year thereafter. The report shall include the following information:

    a) the trap and transfer programme catch data (report form attached as Appendix Four);

    b) the date, total weight and estimated number of eels (those greater than 20 grams (g)) of each species trapped and released during the transfer and release programme, and the date and location when/where the collection and release took place (record the details in the Species Composition report form attached as Appendix Five and the eel field data sheets attached as Appendix Six);

    c) the date, total weight and estimated number of elvers (those less than 20 g) of each species collected and released, and the date and location when/where collection and release took place (record details in the Species Composition report form attached as Appendix Five and the elver field data sheets attached as Appendix Seven);

    d) the method of capture, data analysis and raw data used to obtain the estimated numbers of eels and elvers.

18. If the permit holder retains and provides subsamples for MPI's agent to undertake analysis of species composition as prescribed in condition 16 c) above, the permit holder must submit a report summarising the trap and transfer of native fish to the Spatial Allocations Manager and MPI's agent (details attached as Appendix Two), by 15 April 2015.
The report shall include the following information:

    a) a summary report of the trap and transfer programme catch data;

    b) the date, total weight and estimated number of eels (those greater than 20 g) of each species trapped and released during the transfer and release programme, and the date and location when/where the collection and release took place (record details in the Trap and Transfer Programme Catch Data Form attached as Appendix Four

but note in the comments section that species composition unknown and that subsamples were provided to MPI's agent);

c) the date, total weight and estimated number of elvers (those less than 20 g) of each species collected and released, and the date and location when/where collection and release took place (record the details in the Trap and Transfer Programme Catch Data Form attached as Appendix Four but note in the comments section that species composition unknown and that subsamples were provided to MPI's agent);

d) the number and date of subsamples collected and provided to MPI's agent as prescribed in condition 16 c) above.

19. For the purposes of this permit, the permit holder is not required to meet the requirements of the *Fisheries (Reporting) Regulations 2001* and the *Fisheries (Recordkeeping) Regulations 1990*.

General conditions

20. Except as otherwise provided to the contrary under this special permit, the provisions of the Act or any regulation, notice, direction, restriction, requirement, or condition under this Act shall apply to any fishing, or any person engaged in fishing, carried out under the auspices of this special permit. Fishing shall have the same meaning as defined in section 2 of the Act.

21. This special permit must be held at the office of the permit holder. Persons in charge of collecting and transferring native fish must have a copy of this special permit in their possession while collecting and transferring native fish under the authority of this special permit. In all cases, copies of this special permit must be produced for sighting on request by a Fishery Officer.

22. At any time during which this special permit is valid, the Director-General of MPI, or his or her delegate, may amend any of the conditions of this special permit, or revoke this special permit, by notice in writing to the permit holder.

23. Failure to comply with the conditions of this special permit can, at the discretion of the delegated officer, result in the revocation of the permit. Furthermore, the delegated officer may direct that the involvement or assistance of other parties be restricted or not used if there is any compromise on the efficient and safe capture, transfer, and release of native fish.

24. The authority to take native fish under this special permit does not preclude the permit holder from obtaining any other approvals for the taking, possession, transfer or retention of any aquatic life under any other legislation or regulations administered by other authorities.

25. No fishing undertaken, or catch taken or otherwise possessed under the authority of this special permit shall give rise to any right, privilege, or expectation or preference in regard to the granting of any future permit, license, authorisation, quota, catch history, individual catch entitlement or other right whatsoever under the Act or any statutory amendment or re-enactment of that Act.

DATED at Nelson on 11th day of February 2015.

David Scranney
Spatial Allocations Manager
Acting pursuant to a delegation issued under Section 41 of the State Sector Act 1988.

APPENDIX ONE – CATCH MONITORING INSTRUCTIONS

Catch monitoring instructions
Elver transfer programme

1. *Collect catch from tank/trap (no more than 5 kg at any time in bucket).*
2. *Separate dead and live eels (i.e. 20g - pencil size or more).*
3. *Count, and weigh dead eels caught and record on Catch Record Form.*
    a. *If fewer than 10 individuals are caught, identify, weigh and measure each. Retain dead eels in a labelled bag (including collection site and date) and freeze. Contact MPI's agent (see below for contact details) for instruction on whether samples are required to be retained and provided for further investigations. If the sample is not required, dispose as permitted under your special permit.*
    b. *If more than 10 individuals are caught, identify, weigh and measure each. Retain a representative sample of 10 eels and dispose of surplus as permitted under your special permit. Retain the sample in a labelled bag and freeze. Contact MPI's agent for instruction on whether the sample is required to be retained and provided for further testing. If the sample is not required, dispose as permitted under your special permit.*
4. *Count, weigh and indentify live eels caught and record on Catch Record Form.*
5. *Remove any other species, identify, count and/or weigh, record as by-catch. Retain a sample of up to 10 individuals of each species identified in a labelled bag (including collection site and date) and freeze. Contact MPI's agent for instruction on whether samples are required to be retained and provided for further investigations. If not required, dispose as permitted under your special permit.*
6. *Drain live elvers and remove any that are dead.*
7. *Weigh live elvers. Record on Catch Record Form.*
8. *Weigh dead elvers. Record on Catch Record Form. (Once identified, counted and weighed place dead elvers in labelled bag and freeze. (If more than 100, process a subsample of a 100 and dispose of surplus as permitted under your special permit).*
9. *Transfer eel and elver catch records onto the Transfer Form.*
10. *Collect a sample of elvers for species identification at no less than 7 day intervals when transfers are made. (Note: mix catch well before taking sub-sample). If species identification is carried out by suitably experienced personnel (as described in the attached document entitled Species Identification Instructions) up to 100 individuals are required to be identified as follows:*
    i. *If fewer than 100 elvers are present the total catch is to be identified to species, and the total weight and number of each species present recorded.*
    ii. *If more than 100 elvers are present a representative sub-sample of at least 100 elvers must be examined (and preferable returned live to the*

release location). The total weight and number of each species present in the sub-sample are to be recorded.

11. *Process sample as per instructions for species identification (attached).*
12. *Check that Catch Record and Transfer Record forms are filled out correctly.*
13. *If species identification cannot be made on–site by experienced personnel, retain a sub-sample in a labelled bag and freeze. Contact MPI's agent for instruction on how to provide the sample to NIWA for species identification or alternatively send the subsample to your own suitably qualified agent for identification. When collecting samples for species identification the following samples sizes apply:*
    i. *If more than 1000 elvers are present a representative sub-sample of at least 100 elvers must be retained for species identification.*
    ii. *If less than 1000 elvers and greater than 100 elvers are present a representative sub-sample of at least 10 percent must be retained for species identification.*
    iii. *If less than 100 elvers are present the total weight and number must be recorded and species noted as unidentified then released.*
14. *Check that Catch Record and Transfer Record forms are filled out correctly.*
15. *Check trap and transfer equipment is in good condition (see the guidelines and report from attached entitled Equipment Monitoring and Operator Monitoring Sheet, respectively).*

Equipment Monitoring
Elver transfer programme

1. *Check for aggregation of elvers around ramps and trap. Record if elvers are present.*
2. *Determine if the number of elvers present in the holding tanks warrant a transfer.*
3. *Check water supplies for holding tanks, ramps and traps are flowing correctly. Adjust if necessary.*
4. *Record weather, water level and number of turbines operating. Note any changes observed. Examine catch for signs of stress or disease.*
5. *Check for bad smell and if present locate source and fix problem.*
6. *Open all valves fully and flush until water runs clear of silt. Return valves to original positions.*
7. *Check ramps. Clean if required.*
8. *If silt has accumulated in tanks flush and clean with pressure hose and brush. Use weak Janola solution (1% or 1:100 dilution) and rise well if sign of fungal infection is detected on elvers.*
9. *Adjust attraction and flushing flows on ramp.*
10. *Record any malfunctions on sheet attached entitled Operator Monitoring Sheet.*

Operator Monitoring Sheet -Elver trap and transfer programme

Location:

Date:

Time: In Out

Operator: Visitor(s):

Reason for visit: .....

Weather

Tailrace level

Which turbines operating? .....

.....

Elvers seen (Y/N) ?

If yes, where? .....

Eels seen (Y/N) ?

If yes, where? .....

Water supply OK ?

If not, what is the problem ? .....

Any signs of disease or bad smells ?

If so, where and what type? .....

Water valves open fully and reset?

Water tanks clean ?

ACTIONS TAKEN TODAY

	Trap 1	Trap 2	Trap 3		
Elver catch transferred					
Trapping re-started					
Elvers identified					
.....					

Sample taken? (yes/No)

COMMENTS

.....

.....

.....

.....

.....

Please leave a copy of this form at entrance to station so it is available for other operators to fill in

APPENDIX TWO – CONTACT DETAILS

The Spatial Allocations Manager can be contacted by the following:

Spatial Allocations Manager
Ministry for Primary Industries
Private Bag 14
Nelson 7042
[Tel: (03) 5481069, Fax: (03) 5457799]

MPI's agent for Species Identification reporting can be contacted by the following:

NIWA
P.O. Box 11-115
Hamilton
[Tel: (07) 8567026, Fax: (07) 8560151]

Key personnel

J. Boubée:	Mobile 0274 799485	jacques.boubee@niwa.co.nz
Mike Martin:	Mobile 0274 840793	mike.martin@niwa.co.nz

MPI District Compliance Manager Southland can be contacted by the following:

Reece Murphy
Tel: (03) 211 1961, Fax: (03) 211 1969
Email: Reece.Murphy@mpi.govt.nz
cc. Cheryle.Blight@mpi.govt.nz

APPENDIX THREE – SPECIES IDENTIFICATION REQUIREMENTS AND GUIDELINES

Species identification instructions
Elver transfer programme

CATCH ANALYSIS (TO BE DONE FOR *EACH* TRANSFER)

1. *Do not smoke or eat when processing elvers with anaesthetic. Keep hands clear of mouth and eyes.*
2. *Mix catch and obtain a sample of about 100[1] elvers.*
   - *i. If fewer than 100 elvers are present the total catch is to be identified to species and the total weight and number of each species present recorded.*
   - *ii. If more than 1000 elvers are present a representative sub-sample of at least 100 elvers must be examined. The total weight and number of each species present in the sub-sample are to be recorded.*
   - *iii. If less than 1000 elvers and greater than 100 elvers are present a representative sub-sample of at least 10 percent must be examined. The total weight and number of each species present in the sub-sample are to be recorded.*
3. *Prepare three buckets. Fill two with clean fresh water and label as SF and LF.*
4. *In third bucket place about 5 L of water and 2 ml clove oil solution (pure clove oil dissolved in 80-% ethanol at rate of 1 to 10 – purchase from chemist or from MPI's agent). Mix well.*
5. *Place a small number of elvers (about 10) at a time in anaesthetic.*
6. *Quickly identify each and record. Place in SF or LF in fresh water bucket as appropriate until recovered.*
7. *Repeat until sample is processed.*
8. *Sieve the sorted elvers to drain out water and weigh each species separately (total weight not individual weight of elvers).*
9. *Record number and weight of each species on species composition form.*
10. *Return recovered elvers to holding tank for transport.*
11. *Complete species composition form and fax/email to MPI agent every two weeks.*
12. *If species identification cannot be carried out by suitably experienced personnel (or if instructed by MPI or its agent) freeze a sample of elvers for species identification and ageing purposes (at least 1 sub-sample every 15 days). Alternatively, for every 15-day period identify, measure and weigh 100 shortfins and 100 longfins (if available, but accumulate records for up to 15 days if required). Complete form provided noting date of each analysis and fax/email to MPI's agent (see details provided in Appendix Three).*
13. *Rinse all equipment and wipe clean. Wash hands with plenty of water.*

[1] MPI's agent can provide a conversion factor on request.

APPENDIX FOUR: TRAP AND TRANSFER PROGRAMME CATCH DATA FORM

Operator:

Date:

Time:

Date of last removal:

Eels separated from elvers? (circle) YES / NO

Trap 1

ELVERS					
		Live		Dead	
Total	Bucket	Net Wt.	Count	Net Wt.	Count
COLUMN TOTAL					

EELS					
		Live		Dead	
Total	Bucket	Net Wt.	Count	Net Wt.	Count
COLUMN TOTAL					

Trap 2

		Live		Dead	
Total	Bucket	Net Wt.	Count	Net Wt.	Count
COLUMN TOTAL					

		Live		Dead	
Total	Bucket	Net Wt.	Count	Net Wt.	Count
COLUMN TOTAL					

Trap 3

		Live		Dead	
Total	Bucket	Net Wt.	Count	Net Wt.	Count
COLUMN TOTAL					

		Live		Dead	
Total	Bucket	Net Wt.	Count	Net Wt.	Count
COLUMN TOTAL					

Trap 4

		Live		Dead	
Total	Bucket	Net Wt.	Count	Net Wt.	Count
COLUMN TOTAL					

		Live		Dead	
Total	Bucket	Net Wt.	Count	Net Wt.	Count
COLUMN TOTAL					

BYCATCH:

Species				
Number				
Weight				

LOCATION OF RELEASE: .....

COMMENTS:

.....

.....

.....

.....

APPENDIX FIVE: SPECIES COMPOSTION REPORTING FORM

Species Composition - elver trap and transfer programme

Location | Date | Operator

ELVERS: EELS:

Notes	Shortfins counts	Longfins counts	Shortfins counts	Longfins counts
	1–50 / 51–100	1–50 / 51–100	1–50 / 51–100	1–50 / 51–100
Extras				
Total No. in sample				

	ELVERS:		EELS:	
Total weight (g)	sf	lf	sf	lf
Total sample weight (g)				
Total No. in sample				

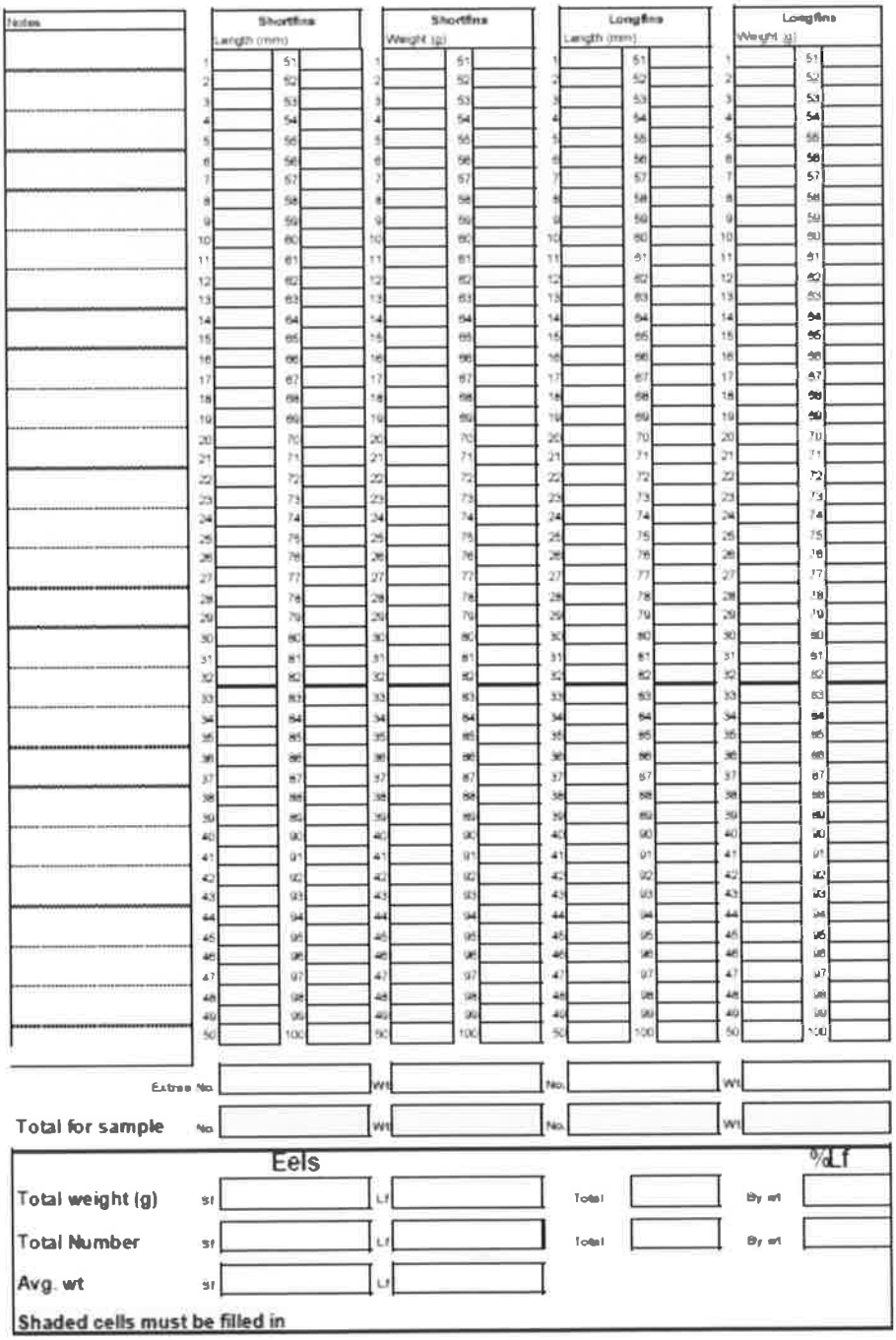
Shaded cells must be filled in

APPENDIX SIX: EEL TRAP AND TRANSFER PROGRAMME FIELD DATA SHEET

Eel size - elver trap and transfer programme

Location | Date | Operator

Eels



Eels

%Lf

Total weight (g)	Sf		Lf		Total		By wt
Total Number	Sf		Lf		Total		By wt
Avg. wt	Sf		Lf				

