NEW ZEALAND KING SALMON

TAKAKA SALMON FARM WATER TAKE AND DISCHARGES

Application for Resource Consent and Assessment of Environmental Effects

Prepared for New Zealand King Salmon

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1.0 INTRODUCTION

This Assessment of Environmental Effects (AEE) has been prepared under the 4th Schedule to the Resource Management Act 1991, to support the applications of the New Zealand King Salmon Co Ltd (King Salmon).

King Salmon seeks resource consents to take and use water from downstream of the Waikoropupu Springs, and discharge water and contaminants to the Springs River, Takaka. The consents sought are associated with the operation of its existing salmon farm located downstream of the Waikoropupu Springs. The applications essentially seek renewal of the existing water and discharge permits under which the farm currently operates. Also sought is an additional consent for the use of the water taken for the purposes of salmon farming, as required under the Tasman Resource Management Plan.

In summary, King Salmon seeks permits for the following activities:

1. To take water from downstream of the Waikoropupu Springs at two intakes by gravity flow, at a maximum rate of 4 m^3/s.

2. To use water from downstream of the Waikoropupu Springs for the purposes of salmon farming.

3. To discharge water and salmon farming effluent via a settling pond to the Springs River.

4. To discharge water and salmon farming effluent via a bypass channel to the Springs River, only when the effluent settling pond is being emptied, cleaned, and maintained.

No changes to the existing quantities of water taken and discharged from the farm are sought under this application.

This Assessment of Environmental Effects (AEE) in **section 5.0,** first outlines the background to the operation of the existing farm in relation to the Springs River environment. It follows the history of the original farm from its establishment in 1976, its ongoing expansion, and major consenting history. This includes permits for the taking and discharge of water in 1984/85, and subsequent renewals in 1994/95.

Section 6.0 then outlines the proposal in more detail noting that under section 124(3) of the Act, King Salmon may operate under the terms of its existing permits, until such time as these applications are determined. **Section 7.0** then addresses the activity status under the Tasman Resource Management Plan under which these applications fall. It identifies that the activities for which consent are sought are discretionary activities in terms of the Resource Management Act 1991.

Section 8.0 describes the existing Springs River environment, having regard to the influences of the existing farm operation on water quantity and quality. This section essentially provides the environment, against which the effects of the operation for which consents are sought are assessed. This section outlines the natural water flows and quality of the existing Springs River environment and the impact of the farm on downstream visual clarity and in-stream health over the current consent period. In so doing it recognises instances of non-compliance with current permit conditions, and identifies issues to be addressed in seeking consent renewal.

Section 9.0 assesses the environmental effects of the activities for which permits are sought on downstream water quantity and quality. It addresses issues raised from a review by Cawthron Institute of the condition of the existing river environment, and identifies means, including volunteered conditions, to avoid, remedy, and mitigate any such effects where required. A complete list of conditions volunteered by King Salmon is attached as **Appendix 8**.

Finally, a record of consultation undertaken is contained in **Section 10.0.**

2.0 APPLICANT AND PROPERTY DETAILS

A completed application form is enclosed as **Appendix 1**. In summary the details of the applicant and the site are as follows:

To:	Tasman District Council
Applicant's Name:	The New Zealand King Salmon Co. Ltd
Address for Service:	Duncan Cotterill PO Box 827 197 Bridge Street Nelson 7040 Attn: Camilla Owen Telephone: (03) 546 6223 Fax: (03) 546 6033 Mobile: 21 248 6103 Email: C.Owen@DuncanCotterill.com
Address for Fees:	The New Zealand King Salmon Co. Ltd PO Box 1180 Nelson 7040
Site Address:	367 Pupu Valley Road, Takaka
Legal Description:	Lot 1 DP14799; Sections 296 - 297 Takaka District (CT: NL9C/364) Nelson Land Registry (refer Certificate of Title, **Appendix 2**)
Resource Management Plan Zoning:	Rural 2
Designations / Limitations:	n/a

3.0 APPLICANT PROFILE

King Salmon is the largest producer of farmed salmon in New Zealand, and the largest producer of farmed Chinook salmon in the world. King Salmon aims to produce high quality products for the national and international market place and has annual sales of $110 million. It produces 7500 tonnes of salmon per year, which are marketed under the Regal, Southern Ocean, and Seasmoke brands. 50% of this is exported, mainly to Japan, the USA, and Australia. Other overseas markets include countries in South East Asia, the Middle East, and the Pacific.

Headquartered in Nelson, King Salmon operates 2 hatcheries for juvenile salmon and broodstock (at Takaka and Southbridge), and 5 marine farms for production all located in the Marlborough Sounds. It also operates shore based infrastructure in Picton to support the marine farms, including facilities for dive support, engineering, and net making/repair. Four processing factories are located in Nelson, each focusing on various product lines.