Shaded cells must be filled in

APPENDIX SEVEN: ELVER TRAP AND TRANSFER PROGRAMME FEILD DATA SHEET

Elver size - elver trap and transfer programme

Location | Date | Operator

Elvers

Notes	Shortfins Length (mm)	Shortfins Weight (g)	Longfins Length (mm)	Longfins Weight (g)
	1–100	1–100	1–100	1–100

Extras No. | Wt | No. | Wt

Total for sample No. | Wt | No. | Wt

Elvers

	Sf	Lf	Total	By wt
Total weight (g)				
Total Number				
Avg. wt				

Shaded cells must be filled in

Ministry for Primary Industries
Manatū Ahu Matua

File Ref.: NFT213

Mataura Industrial Estate
PO Box 43
Dunedin

AUTHORISATION pursuant to Section 26ZM(2) of the *Conservation Act 1987* is given to:

Gregory John Paterson, of Mataura Industrial Estate

To transfer from:	the Mataura River within 500 metres upstream or downstream of the Mataura Falls and weir.
To release to:	the Mataura River within two kilometres upstream or downstream of the Mataura Falls and weir.
The following:	longfin and shortfin eel (*Anguilla* spp.), and *Galaxiid* spp., irrespective of size and numbers.

This approval is subject to the following conditions:

1. This approval is effective from the date of signature and is valid while special permit 592 remains in effect.
2. Fish must be visually inspected directly prior to release. Any fish with any lesions or any signs of disease or stress shall not be transferred and released. Any individual fish found dead, distressed or moribund must be immediately removed from the holding tank, and not released into the fish farm.
3. The Ministry for Primary Industries (**MPI**) is to be notified on the emergency hotline (0800 809966) as soon as practicable should significant mortality or abnormally high numbers of distressed, diseased, or moribund fish occur. If such an event should occur, no fish, or transport water, should be released to any waterbody and samples should be kept (chilled not frozen, or as advised by MPI) for MPI investigation.
4. Any distressed, diseased, moribund or dead fish, as well as any contaminated transport water shall be safely disposed of in a biosecure and humane method.

5. Adequate husbandry techniques must be undertaken to ensure stress on fish is minimised and an appropriate level of care is provided (e.g. water quality, feed, stocking density).

6. Any transfer and release undertaken with this authority must be done in accordance with any other relevant legislation (e.g. Biosecurity Act 1993) that relates to the transfer, release or disposal of organisms.

Growing and Protecting New Zealand

In exercise of powers delegated to me pursuant to the State Sector Act 1988.

David Scranney
Spatial Allocations Manager
Dated: 11 February 2015

Vaipuhi
Consulting

Draft Downstream Eel Monitoring Programme for Mataura Falls

Prepared for Alliance Group Limited

V3.0 March 2018

Draft Downstream Eel Monitoring Programme for Mataura Falls

Prepared for Alliance Group Limited

Vaipuhi Freshwater Consulting Report No: 201802
V3.0 March 2018

Reviewed and approved for release by Mark James (Aquatic Environmental Science)

Signature: ----------
Xx/xx/20xx
Date: ----------

Cover photo: Examining the head of a longfinned eel to determine its migratory status. [Photo J Boubée].

Contents

Figures

Executive summary

Alliance Group Limited (Alliance) is in the process of reconsenting a small hydro-electric power plant that it operates at its meat processing site on the true right bank of the Mataura Falls. Revised Consent Conditions drafted on 15 February 2018 require that a Downstream Eel Monitoring Programme be developed and submitted to the Consent Authority for certification.

The purpose of this monitoring is to ascertain if eels are entering the turbine during the downstream migration period, and if so, how many, what size, which species and when. The aim is to determine what, if any, significant adverse entrapment effects the hydro scheme is having on downstream migrant eels, and outline potential mitigation actions should they be required.

This draft monitoring plan reviews available information on the life history of eels, and experience gained both here and overseas on the effect of hydro generation on downstream migrants. It identifies possible mitigation actions that could be considered should a significant impact on downstream migrant eels be found. Suggestions made are not exhaustive and should not construed as an indication of an adverse effect nor of the need, acceptance, or preference for any particular mitigation action.

Monitoring plans typically follow general guidelines, but are all site and resource specific. Local knowledge and observations are a key part of these operations, notably at the start of the operation. Consequently, it is normal for operations to be modified as experience is gained and, as stipulated by Consents, this downstream eel monitoring plan will need to be reviewed at least annually.

As drafted, the plan provides monitoring guidelines for up to five years. It should be adaptive and it will be up to the future operators, reviewers, stakeholders and consenting authorities to determine if the Alliance hydro-electric power plant is having a significant impact on downstream migrant eels and, if so, what long-term mitigation measures may need to be implemented.

1 Introduction

Alliance Group Limited (Alliance) is in the process of reconsenting a small hydro-electric power plant that it operates at its meat processing site on the true right bank of the Mataura Falls (Mitchell Daysh 2016). Revised Consent Conditions drafted on 15 February 2018 (see Appendix A) requires that a Downstream Eel Monitoring Programme be developed and submitted to the Consent Authority for certification.

The purpose of this monitoring is to identify if eels are entering the turbine during the downstream migration period, and if so, how many, what size and species, and when. The aim is to determine what, if any, significant adverse entrapment effects the hydro scheme is having on downstream migrant eels.

The revised Consents Conditions stipulate that the Monitoring Programme shall include details relating to:

(a) Modifications required to the trash screen bar size so as to be consistent with national fish screening guidelines or other best practice fish screening requirements, and not be greater than 30 mm;

(b) Monitoring dates;

(c) Screen inspection frequencies, including increased frequencies during elevated flow events;

(d) The recording and reporting obligations associated with monitoring undertaken;

(e) Recording screen by-catch.

Vaipuhi through Aquatic Environmental Sciences Ltd was commissioned by Alliance to draft this downstream eel monitoring plan. The writer has not visited the site in recent times and to date has not been involved in the negotiations. The Plan, as drafted, is based on personal experience of eel migration, and impact of hydro-electric turbines and flood pump stations, both overseas and around the country, as well as information provided by Alliance. The plan follows present best practice downstream passage guidelines at hydroelectric dams as detailed by Paterson and Boubée (2010).

Monitoring plans typically follow general guidelines, but are all site and resources specific. Local knowledge and observations are a key part of these operations, notably at the start of the operation. Consequently, it is normal for operations to be modified as experience is gained both at the site of interest and also globally. It is therefore expected that the present draft plan will be altered over the years of operation as more observations and records become available.

As such, and as stipulated by Consents, this downstream eel monitoring plan for the Alliance power plant should be reviewed at least annually.

2 Eel life cycle

In the Mataura River Catchment longfin (*Anguilla dieffenbachii*) and to a lesser extent shortfin (*A. australis*) eels support an important customary, commercial and recreational fishery. Commercial catches of eels are expected to vary markedly depending on fishing effort and markets, as well as availability of quota. As a guide, some 4.1 tonnes of longfins were commercially captured in the Mataura catchment upstream of the Falls in the 2014/15 fishing season.

To complete their lifecycle, freshwater eels must move between freshwater and the sea. Breeding occurs in the marine environment, following an extended adult growth stage in freshwater, and a long migration from their freshwater habitat.

In New Zealand, freshwater eels typically migrate downstream between January and May. The precise trigger that causes adult eels to develop into migrants (i.e., tuna heke) is not well known, but high fat content that provides sufficient energy to develop gonads and cover the long distance to spawning grounds appears to be essential (Larsson et al. 1990). Once eels become migrants they stop feeding, and progressively develop the external features that clearly distinguish them from 'feeders'. These features include: the head becoming flatter and slender, lips becoming thinner, the head and back may become darker, and the belly may lighten to a bronze or silver colour. In addition, the pectoral fins darken, and the eyes enlarge and become surrounded by a narrow ring (see cover photograph as well as Todd 1981a and 1981b).

There is a considerable amount of literature from Europe, the United States and Australasia regarding the downstream migration of anguillid eels. In New Zealand, adult migrant eels are the largest fish requiring protection and safe downstream passage at hydroelectric facilities. Upstream reaches of waterways as present in the Mataura catchment are well suited to the production of large female eels. This is important as the capacity to carry eggs increases with size, and Todd (1981a) demonstrated that a 700 mm female longfin carried c. 1 million eggs whereas a 1400 mm fish produced over 20 million. Downstream migrating female eels, especially large ones, should therefore be a priority for providing safe downstream passage and conservation.

It is accepted by most researchers that anguillid eels around the world exhibit similar migratory behaviour and that the findings related to one species are generally applicable to the others (Richkus & Dixon 2003). Observations of migrant European eels in an experimental flume indicated that eels exhibit three types of behaviour: passive drift, controlled drift and active downstream movement (Adam & Schwevers 1997; Adam et al. 1997). This suggests that adult eels may follow the flow like many smaller migrants but also have the ability to actively change direction. Studies by Thorpe et al. (1981) suggested that high velocities may be preferred by downstream migrant fishes as a mechanism to save energy. Further study indicated that migrant European eels within an experimental channel always collided with objects, unlike yellow eels (adult "feeding" eels, i.e., not migrant) who were able to avoid objects (Adam et al. 1997). If the collision was intense, the eels showed a 'startle' response and sprinted upstream. However, after a moderate collision, the eels tended to settle in front of the barrier.

Studies undertaken both internationally and in New Zealand indicate that in riverine environments eels tend to use the whole water column when migrating downstream (Moriarty 1978; Haro et al. 1999; Boubée et al. 2007; Aldridge et al. 2009). They have therefore the ability to use surface and bottom downstream bypasses and will go over weirs and spillways when these overtop.

Downstream migration of eels may comprise long periods of inactivity punctuated by short peaks of extensive movement (Lowe 1952). Researchers have identified a number of cues, or triggers, for initiating and/or ending downstream movement including water temperature, river/stream discharge (including changes in water level and increased precipitation) and light intensity (which can also include lunar phase) (Richkus & Dixon 2003). These cues may affect migration independently or in combination. However, the precise magnitude of the environmental triggers which influence migration is recognised to vary on a site-specific basis (Boubée et al. 2001; Richkus & Dixon 2003).

Most eels migrate when temperatures are declining (Lowe 1952; Boubée et al. 2001; Boubée et al. 2007). Vøllestad et al. (1986) reported that in the River Imsa (Norway) most European eels migrated when water temperatures were in the range 9–12ºC, and that few migrated when temperatures were above 18ºC or below 4ºC. In contrast, in the St Lawrence and Richelieu Rivers (Canada), peak migration occurred when water temperatures were high, often over 20ºC (Kleinschmidt Associates 2001, in Richkus & Dixon 2003). In New Zealand, water temperatures below c. 11ºC caused migration to cease in the Rangitaiki River (Boubée et al. 2001) while in Lake Manapouri migrant activity declined markedly below 13ºC (Stevenson 2008).

Rainfall events have previously been found to have a significant association with large runs of migrant eels in New Zealand (Todd 1981b; Boubée et al. 2001), and the importance of flow has also been highlighted in other studies (Lowe 1952; Burnett 1969; Vøllestad at al. 1986).

Light avoidance has been proposed as a means of inhibiting eel migration (Lowe 1952; Vøllestad et al. 1986), although it appears that its effect can be diminished by other environmental cues (e.g., rising floods or dark stormy nights, Lowe 1952). Under experimental conditions with migrant European eels, Hadderingh et al. (1999) found that dark flume areas were preferable to areas with high flows, although there had to be sufficient distance between the eels and the light source to allow it to react, especially in the presence of a water current.

3 The Alliance power plant

The Alliance power plant on the true right bank of the river at Mataura Falls (Figure 3-1) consists of a Francis turbine generating 530 KW at a design flow rate of 9.5 m^3/s and a fall of 7.25 m.

The Falls provide most of the head that runs the turbine (Figure 3-2).

A weir in the river above the falls (Figure 3-3) diverts flow and provides additional head for the Alliance plant as well as the power plant operated by Mataura Industrial Estate (MIE) on the opposite side of the river. A minimum of 50 mm of water is maintained over the weir, while the hydro-electric plants are in operation.

Figure 3-1: Upstream view of the Mataura Falls and associated infrastructure. The Alliance Plant is on the left (true right bank). From Golder 2007.

Figure 3-2: Upstream view of the Mataura Falls. Photo credit Andrew Ross MT2015.25.54. Copyright Mataura and Districts Historical Society Incorporated.

Figure 3-3: The Mataura Weir summer 2017. Note salmonid ladder at centre weir. Photo courtesy Alliance.

The median flow of Mataura is 55.7 m^3/s and the 7 days mean annual Low flow 18.9 m^3/s. Water is drawn from the river by a c. 300 m long hydro race that is about 7 m wide at the entrance and 4 m wide at the turbine intake. Water depth at the intake is about 2 m. At a river flow of 108 m^3/s approximately 75% of the length of the hydro race and associated structure overtops. Maximum flood levels in the river can be more than 2 m above the level of the intake channel wall (PDP 2017).

There is a trash screen in front of the turbine intake (Figure 3-4). Trash bar spacing is approximately 70 mm (60 mm gap between the bars) (D Richardson, Alliance, pers. comm., 21st February 2018). There is a penstock sluice gate near the screens (Figure 3-4) and this potentially could be part of an eel downstream bypass if found necessary in future.

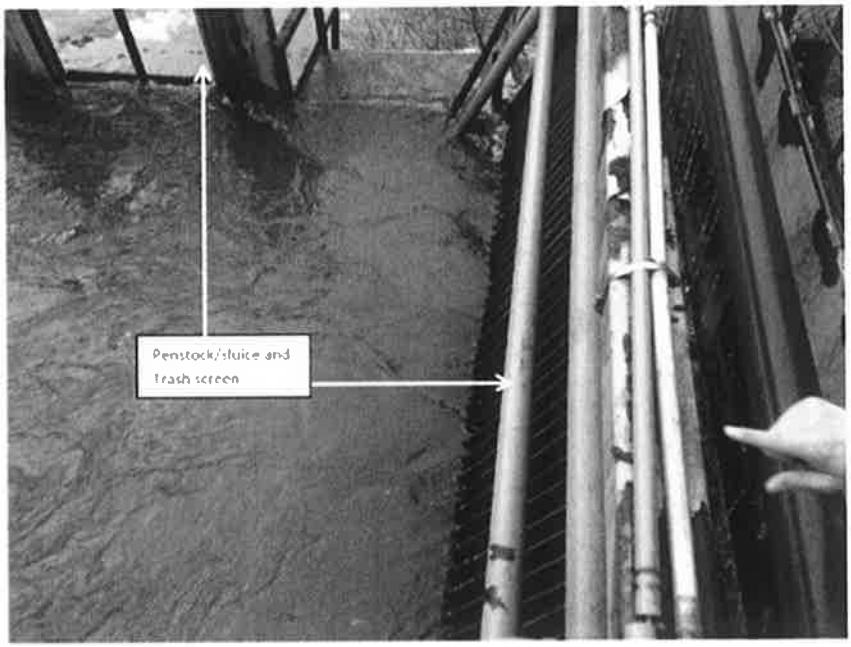


Figure 3-4: Trash screen and sluice before entering the turbine. Photo courtesy Alliance.

The screen cleaner consists of a rake bar that is swept up across the screen by means of chains located on either side of the screen (Figure 3-5, Figure 3-6). The screen cleaner operates automatically on pressure differential across the screen and can also operate on a timer.

Figure 3-5: Dewatered trash screen. Note silt deposit at bottom of intake. This may indicate reduced velocities which could be used by eels to avoid impingement and entrainment. Photo courtesy Alliance.

Figure 3-6: Trash cleaner bar progress up the screen. (**Top**) Rake bar reaching the apex of screen; **(Middle)** Rake at apex of its run; (**Bottom)** Rake on its way back down the screen. Note: If required in future it may be possible to make the rake bar more eel friendly by widening the rake blade and providing a backing plate and sides so as to produce a bucket that could safely hold the impinged eels

up the screen. Extra sprockets may be required to tip the "bucket". Photos extracted from Video clip provided by Alliance.

4 Historical observations of eels in the upper Mataura River

The upper Mataura is a productive eel fishery dominated by longfinned eels but there appears to be little published information on the impact of the two hydro plants at the Falls. There is, however, a 1926 photograph in the collection of the Mataura and Districts Historical Society Incorporated which shows the then paper mill manager with a large number of longfinned eels in front of the intake screen (Figure 4-1). This was prior to commercial fishing being established in New Zealand, and during a period when the Acclimatisation Society (now Fish and Game) actively pursued an eel extermination programme. Catchment development and habitat losses have since also reduced eel habitat considerably and it would be unlikely that such numbers now impinge on the screens of the power stations.

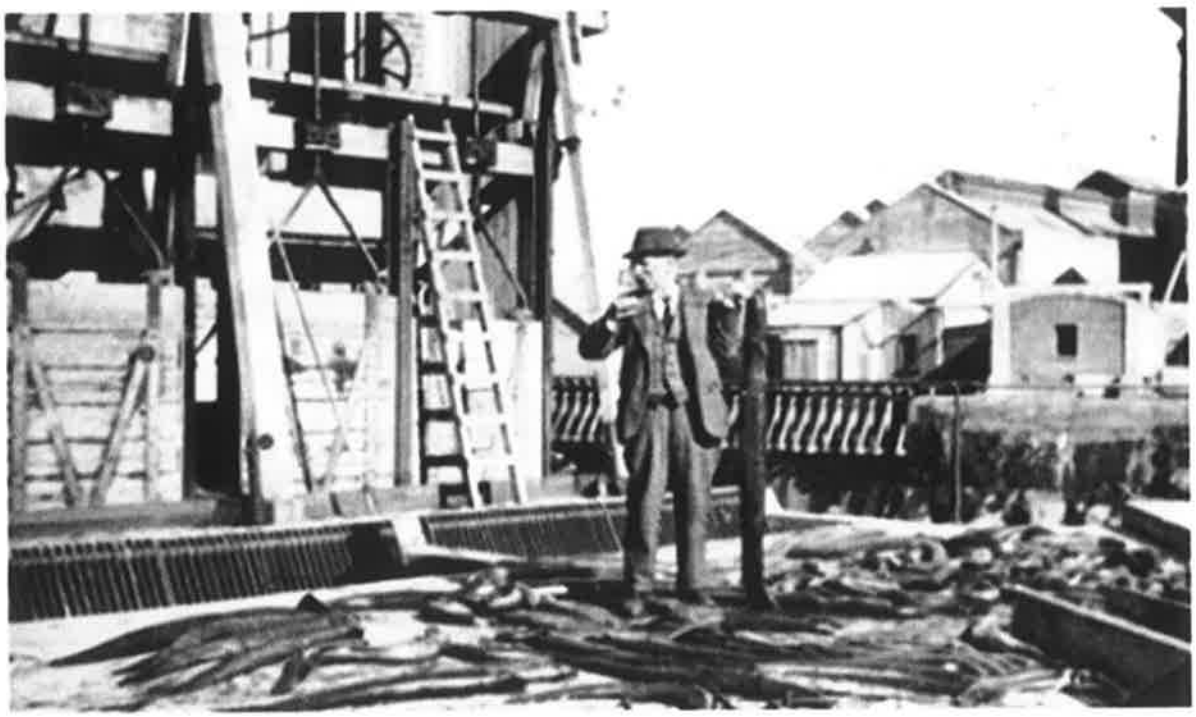


Figure 4-1: Mataura-paper-mill-manager-W-Ross with Longfinned eels collected off the power plant intake in 1926. Copyright Mataura and Districts Historical Society Incorporated.

5 Postulated effects of hydro power generation

Turbines are normally protected by trash racks to ensure that debris carried by the flow do not block or damage the turbines. Fish too large to pass through the screen may impinge on the screen especially where the water velocity is too high or the distance to safe escape route is too great.

These impinged fish are removed along with the collected trash by the screen cleaner, but if left there too long or if subjected to high pressure or mechanical damage are often seriously damaged or dead when collected.

Smaller fish passing downstream through the screen are entrained into the turbine. Passage survival is dependent on the type of turbine installed, the speed of turbine rotation, the species of fish and the physical shape of the fish (Larinier & Travade 2002, Boubée & Williams 2005). Turbine mortality prediction for the Mataura Power Plant undertaken by Golder (2016)[1] estimates a 14% mortality for small fish such as lamprey juveniles, and above 40% for fish longer than 300 mm (e.g. eels). Reducing the number of eels entering the turbine, notably of large female migrants, would therefore be desirable if the number affected is shown to represent a large proportion of the total eel reproductive output from the Mataura Catchment.

5.1 Screen spacing and size of eels entrained

The results of German studies by Berg (1995 cited by Thon, 1999) concluded that eels up to 70 cm in length were able to pass through bar racks with 25 mm spacing, and that eels of 55 to 60 cm could pass through 20 mm spaces. Based on these results, 20 mm bar spacings were initially prescribed for intake screens at hydroelectric projects in Germany, but as the water velocity at the bar rack was often over 1 m/s, a high mortality of migrating eels due to impingement and partial passage through the screens was soon observed (Figure 5-1). Subsequent work, notably by Adam and Schwevers (1997), led to present Europeans' recommendation for bar spacing to be no more than 10-15 mm, and approach velocities of less than 0.3 to 0.5 m/s at small (<30 m^3/s) power plants. The cost of a similar but finer screen for the Alliance site, is estimated at $1.5 M (PDP 2017).

Figure 5-1: European eels (length 0.7 to 0.9 m) passing through an intake screen grate with 20 mm spacing and approach velocity of 0.9 to 1.0 m/s. (Photo - U. Dumont pers. comm.).

For larger power schemes in Germany, where fine screening is not technically possible or too onerous to install, predictive monitoring using an electronic early detection system for fish migration activities (MIGROMAT®), is routinely used to induce turbine shutdown and spillway openings during recorded migration peaks.

[1] Included as Appendix E of Alliance 2016 AEE

Records on bar rack width and eel size in New Zealand are sparse and are, again, limited to relatively large hydro power scheme intake structures. Boubée et al. (2001) measured the length and head width of eels collected at Aniwhenua Power station on the Rangitaiki River above the screened turbine intake (i.e. impinged eels). The screens at this power station had a relatively narrow bar spacing at 30 mm.

The results of this study (Figure 5-2) indicate that the 30 mm screen has been effective in preventing larger eels (25 mm head width no longer than 85 cm) from entering the turbines. Although relatively small migrants were collected, the records gave no indication if the size distribution of the eels collected is representative of the migrant population. Given that the European studies have shown that a 70 cm eel could pass through a 25 mm gap, it is highly likely that a large proportion of "smaller" migrants (i.e. males) were able to pass through the 30 mm screens at Aniwhenua Power Station.

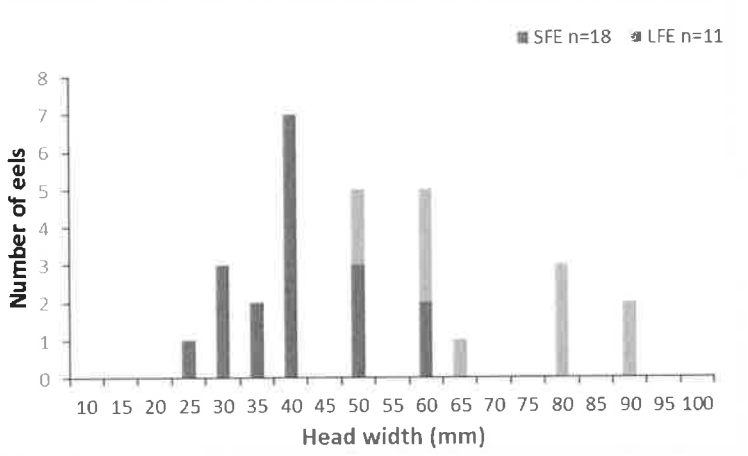


Figure 5-2: Size distribution of migrant eels collected from Aniwhenua Power Station in the 1990s. (A head width of 25 mm equates to an eel around 85 cm in length (so a female). (graph from Boubée et al. 2001).

Studies at Mokauiti and Wairere Falls power stations where screens with 30 mm gaps are also present, indicated that eels over 1 m long could pass through these relatively narrow intake screens (Boubée 2001). The likely cause for this is that over time, screens become damaged by debris and bars are often pushed apart by debris resulting in screen gaps wider than those nominally installed.

Data collected from the Rangitaiki River by Boubée (2001) were used to compare eel length against head diameter for a number of shortfin and longfin downstream migrant eels (Figure 5-3). This data shows that, at a minimum, migrant eels of up to one meter should be able to pass through a screen with 50 mm bar spacing. However, it is likely that downstream eels considerably longer than one meter would also be able to pass through a 50 mm screen, given their ability to squeeze through gaps much smaller than their head widths (Adam and Schwevers 1997).

Overall the records indicate that screens with a 50 mm bar spacing are sub-optimal in terms of their ability to exclude small migrant eels. Consequently, smaller spacing is recommended, and Alliance proposes to either add one extra bar between each of the existing bars, or install a new monitoring screen, both options resulting in a spacing of about 20 mm. This should retain most migrant longfin females but will cause the through-screen velocity to increase from an estimated 1.4 m/s to 1.8m/s at high flows.

One issue that therefore remains with the screen gap reduced to 20 mm is the relatively high predicted through screen velocity which will cause eels to impinge. Should high entrainment rate and high mortality of impinged eels be recorded one option that could be considered in future would be to modify the screen cleaner and operate it in such a way as to reduce injury and mortality rate. If this proves inadequate, the screen area could also be increased, and an effective downstream bypass installed. The present monitoring plan takes these options into consideration.

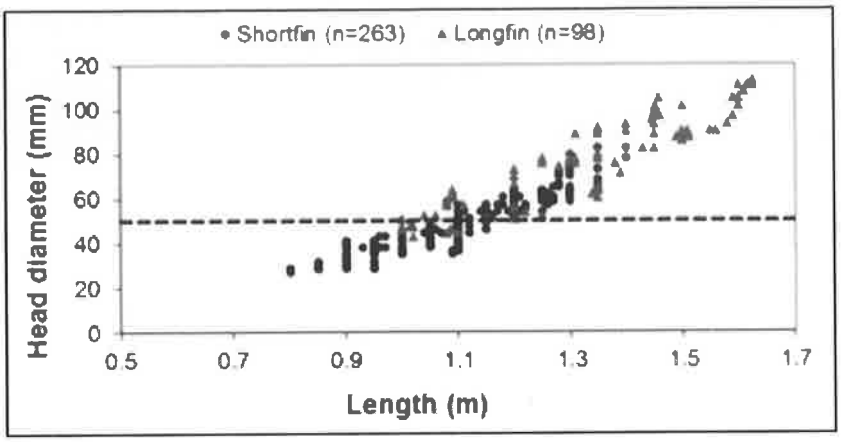


Figure 5-3: Eel length vs head width – Rangitaiki River. (graph from Boubée et al. 2001)

5.1.1 Screening alternatives

In order to mitigate the potential effects on adult eel migration downstream, the Alliance AEE (Mitchell Daysh 2016) originally proposed to shut down generation of the hydroelectric plant during the main migration period. Ceasing or suspending generation is the ultimate way of protecting downstream migrating fish. In cases where peak migrations occur at off-peak power demands (i.e. migrant eels actively migrating downstream at night) there may be trade-offs for the generator between the cost of lost production and the cost of installing physical or behavioural deterrents (Richkus & Dixon 2003).

Although environment clues such as rainfall and increased flow do indeed trigger eel migrations, timing and duration of the runs remain difficult to predict without information specific to the catchment (Haro et al. 2003). Consequently, one aim of the present monitoring plan is to try and collect information on migration timing and potential environmental eel migration triggers.

Development of the MIGROMAT® system, which uses the activity of captive eels held in river water to indicate migration activity in the river may assist in predicting migration (Bruijs et al. 2003; Adam and Bruijs 2006). The system has been implemented on a number of rivers in Europe but has not yet been tried in New Zealand. Such a system is therefore included as a future option for monitoring should the need for turbine shut down prove necessary in the future.

Potentially the information collected in the proposed monitoring plan could provide some valuable information for other power generators and resource managers, and it is recommended that results and conclusions be shared. Sharing of monitoring and development costs could also be considered in

order to improve opportunities for the implementation of effective and innovative protection systems in the future should these prove necessary.

6 Downstream migrating eel monitoring programme

6.1 Objectives and purpose of plan

- The o**bjective** of this Monitoring Programme is to facilitate the monitoring of the effects of the hydro scheme on the downstream passage of adult migrating eels.
- The **purpose** of this monitoring is to identify if eels are entering the turbine during the downstream migration period, and if so, how many eels, what size and species. This is to determine what, if any, significant adverse entrapment effects the hydro scheme is having. Understanding the timing of eel movement to the turbine within the migration period will also be investigated.

6.2 Permits

- The person implementing the Mataura Downstream Eel Monitoring Programme is to be suitably trained and, if required, licensed with a special permit from MPI to hold and release fish under the Fisheries Act 1996.
- An animal ethics permit may also be required where eels are held for observation and manipulation such as tagging.

6.3 Health and safety

Before any monitoring work can begin, a Health and Safety plan must be drafted. This plan must be followed at all times and, at a minimum, must take account of the following:

- Other operations at the site;
- Screen cleaner and other automated devices at the intake (i.e. these being preferably turned off and isolated before any inspections can take place);
- Need for harness and lanyard if risks of slipping and falls are present;
- Weather and flood risks;
- Sudden shutdown (tripping) of the turbines;
- Emergency escape procedures;
- Recovery in case of injury;
- Risk of drowning;
- Communication protocols;
- Means of contacting emergency services;
- Risk assessment at the beginning of each work day;
- Induction and supervision processes for visitors and observers.