King Salmon employs over 430 staff, and is a significant contributor to the Marlborough/Tasman economy. Salmon farming operations also support a significant number of other local businesses including those providing services for barging, warehousing, engineering, environmental monitoring, diving, air freight, and construction.

The Takaka farm itself is a significant contributor to the local Golden Bay economy. In particular the farm employs 9 full-time permanent and 4 full-time fixed term (seasonal - 6 months per year) staff, all recruited locally. This contributes $600,000 per annum in wages to the local economy. The farm also spends up to $100,000 per annum on local services, including: repairs and maintenance; freight; cleaning; utilities; and personnel costs.

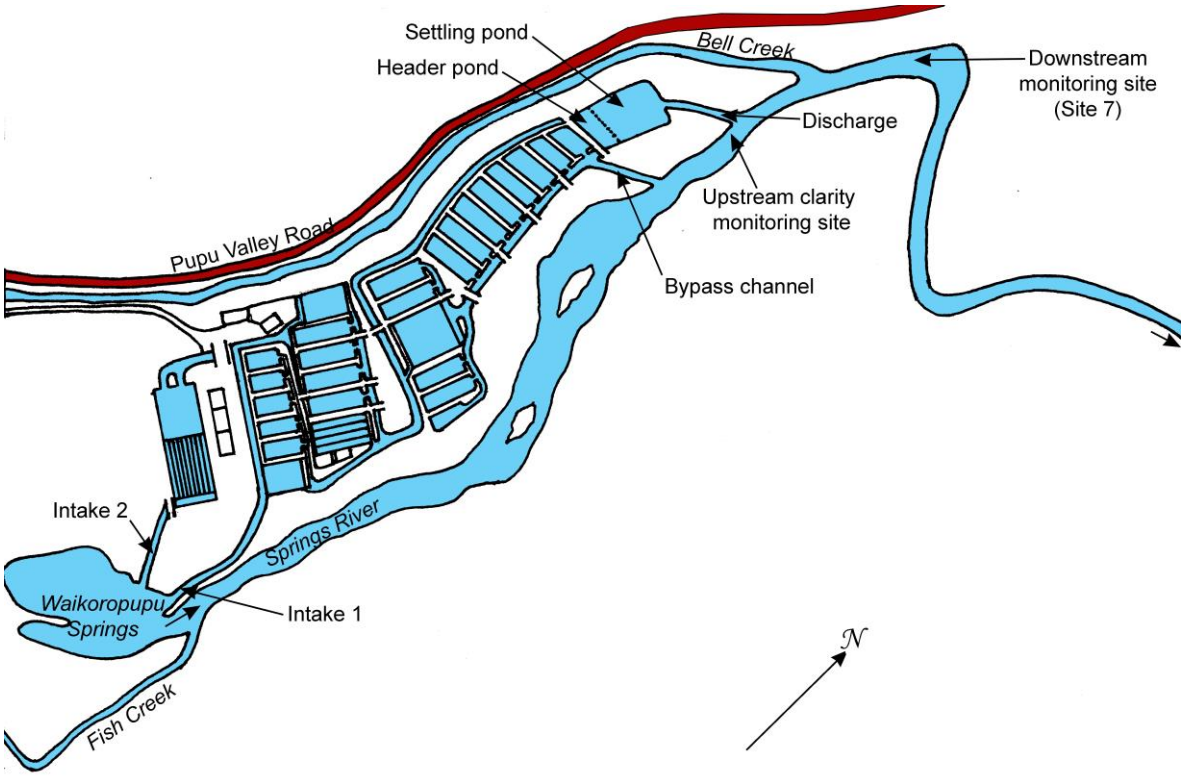
King Salmon sees itself as part of the successful branding of the region. Most of the salmon that one can buy at retail and restaurant outlets around Nelson / Marlborough and the rest of New Zealand come from King Salmon's farms. Its salmon are an important part of the 'local' produce that is promoted in many of the region's winery and restaurant menus. New Zealand consumption of King Salmon's products continues to increase year on year.

Environmental care and management is principal to the company's operations, and its success. In recent times it has invested considerably in improved feed technology, and environmental monitoring.

4.0 DESCRIPTION OF LOCATION AND SITE

King Salmon's Takaka farm is located on the true left bank of the Springs River immediately downstream of the Waikoropupu Springs, Takaka. **Figure 1** below shows the location, layout, and surroundings of the farm.

Figure 1 – New Zealand King Salmon Takaka Salmon Farm



The Waikoropupu Springs are the largest freshwater springs in the southern hemisphere and the 24th largest known karst spring system in the world. They are of significant geological, natural, cultural, and aesthetic value both nationally and internationally. Measurements of the visual clarity in the springs are the highest reported for a freshwater system and are close to the theoretical maximum for optically pure water (Davies-Colley & Smith 1995). Only the water beneath the frozen Weddell Sea in Antarctica is known to have clearer water. Accordingly the water in the river downstream of the springs also has a very high visual clarity relative to other New Zealand rivers.

The springs are of cultural significance to Manawhenua ki Mohua whose ancestral connections encompass both the spiritual and the physical realms. Tangata whenua have maintained these connections through customary practices such as using the sacred waters for ceremonial, blessing and healing purposes. Te Waikoropupu and the interconnected Takaka River system have a mauri/life force, tapu/sacred nature and mana/power of their own. They are entities in their own right and have a distinct essence and identity. For the Manawhenua, the health of the system reflects the health and well-being of the people that live around it.

The springs themselves are contained within the confines of a Department of Conservation scenic reserve located on the opposite eastern side of the Springs River from the farm. The reserve attracts visitors from all around the world, with an average of 50,000 people visiting the reserve annually.[1]

Historically the springs and river were used for recreational scuba and drift diving. However this, along with all contact recreation, was prohibited by the Department of Conservation in 2006. This was done so as to prevent the introduction of *Didymosphenia geminata* (Didymo). Other current recreational use of the river includes fishing for trout and salmon downstream of the springs.

The farm is located just downstream of the main pool of the springs and is confined between the Springs River to the east, and Bell Creek to the west, with the confluence of these two waterways being at the northern downstream extent of the farm. Photo 1 in **Appendix 10** shows an oblique aerial view of the farm looking East with the springs located at the extreme left of the shot.

The farm takes a maximum of 4 m^3/s of water via two intakes from the main pool of the springs and diverts this through a series of races and ponds used for the rearing of juvenile and broodstock salmon. At the downstream end, water flows through a settling pond prior to discharge back into the Springs River just upstream of its confluence with Bell Creek. During periodic dredging or weed clearance from the settling pond, water is discharged back to the river via a separate bypass channel just upstream of the primary discharge point.

Section 8.0 of this assessment describes the existing environment in more detail, and in particular the operation of the farm and its influence on water quantity and quality in the Springs River.

[1] Te Waikoropupu Springs Management Plan, Department of Conservation, March 2009

5.0 BACKGROUND

Salmon farming has occurred from the site downstream of Waikoropupu Springs since 1976. Operations by Bubbling Springs Salmon Farm Co Ltd (Bubbling Springs) commenced initially on an experimental basis, and in 1977 a diversion of Springs River into the farm was established and permits were granted to increase the quantities of the water take and discharge to 550l/s.

In 1984, Bubbling Springs applied to increase the take and discharge to a maximum of 15 m^3/s, leaving a residual flow in the river of 1.5 m^3/s. At this same time applications were also made by other applicants to take water from the springs. These included a separate application by the King Salmon Co for salmon farming, and applications to take water for dairy farming, and water bottling/export. All applications were heard by a Special Tribunal of the Nelson Catchment Board in 1985. Applications were granted enabling a maximum combined permissible take for both salmon farms (Bubbling Springs & King Salmon Co) of 2.4 m^3/s when the spring flow was less than 5.3 m^3/s, rising to 4 m^3/s when the flow exceeded 10 m^3/s.

The Tribunal decision was subsequently appealed by the salmon companies, and the Department of Conservation. The Nelson Underwater Club also objected due to potential impacts of the reduced flow on recreational drift diving. The main issue of contention was the minimum flow required in the Springs River to maintain ecological health and recreational amenity, versus the water needs of salmon farming.

Mediation ultimately led to a resolution and water permits being granted. These allowed the salmon farms a combined maximum take of 1.1 m^3/s when the river flow was less than 5.3 m^3/s, rising to a full take of 4 m^3/s when the flow exceeded 8.2 m^3/s. The permits also required that only the amount of water required be taken, and that effects of the take on river ecology be monitored. A condition also allowed drift divers the opportunity to request at least a day in advance, a 50% reduction in water taken by the salmon farm for 30 minutes between 8am and 5pm. The related discharge permits limited the quality of the effluent discharged as follows:

- Suspended solids of less than 10g/m^3;
- Biological oxygen demand (BOD_5) less than 3g/m^3;
- Dissolved oxygen greater than 6g/m^3;
- Undissociated ammonia less than 0.025 g/m^3

Bubbling Springs changed its name to Southern Ocean Salmon Ltd (Southern Ocean) in 1990 and obtained the water rights held by King Salmon Co. This enabled a maximum authorised water take of 4 m^3/s from the current salmon farm. All other permits to take water from the springs granted at this time for dairy farming and water bottling were never exercised.