6.4 Timing of operations

Monitoring is currently set for up to five years and use an adaptive management process based on the results to modify the planned activities so as to ensure eel mortality and injury is not significant.

In year 1 it is proposed to undertake the monitoring from 1 February to the end of May. This timing will need to be reviewed annually.

(Note: Should results indicate significant adverse effects during the planned monitoring period one option that could be considered is a shutdown of the plant during fresh/flood events over the main migration period (Mitchell Daysh 2016). As such action may affect the ability to monitor the full impacts of the power plant and also prevent trigger factors to be fully established it will need to be carefully appraised before being implemented.)

6.5 Proposed screen modification

The aim of the screen modification is initially to minimise the entrainment of large downstream migrating eels through the turbine and allow the impact of the power plant (if any) to be assessed. Long-term, depending on results, the modified screen may facilitate the safe collection or deflection of migrant eels so they can be returned to the river.

Initial monitoring years

In year 1 of the monitoring program:

- Insert a screen with bar gaps of about 20 mm during the monitoring season (1 February until the end of May).
- Modify the screen cleaner (if required) to cater for reduced screen gap spacing and operate so as to maximise survival of impinged eels (use adaptive management to set rotation speed and operating time of screen cleaner so as to minimise wear).

To assess the injury status of impinged eels that are retrieved from the screen the trash sluice will need to be modified so as to retain the eels in as safe a condition as possible until they can be separated from trash, processed and if un-injured safely returned to the river.

To ensure that the modifications are fit for purpose and to obtain an indication of the size of eels able to pass through the screen, subject to obtaining appropriate permits, 10 or more migrant shortfin females of at least 800 mm - and preferably up to 1.2 m in size - will be obtained from the local eel processing plant, tagged with PITs (Passive Integrated Transponders) and released at night in a slow moving section of the intake canal as close as possible to the intake. (Note: Preferably choose a period when the canal does not overtop the side weir and generation is at its maximum).

Subsequent monitoring years

Should significant mortality be recorded in the initial and subsequent monitoring years (i.e. at any time during monitoring year 1 – year 5), consider modifying the screen cleaner by incorporating a series of fish recovery buckets and means of emptying these into the trash sluice. Continue monitoring of screen trash for at least one year.

If additional changes prove necessary, i.e. if there is a significant impact during monitoring, shutting down the turbine during events that result in high eel mortality (most likely floods) could be considered, as discussed in Section 6.4.

6.6 Observations and fish records

To facilitate observations and minimise visits to the screen it is proposed to install a camera over the collection sluice so it can be viewed remotely. The camera will also be used to collect information on when the eels are retrieved. This will be done by taking still pictures of the sluice gate at regular intervals and obtaining short videos once the screens are turned on.

At least once a day the material collected in the collection sluice will be examined, and any fish present separated from the trash. Live fish will be placed in a tank of aerated water and dead or seriously injured fish in a separate bin. The eels will then be identified and measured and assessed under the following behavioural states:

- Motor capacity – Is the eel moving and lively?
- Response – Does the eel respond to stimuli (e.g. pinch)?
- Body form – Does the eel conform to a normal shape?
- Buoyancy – Is the eel in a neutrally buoyant position?

If the answers to all the above questions are yes, the eel will be assigned a behaviour category of "Normal". However, if the answer to any question is no, the eel be classified as "Abnormal".
In addition, the eels will be assessed for injury based on the following categories:

1. No visible damage to the eel exterior, the eel is alive and appears healthy;
2. Minor injury; mainly superficial – unlikely to affect function or survival;
3. Moderate injury; more substantial injury – likely to affect function;
4. Major injury; severe injury – likely to affect both function and survival;
5. Mortality, the eel is no longer alive.

In addition to the above, the following details shall be recorded for each eel retrieved

- Date and time of collection
- Species
- Eye diameter (height and width)
- Migrant status (based on body colour, eye shape and fin size and colour) etc.)
- Total length
- Weight
- Body width (at pectoral fins)
- Type and location of injury (if any), and photographs of these.

On at least three occasions each monitoring season, if present, up to 10 eels in categories 1 and 2 will be retained for up to five days in a 2 m^3 (or more) aerated water tank supplied with fresh running fresh water. The eels will be examined each day and after 5 days their behaviour re-assessed. Live eels will then be returned to the river but any unlikely to survive will be euthanized using an over-dose of a registered fish anaesthetic, and disposed of on land.

6.7 Hokonui Runanga participation in the monitoring

During the elevated flow events and/or when a number of migrant eels are being collected (e.g. more than 2 per day), Alliance will invite the chair of the Hokonui Runanga or a Runanga nominated

representative to observe the monitoring of the trash screen and chute, and eel collection. This invitation will be extended each monitoring season. Alliance will be required to retain fresh eel carcasses and offer these to the Hokonui Runanga.

6.8 Bycatch

Record species, size and timing of any other fish (i.e. bycatch) collected, and include records together with environmental condition under which they were recorded in the annual report.

6.9 Disposal of recovered fish

All eels in injury categories 1 and 2 will be returned to the river once examined. Eels in categories 3 to 5, as long as fresh, will be offered to Hokonui Runanga on day of collection or frozen for later retrieval. (Note: as this provides a unique opportunity to collect otoliths from migrant longfinned eels for ageing purposes, Hokonui Runanga may consider extracting otoliths of these eels and sent them to NIWA in individual envelopes labelled with date, location, species, head width, total length and, if available, weight.)

All bycatch species will be returned to the river once processed.

6.10 Environmental variables

Throughout the monitoring period the following data will be collected:

- Daily rainfall;
- Average daily river flow;
- Daily generation output of the Alliance power plant;
- Average daily water level at the weir;
- Average daily water temperature;
- Moon phase;
- Screen on/off records;
- Water levels at the screen.

6.11 Reporting

By 31 August each year, a suitably qualified and experienced expert will prepare a report summarising the findings and assessing the actual propensity for impingement at the intake screen. The report will include recommendations as to whether the monitoring should continue, or whether it is necessary to design and implement option(s) to mitigate against any identified significant adverse effects of eel entrapment in the hydro race. As a minimum, the report will cover:

- Start and finish date of monitoring;
- Dates of inspection and summary of observations;
- Number, species, size and maturity of eels recorded, as well as injury level;

- Number of by-catch species collected (including trout);
- Fate of the fish collected;
- River flows and other environmental variables, notably water temperature;
- Operation of the hydro-turbines and screens;
- Recommendations for any changes to the monitoring programme and in the operation of the power plant;
- A critical evaluation of the data in order to determine whether mitigation is necessary and appropriate recommendations in this regard.

The monitoring and reporting requirements shall continue for a period of up to five years. During this time, if analysis of the results determines that there is potentially a significant impact, further options for mitigation and/or monitoring will be identified and assessed for suitability. This may include:

- Modifying the screen cleaner by incorporating a series of fish recovery buckets and means of emptying these into the trash chute for safe return to the river;
- Targeted shut down of the turbine during events that potentially result in high eel mortality (most likely floods);
- Close down the turbine during the entire main downstream eel migration period;
- Install an eel activity holding tank (e.g. MIGROMAT® system) that is provided with water from the river, and shut down the turbine every time eel activity increases markedly;
- Subject to obtaining appropriate permits, determine relative proportion of migrant eels entering the turbines on both sides of river by monitoring the passage of up to 30 acoustic tagged migrant eels using an array of acoustic receivers. Alternatively install PIT aerials on both intake canals and at intervals through the autumn release up to 100 tagged migrant eels 1 km or more upstream of the Falls. If 5% or more of the tagged migrants enter the intake on the Alliance side, consider further mitigation actions such as habitat enhancement, behavioural deflection systems such lights along the banks upstream of the intakes, physical barriers such as deflector nets at the canal intake or ultimately, if technically and economically viable, modification of the screen so through-screen velocity is less than 0.5m/s and insertion of an eel passage shield on the bottom of the canal in front of the screen with a bypass to the river. To monitor the efficiency of these measures consider installing PIT monitoring aerials in the canal, bypass and trash collection bay. Release at least 10 PIT tagged migrant eels into the canal and monitor passage progress.

The above proposed mitigation is not intended to be an exhaustive list of options. Details of the preferred mitigation option(s) would be described in Final Downstream Eel Mitigation Plan, which would be prepared following the specified monitoring period.

6.12 Review of monitoring

In consultation with stakeholders and using the report and recommendations of the accredited expert as a base, the monitoring plan shall be reviewed annually.

Based on these discussions the revised monitoring and/or mitigation actions will be drafted in preparation for implementation. Monitoring will only continue if the implemented mitigation is not considered "best practice" or the time frame has been too short to prove its effectiveness.

7 Monitoring summary

A summary of proposed monitoring activities and time line is provided in Table 1 below. As stipulated by Consents, the downstream eel monitoring plan will need to be reviewed at least annually.

Table 1: Mataura Falls - Draft guidelines for monitoring downstream Migrants

Year	Obj. No,	Action	Description/references	Time-line	Related Consents condition
1-5	1.1	• Insert screen with bar gaps of around 20 mm for monitoring purposes. • Modify and operate screen cleaner to maximise survival of impinged eels. • Modify trash collection sluice to retain eels and other fish until content can be inspected. • If necessary, obtain permit from MPI to retain eels for monitoring purposes. • Install a camera over trash bay to remotely observe activities. Camera to also take and store a short video each time the screen begins to operate and take and store still images at no less than hourly intervals so as to observe time of day when impingement occurs. • When shown to be required an operator is to collect and assess fish from the trash chute every morning (more often if trash pile greater than capacity of available storage). Inspection to increase to at least twice per day during elevated flow events. • During the elevated flow events Alliance will invite a representative of Hokonui Runanga to observe the monitoring of the trash screen and chute, and eel collection. • Provided the appropriate permits can be obtained, test the efficiency of monitoring by releasing 10 or more large active tagged migrant shortfin eels of varying size in the intake canal (obtain migrants from eel	Paterson & Boubée 2010	• Monitoring plan approved by 30th Jun 2018. • Permits received by 1st Aug 2018. • Monitoring activities 1st February to 31st May. • Reporting by 31st August. • Revised program completed and ready for implementation by 15th January each year. • Operator trained to do eel inspection and assessment by 15thJanuary each year.	13, 18

		processing plant or fisher and operate under an animal ethics permit and MPI trap and transfer permit). • Record number, species, size, sexual maturity, timing and environmental conditions under which eels are collected. • Record species, size and timing of any other fish collected. • Live and non-seriously injured eels once measured will be assessed according the following behavioural criteria: **Motor capacity** – Is the eel moving and lively? **Response** – Does the eel respond to a pinch stimuli? **Body form** – Does the eel conform to a normal shape? **Buoyancy** – Is the eel in a neutrally buoyant position? • Once assessed as above the operator will place a representative fraction of the eels collected (up to 10 on 3 occasions) and place them in an aerated tank provided with fresh flowing river water. The operator will the observe the retained eels every morning for 5 days. After 5 days he will repeat the behavioural assessment. All heathy and responsive eels will be released to the river, but abnormal eels will be euthanised using an overdose of a registered fish anesthetic and disposed of on land • Fresh eel bodies or fresh seriously injured eels will be offered to Hokonui Runanga on day of collection or frozen for later retrieval. • Fish other than eels will be identified, counted and returned to the river. • Following each annual monitoring campaign carried out, a suitably qualified and experienced expert will prepare a report summarising the findings, assessing the actual propensity for impingement at the intake			

		screen and providing a recommendations as to whether the monitoring should continue, or whether it is necessary to design and implement option(s) to mitigate against any identified significant adverse effects of eel entrapment at the intake screen. As a minimum the report will: ○ Include a summary of all data collected as required under the conditions of Consent and the present or revised Downstream Eel Monitoring Programme; ○ Critically analyse the information collected in accordance with the conditions of Consent, in terms of identifying any potential or actual significant effects on downstream adult eel migration arising as a result of the operation of the hydro scheme; ○ Critically evaluate the data in order to recommend whether further monitoring is required, or alterations/additions to the monitoring programme are required; ○ Critically evaluate the data in order to determine whether mitigation is necessary.			
2	2.1	• In consultation with stakeholders and using the recommendations of a suitably qualified expert as a base, review the monitoring plan. • Implement the revised monitoring and/or mitigation actions.			
3	3.1	• As per year 2 carry out an annual review of monitoring plan and/or mitigation actions. Should potentially significant mortality be recorded consider amongst other options the following:			

		1. Modify the screen cleaner by incorporating a series of fish recovery buckets and means of emptying these into the trash sluice; 2. Shut down the turbine during events that result in high eel mortality (most likely floods). • Continue monitoring of screen trash for at least one year.			
4 &5	4.1 & 5.1	If it is determined that there is potentially a significant impact, the following options could be considered: • Modifying the screen cleaner by incorporating a series of fish recovery buckets and means of emptying these into the trash chute for safe return to the river; • Targeted shut down of the turbine during events that potentially result in high eel mortality (most likely floods); • Close down the turbine during the entire main downstream eel migration period; • Install an eel activity holding tank (e.g. MIGROMAT® system) that is provided with water from the river, and shut down the turbine every time eel activity increases markedly; • Subject to obtaining appropriate permits, determine relative proportion of migrant eels entering the turbines on both sides of river by monitoring the passage of up to 30 acoustic tagged migrant eels using an array of acoustic receivers. Alternatively install PIT aerials on both intake canals and at intervals through the autumn release up to 100 tagged migrant eels 1 km or more upstream of the Falls. If 5% or more of the tagged migrants enter the intake on the Alliance side, consider further mitigation actions such as habitat enhancement, behavioural deflection systems such lights along the banks upstream of the intakes, physical			

		barriers such as deflector nets at the canal intake or ultimately, if technically and economically viable, modification of the screen so through-screen velocity is less than 0.5m/s and insertion of an eel passage shield on the bottom of the canal in front of the screen with a bypass to the river. To monitor the efficiency of these measures consider installing PIT monitoring aerials in the canal, bypass and trash collection bay. Release at least 10 PIT tagged migrant eels into the canal and monitor passage progress.			
6	6.1	Implement mitigation in consultation with stakeholders. Only continue monitoring if installed mitigation is not considered "best practice" or until shown to be effective.			24,25 and 26

8 Acknowledgements

We wish to thank the Mataura historical society notably David Luoni for sharing information on the Mataura Falls and giving permission to reproduce some of the photographs used in this report.

9 Disclaimer

This report has been prepared for consultation purposes and as a reference document and as such does not constitute the policy of any specific organisation or institution.

The author requests that if excerpts or inferences are drawn from this document for further use by individuals or organisations, due care should be taken to ensure that the appropriate context has been preserved and is accurately reflected and referenced in any subsequent spoken or written communication.

While the author has exercised all reasonable skill and care in controlling the contents of this report, the author and their employer accepts no liability in contract, tort or otherwise, for any loss, damage, injury or expense (whether direct, indirect or consequential) arising out of the provision of this information or its use by you or any other party.

10 References

Achord, S.; Zabel, R.W.; Sandford, B.J. (2007). Migration timing, growth, and estimates parr-to-smolt survival rates of wild Snake River spring-summer Chinook salmon from the Salmon River basin, Idaho, to the lower Snake River. *Transaction of the American Fisheries Society 136*: 142–154

Adam, B.; Schwevers, D.U. (1997). Behavioural surveys of eels (Anguilla anguilla) migrating downstream under laboratory conditions. Report of the Institute of Applied Ecology, Neustadter Weg 25, 36320 Kirtof-Wahlen, Germany. 71 p.

Adam, B.; Schwevers, U.; Dumont, U. (1997). Beiträge zum Schutz abwandernder Fische – Verhaltens-beobachtungen in einem Modellgerinne. Bibliotek Natur & Wissenschaft Band 16. Verlag Natur & Wissenschaft, Solingen, Germany.