Regular compliance monitoring of the permits was undertaken during the period of the permits by Southern Ocean and the Tasman District Council. Limited non-compliance with the water take limits were recorded in 1993 and 1994. Monitoring of water quality generally showed compliance with permit requirements. While there were 3 non-compliances for suspended solids levels, and 3 non-compliances for BOD levels, these occurred when construction works were being undertaken. Macroinvertebrate monitoring on a 6 monthly basis showed a slight degradation immediately downstream of the discharge on the left bank.[2] Results were however considered as indicative of a healthy aquatic ecosystem within the bounds of expected seasonal variability and statistical significance.

[2] This contrasts with more recent results which have shown a gradual improvement immediately downstream of the discharge at monitoring site 5.

Prior to their expiry on the 31st of May 1994, Southern Ocean applied to renew these permits. This occurred in conjunction with enlargement of the farm's settling pond to 3000m^2, including the installation of a head pond to spread the flow entering the settling pond. Construction of a bypass discharge channel was also undertaken for use when the settling pond was being cleaned. Southern Ocean became New Zealand King Salmon Ltd in 1996. As part of the permit renewals, King Salmon sought an additional discharge permit to discharge water from the bypass channel when the settling pond was being cleaned out.

Prior to lodgement of the applications, a meeting between King Salmon, Council staff, and representatives of the Department of Conservation, Fish & Game, and the Nelson Underwater Club was held to identify the issues associated with the consent renewals. The main issue raised was the reduction in visual clarity in the river below the discharge point. As a consequence it was agreed that following public submissions, the assessment of the applications would be delayed until upgrading of the salmon farm settling pond and monitoring of its effectiveness had been carried out. Water quality monitoring of the discharge was subsequently carried out by Cawthron Institute in December 1995, and again in March and May 1996. This followed the installation of baffles in the headpond to improve settling of solids.

The applications attracted three submissions from Golden Bay Underwater Club, Nelson Underwater Club, and the Department of Conservation respectively. A pre-hearing meeting was held on the 24th of February 1997 to discuss proposed conditions of consent, and the following issues:

- Public access and marginal vegetation along the Springs River;
- Duration of consent;
- Ecological impacts of take and discharges;
- Flow reductions;
- Drift diving opportunities;
- Water clarity.

The pre-hearing meeting resulted in changes to the proposed conditions for the permits. The Department of Conservation subsequently indicated its agreement with the conditions. Both underwater clubs however considered that water clarity should be further addressed and advocated for a no more than 20% reduction in downstream water clarity as recommended in Ministry for the Environment guidelines.[3] This compared with the 50% reduction proposed in the conditions. As a consequence further changes to conditions were agreed. This included a requirement that King Salmon use best endeavours to implement steps within 7 years of the granting of permits to meet a standard of no more than a 20% decrease in visual clarity below the discharge.

Ultimately the Tasman District Council was satisfied that King Salmon had taken steps to improve its environmental performance since the commencement of the earlier permits. Furthermore it considered that the additional solids removal would improve the recreational experience for drift divers. As a result, the applications were approved for 14 years with the permits expiring on the 25th of September 2011. Full copies of the existing permits are attached in **Appendix 3**, and the conditions are summarised as follows:

Water permit **NN840174**, to take water from Springs River is, subject to the following conditions:

1. Requirement to keep records and supply information to the Council if requested. Water flows to be continuously monitored and recorded with data supplied on an at least three monthly basis.

2. Provision of access for Council staff and agents.

[3] Water Quality Guidelines No 2 – Colour and Clarity, Ministry for the Environment, June 1994.

3. Provision for review of conditions by the Council annually. Within 6 months of the seventh anniversary, the consent holder shall provide an assessment identifying any trends/problems so that the need for a review can be determined by the Council.

4. Malfunctions or complaints relating to exercise of the consents are to be recorded. The Council is to be notified of any works undertaken in any channel, pond, intake channel, riverbank, or bed.

5. The maximum take is restricted below 4.0 m^3/s linearly down to 1.1 m^3/s when the river flow is between 5.3 and 8.2 m^3/s. The maximum take is restricted to 1.1 m^3/s when the river flow is below 5.3 m^3/s.

6. No water taken is to exceed the maximum required for salmon held at that time.

7. Provision for a 25% reduction in water take at the request of drift divers for a period of up to 30 minutes, once per day.[4]

8. Monitoring is to be summarised and reported in writing annually to the Council. The Council is to be immediately informed of any consent condition breaches.