Adam, B.; Bruijs, M.C.M. (2006) General requirements of fish protection and downstream migration facilities. Investigations on the river Meuse systems. In: Free Passage for Aquatic Fauna in Rivers and Other Water Bodies. Proceedings of the International DWA Symposium on Water Resources Management. April 3-7, Berlin, Germany.

Aldridge, B.; Paterson, C.; Baker, C.; Wadwha, S. (2009). Eel Migration past the Huntly Power Station, 2009. NIWA Client Report HAM2009-167. 56 pp.

Benstead, J.P.; March, J.G.; Pringle, C.M.; Scatena, F.N. (1999). Effects of a low-head dam and water abstraction on migratory tropical stream biota. *Ecological Applications 9*: 656–668.

Boubée, J AT (2001). Downstream migrant eel study at Wairere Power Station. NIWA Client Report KCE2205.

Boubée, J.; Mitchell, C.P.; Chisnall, B.L.; West, D.W.; Bowman, E.; Haro, A. (2001). Factors regulating the downstream migration of mature eels (*Anguilla spp.*) at Aniwhenua Dam, Bay of Plenty, New Zealand. *New Zealand Journal of Marine and Freshwater Research 35*: 121–134.

Boubée, J.; Williams, E. (2005). A review of techniques used to facilitate the upstream and downstream passage of eels at hydro dams in New Zealand. *NIWA Client Report HAM2005-088*. 47 p

Boubée, J.; Bowman E.; Davison, B; Brunton, E. (2007). Tracking longfinned migrant eels in lakes Te Anau & Manapouri – Interim report to June 2007. NIWA Client Report: HAM2007-178. 25 p.

Bruijs, M.C.M.; Polman, H.J.G.; van Aerseen, G.H.F.M.; Hadderingh, R.H.; Winter, H.V.; Deerenberg, C.; Jansen, H.M.; Schwevers, U.; Adam, B.; Dumont, U.; Kessels, N. (2003). Management of silver eel: Human impact on downstream migrating eel in the river Mease. *EU Report Contract Q5RS-2000-31141.*

Burnett, A.M.R. (1969). Migrating eels in a Canterbury river, New Zealand. *New Zealand Journal of Marine and Freshwater Research 3:* 230–244.

Duirs, R. (2017). Native Fish Migration through Land Drainage and Flood Control Infrastructure. An Assessment of Effects and Review of Management Methods. Bloxam Burnett &, Oliver Ltd, Hamilton Report No. 140640-09. 80pp + Appendices.

Golder (2007). Assessment of hydro-electric diversion effects on fish passage. Report to Alliance Group Limited by Golder Associates (NZ) Ltd. 13 pp.

Golder (2016). Mataura River – Ecological Summary and Assessment. Report to Alliance Group Limited by Golder Associates (NZ) Ltd. 15 pp + Appendix

Hadderingh, R.H.; Van Aerssen, G.H.F.M.; De Beijer, R.F.L.J.; Van der Velde, G. (1999). Reaction of eels to artificial light sources and water currents: an experimental deflection study. *Regulated Rivers: Research and Management 15*: 365–371.

Haro, A.; Castro-Santos, T; Boubée, J. (1999). Behaviour and passage of silver-phase American eels at a small hydroelectric facility. Paper presented to the 1999 meeting of the EIFAC/ICES WG on Eels.

Haro, A.; Castro-Santos, T.; Whalen, K.; Wippelhauser, G.; McLaughlin, L. (2003). Simulated Effects of Hydroelectric Project Regulation on Mortality of American Eels. *In*: Dixon, D.A. (ed.) Biology, Management and Protection of Catadromous Eels. American Fisheries Society, Symposium 33, Bethesda, Maryland.

Kleinschmidt Associates (2001). New York Power Authority, ST. Lawrence-FDR Power Project (FERC No. 2000): 2000 Survey of American Eel in the Tailwater of the International St. Lawrence Power Project. Draft Final Report, June 2001. White Plains, New York.

Larinier, M.; Travade, F. (2002). Downstream migration: problems and facilities. *Bulletin Français de la Pêche et de la Pisciculture 364*: 181–207.

Larsson, P.; Hamrin, S.; Okla, L. (1990). Fat content as a factor inducing migratory behaviour in the eel (*Anguilla anguilla* L.) to the Sargasso Sea. *Naturwiss 77*: 488–490.

Lowe, R.H. (1952). The influence of light and other factors on the seaward migration of the silver eel (*Anguilla anguilla* L.). *Journal of Animal Ecology 21*: 275–309.

Mitchell Daysh (2016). Mataura plant – hydro electric generation plant. Alliance Group Limited Resource Consent Applications and Assessment of Environmental Effects.35 pp plus Appendices.

Moriarty, C. (1978). Eels – an natural and unnatural history. David and Charles, Newton Abbot, United Kingdom.

Paterson, C.; Boubée, J. (2010). Best Practice Guidelines for the Passage of Fish at Hydroelectric Dams in New Zealand. Part2 – Downstream Migrants. NIWA Client Report: HAM2010-089. 42pp.

PDP (2017). Fish screening requirements for hydroelectric intake channel. Report to Alliance Group Limited by Pattle Delamore Partners Ltd. 14pp + Appendices

Richkus, W.A.; Dixon, D.A. (2003). Review of Research and Technologies on Passage and Protection of Downstream Migrating Catadromous Eels at Hydroelectric Facilities. In: Dixon, D. (ed.) Biology, Management and Protection of Catadromous Eels. American Fisheries Society, Symposium 33, Bethesda, Maryland.

Smith, R.J.F. (1985). The control of fish migration. *Springer-Verlag, Berline Heidelberg. 243* p.

Stevenson, C. (2008). Tracking longfin migrant eels in Lakes Te Anau and Manapouri 2008. NIWA Client Report HAM2009-060. 61 p.

Thon, M .1999. Protection of Migrating Silver Eels (*Anguilla anguilla*) in Regulated Rivers. RWE Energie AG: Rheinland-Pfalz, Germany.

Thorpe, J.E.; Ross, L.G.; Struthers, G.; Watts, W. (1981). Tracking Atlantic salmon smolts (*Salmo salar L.*) through Loch Voil, Scotland. *Journal of Fish Biology 19*: 519–537.

Todd, P.R. (1981a). Morphometric changes, gonad histology and fecundity estimates in migrating New Zealand freshwater eels (*Anguilla spp.*). *New Zealand Journal of Marine and Freshwater Research 15:*155–170.

Todd, P.R. (1981b). The timing and periodicity of migrating New Zealand freshwater eels (Anguilla spp.). *New Zealand Journal of Marine and Freshwater Research 15*: 225–235.

Vøllestad, L.A.; Jonsson, B.; Hvidsten, N.A.; Næsje, T.F.; Haraldstad, Ø.; Ruud-Hansen, J. (1986). Environmental factors regulating the seaward migration of European silver eels (*Anguilla anguilla*). *Canadian Journal of Fisheries and Aquatic Sciences 43*: 1909–1916.

Note from ES reporting officer:

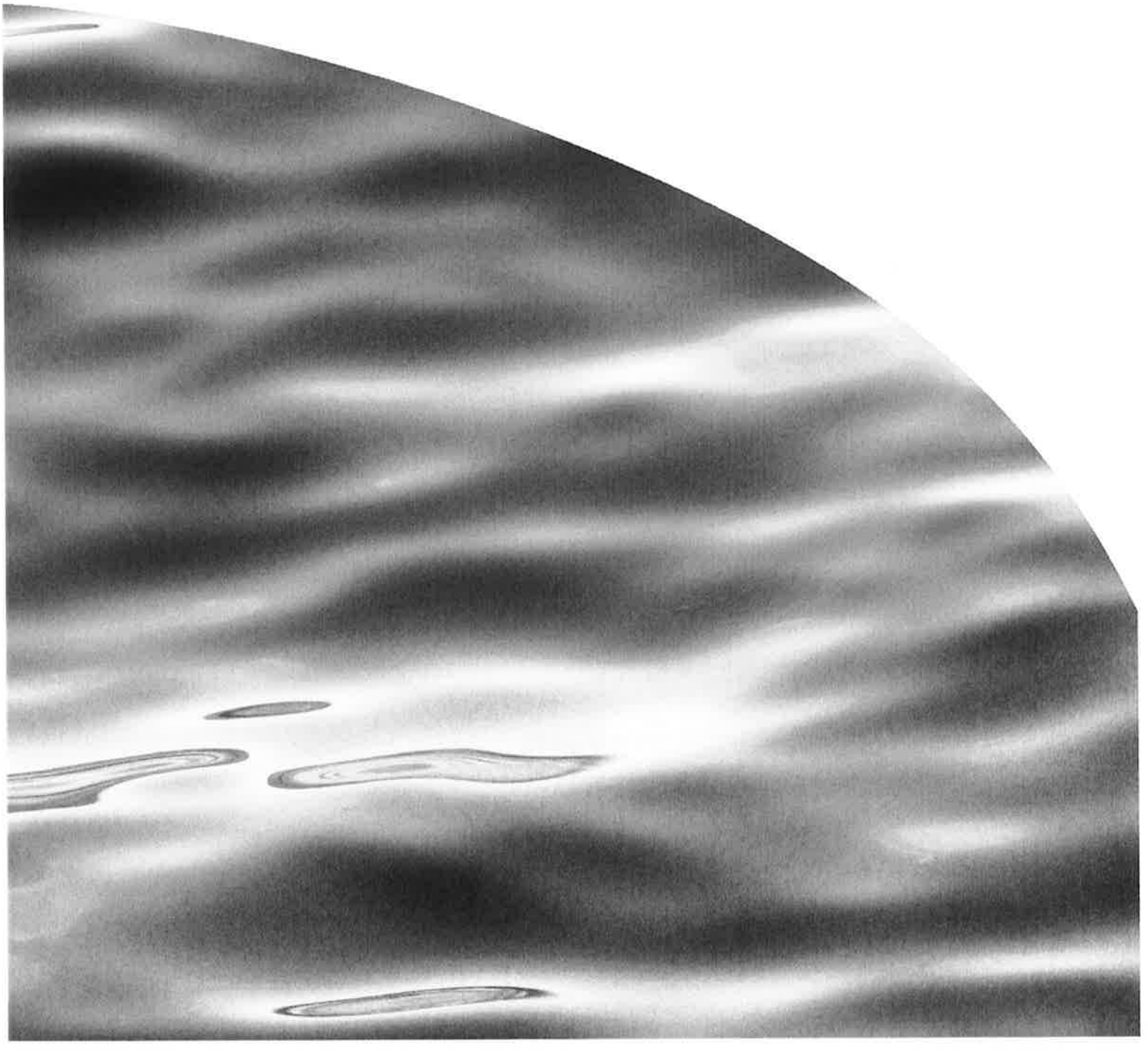
The draft conditions that were attached to the management/monitoring plans developed after the first pre-hearing meeting have been removed from the appendices to the hearing report. The draft conditions were proposed by the applicant as part of negotiations to resolve the application, but were not agreed by the parties to the application.

Report Commissioned by Submitters

CAWTHRON
The power of science®

REPORT NO. 3171

REVIEW OF FISH SCREENING MONITORING PROVISIONS AT MATAURA MEATWORKS HYDRO INTAKE



REVIEW OF FISH SCREENING MONITORING PROVISIONS AT MATAURA MEATWORKS HYDRO INTAKE

JOE HAY

Prepared for Department of Conservation, Ngāi Tahu, and Fish & Game New Zealand

CAWTHRON INSTITUTE
98 Halifax Street East, Nelson 7010 | Private Bag 2, Nelson 7042 | New Zealand
Ph. +64 3 548 2319 | Fax. +64 3 546 9464
www.cawthron.org.nz

REVIEWED BY:
Robin Holmes

APPROVED FOR RELEASE BY:
Roger Young

ISSUE DATE: 14 May 2018

RECOMMENDED CITATION: Hay J 2018. Review of fish screening provisions at Mataura meatworks hydro intake. Prepared for Department of Conservation, Ngāi Tahu and Fish & Game New Zealand. Cawthron Report No. 3171. 17 p.

1. INTRODUCTION

This report provides advice on the likely efficacy of fish screening, mitigation measures and monitoring proposed for the Alliance Group Ltd. hydro intake from the Mataura River, as part of re-consenting conditions. Primarily, I focus on answering questions raised in an e-mail from Herb Familton (Department of Conservation, Christchurch) dated 4:00 p.m. 23 February 2018 (see Section 2). I recognise that these questions were raised on behalf of Fish & Game NZ and Ngāi Tahu, as well as the Department of Conservation, so my advice is intended to cover the interests of all these groups.

After receiving my initial advice on these questions Herb Familton raised several additional questions in subsequent e-mails (dated 16 April 2018 1:55 p.m. and 18 April 2018 9:10 a.m.). I address these questions later in this report (Section 3).

2. INITIAL QUESTIONS

In the paragraphs below I attempt to answer each of the questions raised in the original e-mail regarding the fish screening monitoring and mitigation measures proposed.

Q1. How effective are the proposed 'monitoring' amendments to the bar spacings on the trash screen likely to be for excluding:

a. *adult fish species, including native and sports fish species, present in the Mataura River or seasonally migrating past the intake; and*
b. *juvenile fish species, including native and sports fish species, present in the Mataura River or seasonally migrating past?*
c. *In addition, what degree of fish mortality could be expected to occur as a result of the proposed screening and methodology for removing impinged fish?*

As pointed out in the e-mail, in addition to bar spacing to physically exclude fish the approach velocity is also an important consideration for fish screening efficacy. Ideally, the approach velocity should be slow enough to allow fish to swim away rather than being entrained through or impinged on the screen face.

I recognise that the proposed changes to the existing trash screen (Figure 1) at this stage are intended to assist with monitoring the number of large migrant eels diverted into the intake, rather than to convert it into a functional fish screen. However, principles of good fish screen design are relevant to the question of how effective the proposed screen is likely to be at excluding fish. Jamieson et al. (2007) provide New

Zealand good practice guidelines for fish screening at water intakes up to 10 m^3/s (i.e. the size of Alliance's abstraction from the Mataura). Key considerations include:

- location of screen, to minimise exposure of fish to the screen
- water velocity through the screen (approach velocity) that is slow enough to allow fish to escape entrainment or impingement and sweep velocity across or past the screen sufficient to promptly sweep fish past the intake
- provision of a bypass designed to return fish safely to the source channel
- screening material with openings small enough to exclude fish and smooth enough to avoid damage to fish.

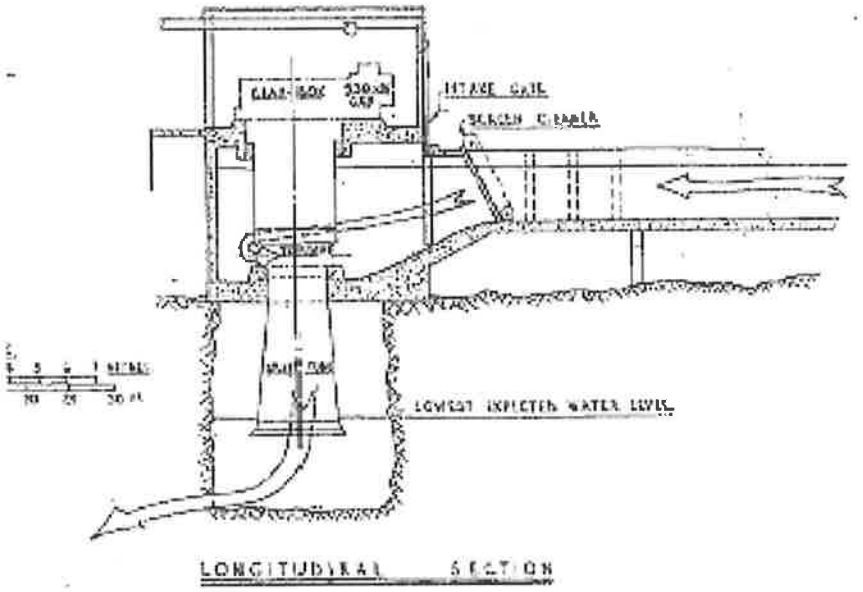


Figure 1. Diagram of tail race (right) leading to screen, then turbine and exit point. The existing trash screen (slanted feature labelled 'screen cleaner') has vertical bars spaced at 60 mm intervals across its width. From the Alliance Group Ltd resource consent application (Mitchell Daysh 2016).

2.1. Entrainment

First, it is necessary to consider what fish species are likely to reside in or pass through the vicinity of the intake and their probability of entering the intake canal.

The fish community near the intake upstream of Mataura Falls includes eels, brown trout, and possibly lamprey and common and/or upland bullies (Golder 2007; Hay 2010). In addition to these species, juvenile koaro are likely to migrate past the intake site (downstream as tiny larvae and upstream as post-whitebait juveniles). As well as residing near the intake, eels will migrate upstream past the intake as small elvers and downstream past the intake as large adults. Conversely, lamprey migrate downstream

as small juveniles and upstream as large adults. It is unlikely that trout migrate upstream past the Mataura Falls (given the height of the falls), though it is possible that some small juvenile fish and occasionally larger trout disperse downstream past the falls. In addition, to these large-scale seasonal migrations, some fish will also move around within catchments throughout the year. Some of these are likely to enter the intake from time to time.

A common assumption in the absence of any other information is that the number of fish entrained into an unscreened water take is directly proportional to amount of flow diverted to the take. On this basis we could expect that under median to low flow conditions between 18% and 53% of fish passing by would enter the intake[1], diminishing with higher river flow. However, while this assumption of direct proportionality to flow may be reasonable for downstream migrants, it is less likely to hold for upstream migrants (actively moving against the current) and probably also for river resident fish, unless they have elected to move downstream close to the point of take for some reason. Consequently, these estimates may represent a worst-case scenario. On the other hand, given the relatively shallow depth of flow over the weir compared with the depth of the intake channel, the proportion of fish diverted may actually be higher if they are following the deeper channel. Thus, the issue of what proportion of fish passing by are actually diverted into the intake remains an unknown, which would be worthwhile addressing through the proposed monitoring programme (as I will discuss later).

Most of the fish likely to encounter the intake are relatively short (i.e. < 100–200 mm), at least in the life phases likely to be entrained into the intake (e.g. downstream seasonal migrants). Consequently, they would be expected to have relatively high survival rates if they are entrained through the intake and pass through the Francis turbine (e.g. < 26% mortality for fish under 200 mm long, see table 3 of Golder 2016). So, in the absence of a fish screen, under the worst-case scenario (described above) of around 53% of fish moving downstream being entrained through the turbine, we would expect less than 14% (i.e. 26% of 53%) loss of all small fish (< 200 mm) moving past the intake, and this loss rate would decline with decreasing fish size (e.g. < 7% for 100 mm fish). However, for fish longer than about 300 mm, such as eels and large trout, the expected turbine passage mortality rates are substantially higher, up to 97% for large eels. Hence, large eels are justifiably the main focus for the applicant's proposed screening, monitoring and mitigation. However, this focus could arguably be extended to include large trout, especially given the outstanding fisheries and angling amenity of the Mataura River recognised in the Mataura Water Conservation Order 1997.

[1] Assuming a 10 m^3/s abstraction, and a median flow of 55.7 m^3/s and the 7-day mean annual low flow 18.9 m^3/s as stated in Boubée (2018b).

In addition to direct mortality from turbine passage discussed above, there may be additional mortality through predation below the outfall. Predatory fish and birds are known to lurk below turbine outlets to take advantage of injured fish or those disorientated by the high velocity and turbulence of turbine passage (Larinier & Travade 2002; Johnson et al. 2003).

2.2. Approach velocity

On the basis of existing information I consider that large trout may be able successfully swim upstream from the vicinity of the trash screen, out of the intake channel and back to the mainstem. However, I think is reasonable to assume that most fish (including native fish and smaller trout) that encounter the trash screen would have great difficulty in returning upstream. Since there is not a fish bypass to return screened fish to the river's mainstem, most of these fish are likely to either pass through the screen and turbine or become impinged on the screen face.

According to Boubée (2018b) the intake channel is approximately 2 m deep by 7 m wide at the entrance, narrowing to 4 m wide toward the trash screen. For a 10 m^3/s abstraction this would translate to an average water velocity of approximately 0.7 m/s at the entrance to the channel, increasing to approximately 1.25 m/s in the narrower channel section.

On the basis of formulae presented by Larinier (2002), these water velocities are within the cruising speed of large salmonids (e.g. maximum cruising speed of salmonids over 0.47 m long is greater than 1.25 m/s), while smaller salmonids would be able to burst swim at these velocities for a few seconds to a few tens of seconds (depending on fish length). Therefore, while large trout ought to be able to make headway back up the intake channel and back to the river, smaller trout probably cannot unless they react quickly before moving far down the channel.

Trout are relatively strong swimmers compared with most New Zealand native fish species, with eels in particular being considered relatively weak swimmers. As with small trout, native fish entering the intake channel are unlikely to swim back out of it, unless they react quickly before moving far down the channel. These water velocities are well in excess of the sustained swimming speeds of small native fish (c. 0.3 m/s Mitchell 1989), though they may be able to burst swim against the current for a few seconds. A water velocity of 0.7 m/s is close to the critical swimming speed[2] for mature migrant shortfin eels in the order of 750 mm long (Tudorache et al. 2015) and

[2] i.e. the water velocity at which test fish refused to swim and were flushed against the downstream grid of the test tunnel (remaining there for at least 20 seconds), in a test where water velocity was increased in increments of 0.1 m/s at intervals of 20 minutes.

a burst swimming formula for eels presented by Boubée et al. (1999) suggests that even 1 m long eels would be able to burst swim at 1.25 m/s for less than 10 seconds.

The intake channel is 270 m long and fish entrained into the channel while intentionally moving downstream may not turn around and attempt to move back upstream until they encounter the screen. This is likely to be the case with downstream migrating eels, if they are moving downstream semi-passively and reacting to obstacles only when these are encountered as discussed by Boubée (2018b). However, it is possible that at certain flows some fish may be able to swim over the weir to escape the intake channel, as Boubée (2018b) states that at a river flow of 108 m^3/s, approximately 75% of the length of the hydro race and associated structure overtops.

Water velocity near the bed and walls of the channel will be lower than the mean column velocity values calculated above, so it is feasible that weaker swimmers may still be able to swim upstream using these velocity refuges. However, in the absence of evidence of this from the site the discussion above provides a conservative assessment of fish swimming ability relative to water velocities expected in the intake channel.

2.3. Bar spacing

The proposed reduction in screen bar spacing can be expected to exclude large migrant eels (> 700 mm), including most migrant females, as well as trout greater than about 200 mm long. Smaller fish are still likely to be able to pass through the screen.

The most recent information from the applicant (Boubée 2018b) suggests the screen bar spacing will be reduced to about 20 mm (from 60 mm). Head width is indicative of the screen bar spacing required to exclude eels of a certain sizes because this is the broadest bony structure in their bodies, although eels are capable of squeezing through apertures slightly narrower than their head width (DWA 2005). As discussed by Boubée (2018b), a 20-mm screen is likely to exclude the majority of out-migrating mature female eels, though smaller adult males and younger river-resident eels of both sexes would still be able to pass through a 20-mm screen. Even eels up to about 700 mm long may pass through a 20-mm screen (DWA 2005; Boubée 2018b). Fish of this length would have high turbine passage mortality rates (e.g. up to 85%, see table 3 of Golder 2016).

The majority of other native fish species likely to encounter the screen would probably also be able to pass through a 20-mm bar spacing.

With respect to trout, DWA (2005) suggest that the maximum fish screen bar spacing to exclude trout should be 10% of the fish's length (i.e. a 20-mm bar spacing would be

expected to exclude trout > 200 mm long), though this obviously depends on body condition. Shorter trout (< 200 mm long) would be able to pass through the screen, but we would expect that fewer than 26% of these trout would be killed passing through turbines (see table 3 of Golder 2016).

Some fish that would theoretically be able to pass through the screen may still become impinged on it, depending on their orientation to flow when they encounter the screen. Reducing bar spacing will increase water velocity through the screen (as discussed by Boubée 2018b[3]), by reducing the effective cross-sectional area conveying flow (due to the cumulative thickness of the screen bars), thereby exacerbating the problem of entrainment or impingement. Any debris build-up on the screen will also increase through-screen water velocity by the same mechanism, so it is important to ensure that the screen is maintained free from obstructions.

In a standard fish screen design the approach velocity (and through-screen velocity) can be reduced by increasing the screen face area, usually by angling the screen to the river flow. This also produces a sweep velocity component, to carry fish past the face of the screen downstream beyond the intake or into a fish bypass. At the Alliance trash screen there is no fish bypass and I understand that under normal operating conditions there is no sweep velocity component (i.e. all flow in the intake channel at the screen face goes through the screen).

2.4. Impingement and holding mortality

The screen is cleaned by a traveling rake bar, drawn up the face of the screen by a chain-drive mechanism. The latest proposal is to use the existing trash rake to remove impinged eels and other fish and modify the existing trash sluice to retain these fish for later (daily) inspection and potential transfer downstream. This would be undertaken during the expected downstream eel migration season (between 1 February to the end of May).

Rates of injury and mortality due to this operation can only be speculated at this stage. However, for large eels, mortality rates in the proposed monitoring programme are likely to be less than mortality rates from turbine passage. Mortality rates are likely to increase with the length of time fish remain impinged on the screen and how long they are held in the modified sluice. Eels can be expected to survive in the sluice for quite some time, provided they are kept cool and moist (e.g. through mist spraying and provision of shade), and avoid mechanical damage from the screen cleaner or debris deposited into the sluice. However, trout and most other fish are likely to experience high rates of mortality unless they are rapidly removed into a cool, aerated, holding tank.

[3] The proposed 20 mm bar spacing is expected to increase through-screen velocity from an estimated 1.4 m/s to 1.8m/s at high flows (Boubée 2018b).

Boubée (2018b) suggested that it may be possible to make the rake bar more eel-friendly by widening the rake blade and providing a backing plate and sides to produce a bucket that could safely hold the impinged eels as they are transported up the screen (see the caption of his figure 3-6). I agree that these modifications are likely to reduce injury and mortality rates. In addition, it may be possible to angle the rake teeth and backing plate in such a way that eels (and other fish) are carried by the rake away from the screen face, to reduce the probability for grinding injury as they are carried up the face of the screen.

2.5. Study design

Q2. Does the proposed monitoring programme represent 'good practice' to determine the adverse effects of the diversion and hydro-turbine on:

a. *adult fish species, including native and sports fish species, present in the Mataura River or seasonally migrating past; and*
b. *juvenile fish species, including native and sports fish species, present in the Mataura River or seasonally migrating past.*

If not:

a. *Why not; and*
b. *What monitoring (including methodology, timing, frequency, duration, seasonality, flows etc) would you recommend to determine the adverse effects of the diversion and hydro-turbine on downstream fish passage; and*
c. *What species of fish and age classes would you recommend monitoring to determine the effects of the diversion and hydro-turbine on downstream fish passage.*

I consider that the proposal is a reasonable study design, given the environmental and logistic constraints, but could still be improved with additional sampling effort. No environmental monitoring programme is perfect. There are inevitably flaws due to logistical and environmental constraints. The Mataura River in the vicinity of the intake is a reasonably large river, which contributes to difficulty in monitoring. In addition, fish populations and fish behaviour are notoriously variable over time. The proposed monitoring programme is likely to provide useful information on the numbers and condition of large migrant eels (and other large fish, e.g. trout) currently being entrained through the turbines over the February to May eel migration period. Since the fish will be captured and can be weighed and measured, the proposed study design will provide additional information relative to a passive observational study (e.g. observation using DIDSON acoustic camera, discussed further below). In these regards I consider that the proposal is a good study design.

However, as discussed above, the sampling method will be biased towards larger fish; it is likely to miss smaller eels and other fish, which will continue to pass through the screen and turbine. Since smaller migrant and river-resident eels will still be able to

pass through the 20-mm screen undetected, the proposed monitoring will underestimate the potential impact on eel populations. It will also not provide information on numbers of fish being entrained at other times of year, nor on the fate of fish that do pass through the turbine.

Reducing the screen bar gap further would help to reduce the size selection bias of the proposed monitoring programme, but would come at the cost of increased through-screen velocity. This is likely to increase impingement injury and mortality rates. It could also result in the capture (with associated injury and mortality risk) of small fish that would otherwise have had relatively high probability of surviving turbine passage.

Extending the existing monitoring programme to periods of a few weeks at other times of year (e.g. stratified by season) may provide some additional information on fish entrainment, notwithstanding the fish size bias discussed above.

I consider that the tagging study suggested by Boubée (2018b) (using PIT[4] or acoustic tags) would also be useful to help clarify the proportion of downstream migrating eels likely to be entrained into the intake. As discussed above, this proportion is currently unknown, but is commonly assumed to be directly proportional to the amount of flow diverted. However, since it may change with the proportion of flow diverted it would be worthwhile targeting environmental conditions when peaks in downstream migration are known to occur in the Mataura. This may be why Boubée (2018b) suggests this work along with mitigation options to follow initial monitoring of eel entrainment at the adapted trash screen.

This type of PIT tagging study could also be extended to include trout resident in the reach immediately upstream of the intake. But since they are not likely to be migrating downstream in large numbers at particular times of year, detection rates are likely to be fairly low.

Ideally, it would be useful to monitor the fate of fish passing through the turbine, perhaps by netting below the discharge point, in order to confirm turbine mortality predictions. However, sampling in the vicinity of the discharge point is likely to be very difficult to achieve due to high water velocities and turbulence.

Cawthron previously proposed to Alliance Group Ltd to use a DIDSON[5] acoustic camera to monitor fish movements into the intake channel and/or at the trash screen. This approach would have the advantage over the proposed monitoring programme of giving insights into fish behaviour in the intake, and perhaps whether they are able to move back upstream away from the screen. However, it would not provide the

[4] passive integrated transponder
[5] Dual-Frequency Identification Sonar

definitive identification of species and size and weight data that the proposed monitoring programme will allow. Deployment of the DIDSON would also likely be restricted to relatively short periods (e.g. a few days), so would not give the same temporal coverage as the proposed trash screen monitoring approach. In addition, DIDSON monitoring may also miss some small fish (depending on the set up) and in the absence of the proposed 20-mm bar screen this monitoring approach would not reduce mortality rates due to turbine passage. Nonetheless, I consider that the DIDSON monitoring may still be worthwhile to augment data from the proposed monitoring programme.

Each of these monitoring approaches has the potential to provide useful information on different facets of fish entrainment and turbine passage at the Alliance hydro plant. Employing a range of these approaches would help produce a more complete understanding of the issue and how it can best be mitigated.

Other alterations to the proposed monitoring design could also be considered to improve animal welfare. For example:

- reducing the period that fish are held impinged on the screen by running the cleaning rake bar more frequently,
- making the cleaning rake bar and the modified sluice more fish-friendly (as discussed above),

thereby reducing the period that fish are held in the modified sluice (installing a video camera to allow remote monitoring of the sluice collection area, as suggested by Boubée (2018b), could facilitate this).

2.6. Upstream elver passage

The focus of the questions was on downstream fish passage and fish screening. However, an interest in the proposed upstream passage mitigation measures was expressed. As discussed, I consider the proposed trap and transfer program[6] to be a good approach to improve eel elver passage upstream over the Mataura Falls. This program may even increase rates of elver passage success beyond natural rates, given the difficult climbing conditions at Mataura Falls. I agree with Richard Allibone (Golder 2007) that rounding off the hard edge at the weir crest is likely to make passage easier for elvers attempting to climb the falls and weir. However, this is probably not a pressing issue, given the proposed trap and transfer program will likely move large numbers of elvers past the falls and weir.