Discharge permit **NN940175**, to discharge effluent via the settling pond, is subject to the following conditions:

1. Requirement to keep records and supply information to the Council if requested. Water flows to be continuously monitored and recorded with data supplied on an at least three monthly basis.

2. Provision of access for Council staff and agents.

3. Provision for review of conditions by the Council annually. Within 6 months of the seventh anniversary, the consent holder shall provide an assessment identifying any trends/problems so that the need for a review can be determined by the Council.

4. Malfunctions or complaints relating to exercise of the consents are to be recorded. The Council is to be notified of any works undertaken in any channel, pond, intake channel, riverbank, or bed.

5. The quality of effluent discharge shall be as follows:

    - Suspended solids not to exceed 10g/m^3
    - 5-day biochemical oxygen demand not to exceed 3g/m^3
    - Dissolved oxygen not to be less than 6g/m^3

6. Discharge is not to result in a reduction in visual clarity of more than 50% compared with that above the discharge, using the black disk method.

7. The settling pond is to be operated and maintained such that visible deposits of solids do not occur downstream. Cleaning of fish ponds only to occur Mon-Thur between 7am – 1pm, and smolt/fry raceways only to occur on Mon & Fri between 7am – 1pm.

8. Records of any chemical, antibiotics, or additives which may be applied to be kept. Only substances commonly accepted for use in fish farming are to be used.

[4] Condition 7 of NN840174 has not been exercised by the dive clubs during the consent period.

9. Monitoring of conditions 5 – 7 is to be carried out at least two-monthly. Macroinvertebrate Community Index and visual monitoring of ecological health is to be monitored 6 monthly, or annually if agreed with the Council.[5] Monitoring is to be summarised and reported in writing annually to the Council. The Council is to be immediately informed of any consent condition breaches.

10. Steps are to be taken to seek improvement in the water clarity below the discharge. The consent holder shall use best endeavours to implement environmentally friendly steps within 7 years of the granting of the consent to meet a no more than a 20% decrease in visual clarity below the discharge. The consent holder may apply under s127 RMA to amend this condition on or after the 4th anniversary of the granting of consent. Evidence of compliance with the condition is to be provided annually.

Discharge permit **NN940183**, to discharge effluent via the bypass channel, is subject to the same general conditions as that for discharge via the settling pond, with the following exceptions:

7. The discharge from the bypass is only to be exercised:

    - When the settling pond is being cleaned or maintained;
    - After solids deposited against the channel gate have been removed;
    - While there is no cleaning of ponds or the raceways occurring;
    - After the dive clubs have been notified in writing of the dates when the bypass will be in operation.

8. Records of the dates and duration of discharges via the bypass channel are to be kept.

Reports of the monitoring undertaken have been submitted to the Tasman District Council during the life of the permits.

As per condition 3 of the permits, King Salmon submitted to the Tasman District Council in 2004 a 7 year anniversary assessment of all monitoring undertaken to identify any trends or problems. No review of consent conditions was initiated by the Council as a result.

The existing permits are due to expire on the 25th of September 2011. Accordingly application is now required for renewal of these permits.

[5] Current MCI monitoring frequencies are annually as agreed with the Tasman District Council.

6.0 THE PROPOSAL

Existing water and discharge permits NN840174, NN940175, NN940183, are due to expire on the 25th of September 2011. These applications are therefore being made to enable King Salmon to continue to operate its existing salmon farming operation. These applications only address matters relating to the taking and use of water, and the discharge of water and contaminants to water.

Consent is sought for the following:

1. To take water from downstream of the Waikoropupu Springs at two intakes by gravity flow, at a maximum rate of 4 m^3/s.

2. To use water from downstream of the Waikoropupu Springs for the purposes of salmon farming.

3. To discharge water and salmon farming effluent via a settling pond to the Springs River.

4. To discharge water and salmon farming effluent via a bypass channel to the Springs River, only when the effluent settling pond is being emptied, cleaned, and maintained.

The terms of the water permit that is sought remain unaltered from that currently being exercised. Accordingly, King Salmon seeks to retain its current level of water take in accordance with condition 5 of water permit NN840174. It also seeks to retain the same rate of discharge to Springs River via both the settling pond, and bypass channel. An additional permit is sought to use the water taken from the springs for the purposes of salmon farming in line with the current requirements of the Tasman Resource Management Plan.

Pursuant to section 123 of the Resource Management Act 1991, King Salmon seeks a duration of consent not less than 25 years for the permits when granted.

No physical or operational changes to the farm operation are proposed through this application. This is with the exception of the possible relocation of the water flow monitoring location from the discharge weir. King Salmon is currently investigating whether it is practicable for flow monitoring to instead be undertaken at the two water intakes. Testing is currently underway to determine the practicality of this and if this proves successful, King Salmon will look to install flow monitoring equipment at the intakes. The current flow recorder at the discharge weir would also be decommissioned. This is discussed further in **Section 9.0.**

Potential conditions of consent are also volunteered and are addressed in **section 9.0.** These include volunteered improvements to the standards for downstream visual clarity as a result of the discharge. Furthermore changes to the monitoring regime included in the current permits are volunteered, reflecting the outcomes of monitoring undertaken over the life of the current permits. The volunteered conditions aim to ensure robust monitoring of the operation going forward.

While no other physical or operational changes are proposed at this time, King Salmon has made changes over the life of the current permits, with the effect of improving its environmental performance. This has included changing from a grow-out operation to a hatchery, as well as implementation of improved feed technology. These changes are addressed in more detail in describing the existing environment in **section 8.0.**

Aside from the permits being sought, the most recent compliance monitoring report from Tasman District Council in March 2010 noted that no resource consent had been obtained for the discharge of sediment and associated contaminants from the dredging of the effluent settling pond, onto land. Solid bio-waste and sediment extracted from the settling pond is deposited/disposed of on an area of land adjacent to the discharge channel. The compliance monitoring report advised that prior to the

next occurrence of pond cleaning, resource consent is to be obtained. Whilst not being sought as part of the current application, King Salmon acknowledges the need to obtain consent and commits to doing so before the next pond dredging occurs in approximately 3 years time.

Under section 124(3) of the Resource Management Act 1991, a consent holder may continue to operate under its existing consents until:

a) A new consent is granted and all appeals are determined; or
b) A new consent is declined and all appeals are determined.

This is on the condition that the application is made for a new consent for the same activity at least 6 months before the expiry of the existing consents, under section 124(1). This application has been lodged prior to the 25th of March 2011, and therefore it is understood that King Salmon can continue to operate under the terms of its existing permits until such time as these applications are determined.

7.0 STATUS OF THE ACTIVITY

The Tasman Resource Management Plan (TRMP) is the relevant statutory plan for the purposes of this application. Part V – Water, and Part VI – Discharges, are the relevant parts of the Plan for the purposes of this application.

Chapter 31 of the Plan sets out the relevant rules for water takes, diversions, uses, or damming. Rule 31.1.3 of the Plan is relevant for the purposes of the water take and use application. The rule and relevant performance standards are as follows:

31.1.3 Controlled Activities (Water Take, Diversion or Use from Rivers, Aquifers and Inshore Coastal Water)

- *The taking, diversion, or use of water from surface water, aquifers or inshore coastal water that does not comply with the conditions of Rule 31.1.2 is a controlled activity, if it complies with the following standards and terms:*

  a) The applicant for the water taking and use is the holder of a water permit that is due for renewal and section 124 applies except:

    i. where the permit has been transferred for a limited period from another point of take in the same management zone under the provisions of Rule 31.5.1 or 31.5.1A; or

    ii. the permit has been issued for taking and use of water that has been reserved for the purposes set out in Schedule 31.1.D under the provisions of Policy 30.2.5.

  …

  f) For uses other than those provided for in (d) and (e), the amount taken and used is the least of:

    i. the level of bona fide use; or

    ii. any lesser rate applied for; or

    iii. the sustainable yield of the bore; or

    iv. the amount specified on the permit being renewed.

The application is for a renewal and section 124 of the Act applies. The current permit has not been transferred from another point of take, or been issued for taking and use of water that has been reserved. Finally, the amount taken and used is the level of bona fide use, as well as the amount specified on the permit being renewed.

Given the above, the performance standards of Rule 31.1.3 are considered to be met and the water take and use component of this application is thus a controlled activity under the Tasman Resource Management Plan.

Chapter 36 of the Plan sets out the relevant rules for discharges to land and fresh water. Rule 36.2.8 of the Plan is considered relevant for the purposes of this application, which reads:

36.2.8 Discharge of Any Contaminant or Water into Water

- *The discharge of any contaminant or water into water that does not comply with the conditions for a permitted activity is a discretionary activity, except where Rule 25.3.2 applies.*

  A resource consent is required. *Consent may be refused or conditions imposed.*

Rule 25.3.2 specified in the above rule is not relevant for the purposes of this application. The discharge component of this application is therefore deemed to be a discretionary activity under the Tasman Resource Management Plan.

Having regard to the above rules, the activity is overall a **discretionary activity** under the Tasman Resource Management Plan.