[6] most recently described in Boubée 2018a

3. ADDITIONAL QUESTIONS

Q1. Fish Handling – Can you outline the sorts of qualifications and experience needed for a suitably qualified fish handler?

Since the purpose of the proposed fish screen operation is to gather data as part of a monitoring programme, the personnel involved should have previous experience or training in humanely handling and measuring fish for scientific studies. This should include safely anesthetising fish, since eels in particular can be very difficult to measure accurately without anaesthetic. It should also include knowledge of requirements to minimise stress to the fish, for example by minimising handling time, avoiding contact with dry hands and equipment, minimising exposure to high temperatures and low dissolved oxygen conditions, and gently releasing fish back to the river rather than dropping or throwing them in.

Q2. Stratified sampling proposed. Can you provide some more detail here on how this could be done in terms of seasonality/timing and flow?

As stated above (Section 2.5), extending the existing monitoring programme to periods of a few weeks at other times of year (e.g. stratified by season) may provide some additional information on fish entrainment.

In terms of seasonality, the proposed February to May monitoring period focuses on summer and autumn. Additional sampling periods focusing on winter and spring may be worthwhile. However, since large fish (trout and eels of the size likely to be caught by the screen) are not likely to be migrating downstream in large numbers during these times of year, detection rates are likely to be fairly low. Consequently, if additional sampling periods are to be considered during these seasons they would probably need to be several weeks long (e.g. at least 3 to 4 weeks) in order to have a reasonable chance of detecting fish. The likely duration required could be informed by catch rates of trout and non-migrating eels during the February to May monitoring period.

This sampling duration would hopefully also ensure that the sampling periods cover a range of flow conditions, since fish movement can be associated with changes in flow (e.g. high flow events) (Hay & Kitson 2013). Alternatively, the monitoring period could be extended to ensure it covered a range of flows. However, if the number of fish diverted into the scheme is assumed to be directly proportional to flow, then the main focus of monitoring ought to be on relatively low flows (e.g. less than mean flow). Once river flows exceed 100 m^3/s, diversion of 10 m^3/s would be expected to result in less than 10% of migrating fish being entrained into the scheme.

Q3. Can you comment on any potential bias by the lack of monitoring outside the proposed February to May period ?

As I stated above, the proposed monitoring design focusing on February to May will not provide information on numbers of fish being entrained at other times of year, nor on the fate of fish that do pass through the turbine. This sampling period should cover most of the eel out-migration period. Generic fish migration calendars (e.g. figure D-3 in Franklin et al. 2018[7]) tend to suggest that eel out-migration may extend into June. However, this timing is likely to vary between locations and presumably the fishery experts consulted by the applicant have taken local knowledge into account when developing the proposing monitoring design.

Since the proposed monitoring design will target only large fish (trout and eels of the size likely to be caught by the screen; see Section 2.3) detection rates are likely to be fairly low outside the late summer to autumn, since these fish are not likely to be migrating downstream in large numbers at other times of year.

Q4. Can you discuss the usefulness of the proposed approach of tagging various-sized trout as discussed in page 21 of Boubee's report? What benefits would that provide?

I can see no mention of tagging various-sized trout in either of Boubée's reports (i.e. Boubée 2018a, 2018b).

I suggested in Section 2.5 that a PIT tagging (or acoustic tagging) study of the type suggested for migrant eels by Boubée (2018b) could be extended to include trout resident in the reach immediately upstream of the intake. This could provide some additional information on whether/when trout might be entering the intake channel. It could also indicate if trout that enter the intake channel subsequently return upstream, rather than passing on downstream through the screen and turbine.

However, since trout are not likely to be migrating downstream in large numbers at particular times of year, detection rates are likely to be fairly low. In addition, there are logistical constraints on the size of fish that this type of tagging study can be used for. The detection radius of PIT tags is proportional to tag size. For example, a standard 20-mm PIT tag is likely to have a maximum detection range of about 1 m. Because the intake channel is 2 m deep, pass-through areal arrays setup to detect tags will only effectively monitor part of the channel. Trout need to be longer than 80 mm to accommodate 20 mm tags. Larger tags are available with greater detection range, but would be suitable only for larger fish.

[7] https://www.niwa.co.nz/static/web/freshwater-and-estuaries/NZ-FishPassageGuidelines-upto4m-NIWA-DOC-NZFPAG.pdf

Q5. Consider any benefits a camera recording over the screen and scraper.

As I stated in Section 2.5, installing a video camera to allow remote monitoring of the sluice collection area could reduce the period that fish are held in the modified sluice, by allowing more rapid response from monitoring staff. In addition, a camera recording over the screen and scraper may help identify the mechanism of any injury to fish caught by the screen, which could be used to design improvements. Depending on lighting and water clarity conditions a camera may also give insights into fish behaviour in front of the screen, which could also be useful for designing improvements. At night or under turbid conditions the DIDSON acoustic camera (discussed in Section 2.5) would be better suited to the latter task than a normal video camera.

Q6. Consider the usefulness of extending the data gathering to species beyond eels (as outlined in page 19 of the Boubee's report).

I consider that it is sensible to extend data gathering to include information on all species caught by the screen. However, as discussed above, this monitoring protocol is expected to be size biased. Consequently, it is likely that large trout and eels will be the only species caught.

As I discussed in Section 2.4, most fish other than eels are likely to experience high rates of mortality unless they are rapidly removed from the sluice into a cool, aerated, holding tank. Consequently, they should be easy to process (weight and measure) under the proposed monitoring regime. Data on the rate of capture of other species over the proposed monitoring period (February to May) will provide a useful indication of the length of sampling period likely to be required to gather meaningful data at other seasons, if seasonally stratified sampling is to be considered.

7. Would rounding off the hard edge at the weir crest to improve elver passage also improve the passage of Kanakana (lamprey) over the falls (they are not part of the trap and transfer program).

Yes, it may. Kanakana climb obstacles by sticking on to the substrate with their suction-cup-like mouths, then whipping their bodies and releasing their grip to flick themselves higher up and suck on again. Their mouths are not able to form a suction seal as well around sharp corners, so they can be dislodged by hard angles in the substrate.

8. The discharge from the turbine (and also the bypass before the trash screen) is on to rocks associated with the Mataura Falls. While smaller fish may be able to pass through the turbine there is concern regarding what happens when the fish are discharged out the other side onto rocks. Can you consider the benefits of a camera at strategic points after the turbine and when the discharge enters the rocks/river.

As mentioned in Section 2.1, passage through a hydro scheme will result in some fish injury and mortality, either directly (e.g. through mechanical damage[8]) or indirectly (e.g. through increased predation risk). If the outflow discharge is dropping onto rocks[9] both direct and indirect injury and mortality rates may increase. A video camera may help detect fish impacting on the rocks at the outfall under low discharge conditions. However, given the large volume of water discharged (up to 10 m^3/s) I do not think that a normal video camera would be much use for detecting injury or mortality at the discharge point at higher discharge rates because turbulent water is likely to obscure most of the area of interest.

Intuitively, injury risk would be greatest under low flow conditions for two reasons. First, protruding rocks are more likely to be covered by elevated water levels at higher flows, also reducing the height of fall. Injury risk increases with velocity, which increases with fall height up to a maximum (DWA 2005; Johnson et al. 2003). Second, with larger discharge rates from the turbine the fish are more likely to be carried within the water column and be cushioned from impacting any rocks or other obstacles.

An underwater video camera a short distance downstream of the outfall may provide more useful footage for assessing injury/mortality, if light and water clarity conditions allowed. Observations of fish behaviour below the outfall may indicate whether fish are injured, disoriented (e.g., irregular swimming behaviour) and/or being predated.

If water clarity and lighting are not suitable for a normal video camera, the DIDSON acoustic camera mentioned in Section 2.5 would provide an alternative for short term monitoring of fish behaviour below the outfall.

Netting fish below the outfall is another alternative to help assess injury/mortality rates, as mentioned in Section 2.5. However, it may exacerbate the problem, since fish may be damaged during capture and handling, and it would not provide the same insights into fish behaviour that video footage would potentially provide.

Construction of a smooth sluice/ramp to direct the discharge water directly into deep receiving water would mitigate the risk of injury at the discharge point.

[8] Mechanisms of direct injury/ mortality from turbine passage include: rapid extreme pressure changes, cavitation, shear stress, turbulence, strike, grinding (Cada 2001; Odeh 1999).

[9] Note: I have not visited the site for many years, so my knowledge of the outfall discharge location and configuration is limited to observations of photos taken from some distance away on the opposite bank.

4. SUMMARY AND CONCLUSIONS

The fish community near the intake upstream of Mataura Falls includes eels, brown trout, and possibly lamprey and common and/or upland bullies. Some entrainment of these fish may occur at any time of the year as a result of facultative movement, but entrainment is most likely during active downstream migration periods.

Assuming entrainment is directly proportional to flow diversion, under median to low flow conditions between 18% and 53% of fish passing by would enter the intake, the proportion diminishing with higher river flow.

Large trout (> 47 cm) that have entered the intake channel may be able to swim back upstream from the vicinity of the trash screen. However, other fish (including native fish and smaller trout) that encounter the intake channel would have great difficulty in returning upstream.

Since there is not a fish bypass to return screened fish to the mainstem, most of these fish are likely to either pass through the screen and turbine or become impinged on the screen face.

There will inevitably be some injury and mortality if fish are entrained through the turbine, either directly through mechanical injury or indirectly, e.g. through increased predation risk.

Most of the fish likely to encounter the intake are relatively short (i.e. < 100–200 mm) and would be expected to have relatively high survival rates if they are entrained through the intake and pass through the Francis turbine (e.g. < 26% mortality for fish under 200 mm long, see table 3 of Golder 2016).

However, for longer fish like eels and large trout the expected turbine passage mortality rates are substantially higher, up to 97% for large eels. Hence, large eels are justifiably the main focus for the applicant's proposed screening, monitoring and mitigation in this case. The focus of monitoring arguably should be extended to include large trout, especially given the outstanding fisheries and angling amenity of the Mataura River recognised in the Mataura Water Conservation Order 1997.

The proposed reduction in screen bar spacing (to ~20 mm) can be expected to exclude large migrant eels (> 700 mm), including most migrant females, as well as trout greater than about 200 mm long. Smaller fish are still likely to be able to pass through the screen.

The proposed monitoring involves capturing fish impinged on the screen, by using the screen scraper to move them to the sluice. Rates of injury and mortality can only be

speculated at this stage. However, for large eels, mortality rates in the proposed monitoring programme are likely to be substantially less than mortality rates from turbine passage.

Mortality rates are likely to increase with the duration fish remain impinged on the screen and the duration they are held in the modified sluice. A remotely monitored video camera watching the screen and sluice could be used to reduce the period that fish are held in the sluice.

Modifications to the screen scraper to reduce the probability for grinding injury as fish are carried up the face of the screen are likely to reduce injury and mortality rates.

Overall I consider that the proposed monitoring programme is a reasonable study design, given the environmental and logistic constraints, but could still be improved.

The proposed monitoring programme will provide useful information on the numbers and condition of large migrant eels (and other large fish, e.g. trout) currently being entrained through the turbines over the February to May eel migration period. But will not detect smaller eels and will not provide information on numbers of fish being entrained at other times of year, nor on the fate of fish that do pass through the turbine.

Employing a range of monitoring approaches and sampling in other seasons (winter and spring), as well as sampling downstream of the turbine discharge point, would help produce a more complete understanding of the fish entrainment issue and how it can best be mitigated.

5. REFERENCES

Boubée JAT, Jowett I, Nichols S, Williams E 1999. Fish passage at culverts – a review, with possible solutions for New Zealand indigenous species. Department of Conservation. Wellington, New Zealand. 63 p. plus appendices.

Boubée J 2018a. Draft elver trap and transfer plan for Mataura Falls. Vaipuhi Freshwater Consulting Report No: 201801 (V3.0 March 2018). Prepared for Alliance Group Limited. 13 p. plus appendices.

Boubée J 2018b. Draft downstream eel monitoring programme for Mataura Falls. Vaipuhi Freshwater Consulting Report No: 201802 (V3.0 March 2018). Prepared for Alliance Group Limited. 31 p. plus appendices.

Cada GF 2001. The development of advanced hydroelectric turbines to improve fish passage survival. Fisheries 26:14-23.

DWA 2005. Fish protection technologies and downstream fishways. Dimensioning, design, effectiveness inspection. German Association for Water, Wastewater and Waste. 19 p.

Franklin P, Gee E, Baker C, Bowie S (Department of Conservation) 2018. New Zealand fish passage guidelines, for structures up to 4 metres. NIWA Client Report 2018019HN. 226 p.

Golder 2007. Assessment of hydro-electric diversion effects on fish passage. Prepared for Alliance Group Ltd. 13 p.

Golder 2016. Mataura River – Ecological summary and assessment. Report Number: 1656011_7410-002-R-Rev4. Prepared for Alliance Group Ltd. 15 p.

Hay J 2010. Instream flow assessment for the Mataura River. Prepared for Environment Southland. Report No. 1757. 35 p.

Hay J, Kitson J 2013. Flow harvesting: a review of policy and potential effects. Prepared for Environment Southland. Cawthron Report No. 2408. 41 p. plus appendix.

Jamieson D, Bonnett M, Jellyman D, Unwin M 2007. Fish screening: good practice guidelines for Canterbury. NIWA Client Report 2007-092. 70 p.

Johnson GE, Ebberts BD, Dauble DD, Giorgi AE, Heisey PG, Mueller RP, Neitzel DA 2003. Effects of jet entry at high-flow outfalls on juvenile Pacific salmon. North American Journal of Fisheries Management 23(2): 441-449.

Larinier M 2002. Biological factors to be taken into account in the design of fishways, the concept of obstructions to upstream migration. Pp. 181-207 in Larinier M, Travade F, Porcher JP, eds. Fishways: biological basis, design criteria and monitoring. Bulletin Français de la Pêche et de la Pisciculture 364 suppl., 208 p.

Larinier M, Travade F 2002. Downstream migration: Problems and facilities. Pp. 28-38 in Larinier M, Travade F, Porcher JP, eds. Fishways: biological basis, design criteria and monitoring. Bulletin Français de la Pêche et de la Pisciculture 364 suppl., 208 p.

Mitchell CP 1989. Swimming performances of some native freshwater fishes. New Zealand Journal of Marine and Freshwater Research 23(2): 181-187.

Mitchell Daysh 2016. Mataura plant – hydro electric generation plant. Resource consent applications and assessment of environmental effects. For Alliance Group Ltd dated 22 December 2016. 134 pages.

Odeh M 1999. A summary of environmentally friendly turbine design concepts (concepts developed by Alden Research Laboratory, Inc., Voith Hydro, Inc. and their teams). Report prepared by USGS for the United States Department of Energy, Idaho Operations Office, Advanced Hydropower Turbine System Program, Under Contract DE-AI07-99ID13741. 47 p.

Tudorache C, Burgerhout E, Brittijn S, van den Thillart G 2015. Comparison of swimming capacity and energetics of migratory European eel (*Anguilla anguilla*) and New Zealand short-finned eel (*A. australis*). Frontiers in Physiology 6:256. doi: 10.3389/fphys.2015.00256

Suggested Conditions

From ES Reporting Officer

environment SOUTHLAND
REGIONAL COUNCIL
Te Taiao Tonga

Cnr North Road and Price Street
(Private Bag 90116
DX YX20175)
Invercargill

Telephone (03) 211 5115
Fax No. (03) 211 5252
Southland Freephone No. 0800 76 88 45

Water Permit

Pursuant to Section 104B of the Resource Management Act 1991, a resource consent is hereby granted by the Southland Regional Council to **Alliance Group Limited** of **P O Box 1, Mataura 9356** from **Date Consent Granted.**

Please read this Consent carefully, and ensure that any staff or contractors carrying out activities under this Consent on your behalf are aware of all the conditions of the Consent.