8.0 EXISTING ENVIRONMENT

This section outlines the existing Springs River environment, having regard to the influences of the existing farming operation on water quantity and quality. This essentially provides the environment, against which the effects of the operation for which consents are sought, can then be assessed.

8.1 Farm Operation

The farm takes water from the outlet of the main pool of the Waikoropupu Springs. Water flows by gravity into two intakes with the level of take controlled by manual control gates at the intake points. Photo 2 in **Appendix 10** shows the main intake for the farm. Flows through the farm are monitored via a remote data logger located at the discharge weir. Data from the logger is correlated with data from a Tasman District Council flow recorder which measures the flow in Waikoropupu Springs. This enables the control gates to be operated so as to manage the level of water take in accordance with current permit conditions.

Water that enters the farm flows though a series of races and ponds used for the hatching and growing of juvenile salmon, and rearing of broodstock. The volume of water entering each pond is controlled to ensure appropriate water distribution to maintain salmon health. At the downstream end of the farm, used water enters first a headpond to distribute flow, before then entering a 3000m^2 settling pond (see Photo 3 in **Appendix 10**). The pond enables sediment and organic matter to settle. Approximately 15% of organic waste matter is collected by the settling pond. Water and any remaining contaminants are then discharged via a weir back into the Springs River just upstream of its confluence with Bell Creek (see Photo 4 in **Appendix 10**).

Cleaning of the ponds occurs on a daily basis within the times specified in the current permit conditions. This essentially involves water blasting the floors and walls of the ponds to remove effluent and weed. Waste then is flushed downstream through the farm to the settling pond. Removal of solids from the settling pond occurs every few years. During the current consent period, the pond was dredged in 2001 and 2008. To enable dredging, discharge water from the farm is instead directed via a bypass channel into the Springs River upstream of the settlement pond. The use of this bypass does not provide for any contaminant removal prior to discharge. Photo 5 in **Appendix 10** shows the bypass channel into the Springs River downstream of the bypass gates.

During the life of the current permits, there have been operational changes to the way the farm operates. Firstly, the operation has moved from a grow-out operation to that of a hatchery. As a result the maximum biomass of fish held on the farm at any one time has reduced from 300 tonnes in 1997 to 180 tonnes currently. The monthly average biomass of fish held has also reduced over this same period from 230 tonnes to 90 tonnes. Consequently the annual average feed input has also reduced from 700 tonnes to 200 tonnes.

King Salmon has also moved to introduce new feed technology at the farm. From approximately March 2000, many of the fish (both broodstock and fry) at Takaka were switched from pressed-pellet diets to predominantly extruded-pellet diets, with most or all fish fed only extruded diets from 2001. Extrusion pellets are of improved physical quality (less dust and chip), can render some components of a diet more digestible and, are of nutritionally optimal composition. As a result they produce a reduced effluent nutrient load.

The pellets now used also include a proportion of semi-float pellets which stay buoyant for much longer. This enables fish to more readily consume the pellets before they reach the floor of the pond where they would otherwise become waste and contribute to the effluent load from the farm.

8.2 Water Flows and Quantity

Water for the farm is sourced directly from the main pool of the Waikoropupu Springs, a large karst resurgence consisting of a collection of springs. The springs themselves are principally fed by the extensive Arthur Marble aquifer system in the upper Takaka Valley. A hydraulic connection also exists between the Takaka River and the springs, and discharges from the Cobb Power Scheme dam also have a measurable, although delayed, effect on the flows from the springs. The springs also have a connection to offshore springs resulting in a daily tidal rhythm and a slight salt content in the discharge. The Springs River has seasonal variation with the lowest discharges being during the summer months.

Water permit **NN840174** currently enables King Salmon to take a maximum of 4 m^3/s of water from the Springs River when the river flow is above 8.2 m^3/s. The maximum take is restricted below 4 m^3/s linearly down to 1.1 m^3/s when the river flow is between 8.2 and 5.3 m^3/s. This is determined by the following equation:

MAX TAKE = RIVER FLOW ABOVE INTAKES – 4.2 m^3/s

This regime is intended to ensure sufficient environmental flows are retained in the river, so as to maintain ecological health, and natural, cultural, and recreational values.

As per the existing permit, water flows are continuously monitored and recorded. For practical purposes in exercising the water take, the springs flow above the intakes is monitored from the springs groundwater bore via the TDC website. This method is used in day to day management of the water take.

Flow data is summarised and reported in the annual monitoring report to the Council. It should be noted for the purposes of the annual report, since 2006 flow data for the springs has been derived from the groundwater bore site within the Main Spring. This is opposed to calculating flows using flow data from Springs River, Fish Creek and the farm (Springs River + Farm – Fish Creek).