Details of Permit

Purpose for which permit is granted:		To dam, divert and use water for hydro-electric power generation.
Location	- site locality	Mataura River, adjacent to 18-30 McQueen Avenue, Mataura
	- map reference	1,281,405E 4,876,540N NZTM
	- catchment	Mataura River
Legal description of land at the site:		Crown land (riverbed)
Expiry date:		**7 November 2026**

Schedule of Conditions

Weir

1. The water diversion authorised by this consent shall not cause the flow at the centre of the existing weir on the Mataura River to fall below a depth of 0.05 metres.

2. The consent holder shall maintain a monitoring system to provide immediate warning to its staff that overflow of the weir has reached a depth of 0.05 metres.

3. When a reduction in water demand for power generation is necessary to comply with condition 2, it shall be achieved by a parallel reduction in water usage by all users of the weir

structure, namely the consent holder and Mataura Industrial Estate (consent 203311), or subsequent consents or consent holders.

Fish Ladder

4. The consent holder shall share in in the maintenance of a fish ladder that is adequate to allow passage of adult trout over the weir with Mataura Industrial Estate (consent 203311) or subsequent consents or consent holders.

   a. The consent holder shall provide a Fish Ladder Operation and Maintenance Plan to the Consent Authority by 31 January 2019.
      i. Thereafter the fish ladder shall be operated and maintained in accordance with the Plan.
      ii. Any amendments to the Plan are to be provided to the Consent Authority without undue delay.

Elver Trap & Transfer

5. The consent holder shall operate a trap and transfer system each year to facilitate the passage of elvers over the Mataura Falls and Weir.
   Note: Permits or licences under other legislation may be necessary

   a. i. The trap and transfer system shall be operated by a suitably qualified person.
      ii. The consent holder shall invite Hokonui Rūnaka or their nominated representative to observe the trap and transfer of elvers each year.

   b. Within three months of commencement of this consent, the consent holder shall submit an Elver Trap and Transfer Plan to the Consent Authority for certification.
      i. Thereafter the consent holder shall facilitate elver passage over the Mataura Falls and Weir in accordance with the Elver Trap and Transfer Plan.
      ii. Any amendments to the plan are to be provided to the Consent Authority without undue delay.

   c. The Elver Trap and Transfer Plan shall be prepared by a suitably qualified and experienced person.

   d. The Elver Trap and Transfer Plan shall include:
      i. The design specifications of the trap and transfer system prepared in accordance with best practice guidelines for the passage of Fish at Hydro-electric dams (Paterson and Boubee 2010) or any revisions of these guidelines;
      ii. When inspections of the base of the Mataura Falls (both sides) will commence each year, and the subsequent frequency of inspections, to identify elver accumulation;
      iii. When and where the trap will be installed based on the quantum of elvers identified at the base of the Mataura Falls;
      iv. Contingency measures if the trap is removed or damaged during the period of elver accumulation;
      v. When the trap will be removed;
      vi. Annual reporting requirements (in addition to those specified in Condition 5(f));
      vii. Maintenance requirements;
      viii. Predator management.

   e. i. A draft of the Elver Trap and Transfer Plan shall be provided to the following groups at least four weeks prior to submission of the plan to the Consent Authority in accordance with Condition 5(b):
      - Te Ao Marama Inc, P O Box 7078, South Invercargill 9844.

- Department of Conservation, Private Bag 4715, Christchurch Mail Centre 8140.
- Fish & Game New Zealand, Southland Region, P O Box 159, Invercargill 9825.

ii. Any feedback on the draft plan from the above groups shall be reported to the Consent Authority with the plan required by Condition 5(b), including an explanation as to whether or not the feedback has been incorporated in the plan.

f. By 1 July each year the consent holder shall provide a report on the elver trap and transfer system to the Consent Authority and the parties listed in Condition 5(e)(i). The report shall include:

i. The inspection dates;
ii. Dates that the trap was installed and removed, including during the season;
iii. Relevant environmental variables including daily river flow, water temperature, and rainfall records during trapping;
iv. Weight of elvers relocated;
v. Details of any by-catch caught, including species, size, condition, injuries/death and release locations of live by-catch and number of bycatch species;
vi. Transfer location(s) of elvers and other fish species;
vii. Any variation from the Elver Trap and Transfer Plan that occurred during the season;
vii. Any amendments recommended for the Elver Trap and Transfer Plan for the following season.

Hydro Scheme

7. a. The consent holder shall manage the hydro scheme to avoid, as far as practicable, or otherwise mitigate, mortality and injuries to eels and fish. This includes during handling, measuring and transferring eels and fish during monitoring associated with the hydro scheme.

b. The spacings between the trash screen bars on the hydro scheme turbine intake shall be no greater than 20 mm during the downstream eel migration period each year.

i. If the trash screen is replaced by a coarser trash screen outside the downstream eel migration period, the start and end of the downstream eel migration period shall be identified by a suitably qualified and experienced person.
ii. The consent holder shall provide confirmation to the consent authority that the trash screen complies with this condition.

8. The consent holder shall monitor the effects of the hydro scheme on the downstream passage of eels and other fish, including determining the timing and river conditions when eel movement occurs within the migration period.

a. i. The person undertaking the monitoring shall be either a suitably qualified and experienced person, or a person who has been trained in the handling and measuring of fish by a suitability qualified and experienced person.

ii. The consent holder shall invite Hokonui Rūnaka or their nominated representative to observe the monitoring of the trash screen and holding chute and the eel collection and monitoring process each year.

b. Within three months of commencement of this consent, the consent holder shall submit a Downstream Eel Passage Monitoring Programme to the Consent Authority for certification.

i. The Downstream Eel Passage Monitoring Programme shall be prepared by a suitably qualified and experienced freshwater fisheries biologist.
ii. Thereafter the consent holder shall monitor the effects of the hydro scheme on the downstream passage of eels and other fish in accordance with the Downstream Eel Passage Monitoring Programme.
iii. Any amendments to the Programme are to be provided to the Consent Authority without undue delay.

c. The Downstream Eel Passage Monitoring Programme shall include:

i. Any modifications required to the trash screen, screen cleaner and trash sluice to facilitate monitoring;
ii. Triggers for the start and end of monitoring;
iii. Screen inspection frequencies, including increased frequencies during elevated flow events
iv. Monitoring using a Passive Integrated Transporter system[1] to ensure any modifications are fit for purpose and to obtain an indication of the size of eels able to pass through the screen;
v. Recording of the number, size and species of eels;
vi. Recording of, as far as practicable, the number, size and species of other fish;
vii. Review of the programme and procedure for modifications particularly to minimise mortality and injury rates to eels and fish;
viii. Any predator management if required;
ix. Fish handling, transport, and release protocol including consideration of release locations to ensure survival of any fish entrapped;
x. Provision for Hokonui Rūnaka participation in the monitoring;
xi. Protocols for the storage and provision of eel carcasses to Hokonui Rūnaka.

d. i. A draft of the Downstream Eel Passage Monitoring Programme shall be provided to the following groups at least four weeks prior to submission of the Programme to the Consent Authority in accordance with Condition 8(b):
- Te Ao Marama Inc, P O Box 7078, South Invercargill 9844.
- Department of Conservation, Private Bag 4715, Christchurch Mail Centre 8140.
- Fish & Game New Zealand, Southland Region, P O Box 159, Invercargill 9825.

ii. Any feedback on the draft Programme from the above groups shall be reported to the Consent Authority with the programme required by Condition 8(b), including an explanation as to whether or not the feedback has been incorporated in the programme.

e. By 1 July each year the consent holder shall provide a report on the downstream eel passage monitoring to the Consent Authority and the parties listed in Condition 8(d)(i). The report shall be prepared by a suitably qualified person, and shall include:

i. A summary of all data collected in accordance with the Downstream Eel Passage Monitoring Programme;
ii. A critical analysis of the monitoring information in terms of identifying, and as far as practicable, quantifying, adverse effects on downstream eel migration as a result of the operation of the hydro scheme. The analysis shall also determine if adverse effects on other species were identified by the monitoring;

---

[1] The Passive Integrated Transporter system involves the tagging and release of migrant eels upstream of the site, and the use of sensors to detect how many of the tagged eels enter the intake.

iii. Recommendations with regard to alterations to the monitoring programme;
iv. Recommendations with regard to mitigation of adverse effects identified in accordance with Condition 8(e)(ii).
v. Confirmation of mitigations that will be instigated by the consent holder in response to the monitoring programme before the next downstream eel migration season, and;
vi. Identification of any adverse effects under Condition 8(e)(ii) that will not be addressed, or mitigations under Condition 8(e)(iv) that will not be implemented, before the next downstream eel migration season.

9. In the event that the Downstream Eel Passage Monitoring Programme identifies that there is an adverse effect on downstream eel migration, or on other species, as a result of the operation of the hydro scheme that will not be addressed in accordance with Condition 8(e)(v), the consent holder shall develop and implement a Downstream Eel Passage Mitigation Plan.

a. The Downstream Eel Passage Mitigation Plan is to be submitted to the Consent Authority for certification within three months of the first report during the term of this resource consent that identifies adverse effects or mitigations measures under Condition 8(e)(vi) that will not be addressed or implemented before the next downstream eel migration season.
i. The consent holder shall update and provide the revised plan to the Consent Authority within three months of any subsequent reports that list mitigations or adverse effects under Condition 8(e)(vi)

b. The Downstream Eel Passage Mitigation Plan shall detail:
i. The mitigations and timeframes for implementation to address adverse effects identified in accordance with Condition 8(e)(ii) which have not already been adopted under Condition 8(e)(v);
ii. An explanation of the proposed timeframe for implementation of the mitigation measures;
iii. Identification of any adverse effects that the consent holder will not address, or mitigation measures that the consent holder will not implement, and an explanation for that decision.

c. i. A draft of the Downstream Eel Passage Mitigation Plan shall be provided to the following groups at least four weeks prior to submission of the Plan to the Consent Authority in accordance with Condition 9(a):
- Te Ao Marama Inc, P O Box 7078, South Invercargill 9844.
- Department of Conservation, Private Bag 4715, Christchurch Mail Centre 8140.
- Fish & Game New Zealand, Southland Region, P O Box 159, Invercargill 9825.

ii. Any feedback on the draft Plan from the above groups shall be reported to the Consent Authority with the plan required by Condition 8(a), including an explanation whether or not the feedback has been incorporated in the plan

10. The Consent Authority may, in accordance with Sections 128 and 129 of the Resource Management Act 1991, serve notice on the consent holder of its intention to review the conditions of this consent during the period 1 February to 30 September each year, or within two months of any enforcement action being taken by the Consent Authority in relation to the exercise of this consent, or on receiving monitoring results, for the purposes of:
a. determining whether the conditions of this consent are adequate to deal with any adverse effect on the environment which may arise from the exercise of the consent and which it is appropriate to deal with at a later stage;

b. addressing adverse effects identified by monitoring in accordance with this resource consent that are not or will not be avoided or mitigated within 12 months of the receipt of the monitoring report
c. ensuring the conditions of this consent are consistent with any National Environmental Standards Regulations, relevant plans and/or the Environment Southland Regional Policy Statement

Notes:

1. *In accordance with Section 125(1)(a) of the Resource Management Act, this consent shall lapse after a period of five years after the date of commencement unless it is given effect to or an application is made to extend the lapse period before the consent lapses.*
2. *Section 126 of the Resource Management Act provides for this resource consent to be cancelled if the consent has been exercised in the past but has not been exercised during the preceding five years.*
3. *If you require a replacement permit upon the expiry date of this permit, any new application should be lodged at least six months prior to the expiry date of this permit. Applying at least six months before the expiry date may enable you to continue to exercise this permit until a decision is made, and any appeals are resolved, on the replacement application.*
4. *The consent holder shall pay administration, consent monitoring and research & monitoring charges to the Consent Authority collected in accordance with Section 36 of the Resource Management Act, payable in advance on 1 July each year.*

for the **Southland Regional Council**

M Durand
Consents Manager

environment SOUTHLAND
REGIONAL COUNCIL
Te Taiao Tonga

AUTH-20171566-02

Cnr North Road and Price Street
(Private Bag 90116
DX YX20175)
Invercargill

Telephone (03) 211 5115
Fax No. (03) 211 5252
Southland Freephone No. 0800 76 88 45

Discharge Permit

Pursuant to Section 104B of the Resource Management Act 1991, a resource consent is hereby granted by the Southland Regional Council to **Alliance Group Limited** of **P O Box 1, Mataura 9356** from **DATE**.

Please read this Consent carefully, and ensure that any staff or contractors carrying out activities under this Consent on your behalf are aware of all the conditions of the Consent.

Details of Permit

Purpose for which permit is granted:		To discharge water from a hydro-electric system into the Mataura River
Location	- site locality	Mataura River, adjacent to 18-30 McQueen Avenue, Mataura
	- GPS reference	1,281,368E 4,876,414N
	- catchment	Mataura River
Legal description of land at the site:		Crown Land (riverbed)
Expiry date:		**7 November 2026**

Schedule of Conditions

1. This consent authorises the discharge of water from the hydro-electric system into the Mataura River as described in the resource consent application dated 19 October 2017[1].

2. The exercise of this consent shall not result in any of the following in the receiving waters at or beyond the zone of reasonable mixing, being 250 linear metres from the point of discharge:

[1] Being the date of receipt by the Consent Authority. Environment Southland's electronic document reference is A358509.

(a) i. The daily maximum ambient water temperature shall not be increased by more than 3°C when the natural or existing water temperature is 16°C or less, as a result of any discharge.

ii. If the natural or existing water temperature is above 16°C, the natural or existing water temperature shall not be exceeded by more than 1°C as a result of any discharge.

(b) The production of conspicuous oil or grease films, scums or foams, or floatable or suspended materials, other than as a result of sediment released into the water column during maintenance of the hydro-electric race;

(c) Any conspicuous plumes, change in colour or reduction of visual clarity, other than as a result of sediment released into the water column during maintenance of the hydro-electric race;

(d) Any conspicuous scour or erosion as a result of the exercise of this consent shall be remediated and effectively stabilised as soon as practicable after the consent holder is made aware of it.

ii. The consent holder shall notify the consent holder (email: escompliance@es.govt.nz) prior to and upon completion of any maintenance works in the hydro-electric race that may result in the disturbance of bed sediments.

a. The notice shall be sent:
   i. no more than 1 week prior to commencement of the works
   ii. no more than two days after completion of the works

iii. The consent holder shall pay an annual administration and monitoring charge to the Consents Authority, collected in accordance with Section 36 of the Resource Management Act, payable in advance on the first day of July each year. The administration charge includes the cost of at least one inspection each year by the Consent Authority.

iv. The Consent Authority may, in accordance with Sections 128 and 129 of the Resource Management Act 1991, serve notice on the consent holder of its intention to review the conditions of this consent during the period 1 February to 30 September each year, or within two months of any enforcement action being taken by the Consent Authority in relation to the exercise of this consent, or on receiving monitoring results, for the purposes of:

(a) determining whether the conditions of this permit are adequate to deal with any adverse effect on the environment, including cumulative effects, which may arise from the exercise of the permit, and which it is appropriate to deal with at a later stage, or which become evident after the date of commencement of the permit;
(b) ensuring the conditions of this consent are consistent with any National Environmental Standards Regulations, relevant plans and/or the Environment Southland Regional Policy Statement;
(c) amending the monitoring programme to be undertaken;
(d) adding or adjusting compliance limits; or

(e) requiring the consent holder to adopt the best practicable option to remove or reduce any adverse effect on the environment arising as a result of the exercise of this permit.

for the **Southland Regional Council**

Michael Durand
Consents Manager

Appendix