For the purposes of this assessment, Envirolink has collated flow data for the springs and farm for the current consent period. The Envirolink report is attached as **Appendix 4**. Flow data is displayed in a series of hydrographs. This shows both flow rates from the springs as well as the permissible and actual water take for the farm over time. This enables flow trends and non-compliance with the permissible water take to be identified. Flow data for the springs has been derived by applying a flow rating retrospectively to Main Spring data, which extended available data back to 19 August 1999. Prior to this date, flows from the springs have been calculated from the combination of Springs River, Fish Creek and the farm.

Table 3a of the report indicates that from 24 September 1997 to 19 August 1999, the maximum flow from the springs was 25.682 m^3/s and the minimum was 7.106 m^3/s. The mean flow over this period was 10.249 m^3/s. Table 2a indicates that from 19 August 1999 to 22 February 2011, there was a maximum flow from the springs of 13.901 m^3/s, and a minimum of 5.607 m^3/s. The mean flow over the period was 9.966 m^3/s.

The data from Tables 2a and 3a indicates that flow restrictions below the maximum 4 m^3/s allowed were in place for 6% of the consent period. The minimum take over the consent period was 1.513 m^3/s on the 6th of April 2010. Accordingly, at no time was the 1.1 m^3/s minimum take reached during the consent period.

The mean take over the period has been more difficult to determine due to the fact that flow data for the take includes flow spikes as a result of flow back-up at the recorder site. In an attempt to demonstrate valid flow statistics for the mean take, spikes were removed where valid reasons for their exclusion could be proven. All upward spikes were checked against elevated downstream flows at the weir, and downward spikes against bypass use. This method could not however be fully applied prior

to the installation date of the downstream weir recorder on 26 November 2004; however, bypass use could still be edited out. Accordingly only the mean take for the period following installation of the downstream weir recorder can be considered accurate. The mean water take for this period between January 2005 to February 2011, was 3.186 m^3/s.

The hydrographs show that King Salmon has generally complied with the parameters of its current water take permit. While the graphs indicate that there have been a significant number of occasions when the actual water take has exceeded, in practice this was not the case. Non-compliance with the maximum permissible take has been largely due to other factors beyond King Salmon's control influencing the results and does not reflect an actual take in excess of that permitted.

The majority of non-compliances indicated on the hydrographs have been due largely to drowning of the flow recorder site during high river flows downstream of the discharge point. The drowning of the flow recorder means no accurate result can be recorded as to the water flows through the farm. To enable identification of instances where high river flows may influence the accuracy of flow readings, King Salmon installed a water level recorder downstream of the farm in November 2004. This is located downstream of the settling pond outlet. A water level of '300 mm' downstream equates to the invert of the discharge weir and therefore, values exceeding 300 mm indicate a 'drowning' of the weir due to flow 'backup'. The results from the downstream recorder are depicted in the hydrographs from December 2004 onwards. Corresponding spikes in upstream flows, downstream flows, and water take indicate instances where flow results from the farm are not accurate.

Accordingly, while in many instances the actual water take is recorded as being greater than 4 m^3/s during high river flows, this is **not** indicative of the amount of water actually being taken through the intakes. This is one reason why King Salmon is investigating the relocation of the flow recorder to the intake points, so as to avoid the loss of take records through downstream flood events. The possible relocation of the flow recorder is addressed further in **section 9.0.**

The other factor influencing water flow results from the farm has been the use of the bypass channel during dredging, weed removal from and maintenance of the settling pond. In these instances, water bypasses the flow recorder, meaning no results are recorded.

Notwithstanding these factors, there have been a few instances where the actual water take has exceeded the permissible water take during times when the water take has been restricted below the maximum 4 m^3/s. These non-compliances are summarised in **Figure 2** below:

Figure 2 – Water Take Non-Compliances – September 1997 – February 2011

Hydrograph Reference	Date/Time of Non-Compliance	Level of Non-Compliance[6]
Figure 2	19 – 21 March 2001	Minimal within 5% of allowable take
Figure 2	28 April – 6 May 2001	Maximum deviation of 603 l/s on 6 May 2001
Figure 4	19 May 2003, 1500 – 16.30 hrs	Maximum deviation of 5260 l/s (1500 – 1630 hours)

[6] With the exception of those that occurred on the 19th of May 2003, all non-compliances occurred when flow restrictions below the maximum 4 m^3/s take were in place.

Figure 4	19 May 2003, 1900-2000 hrs	Maximum deviation of 4881 l/s (1900 – 2000 hours)
Figure 7	21 – 26 November 2005	Maximum deviation 206 l/s (24 November 2005)
Figure 7	1 – 15 December 2005	Maximum deviation 918 l/s (12 December 2005)

While there have been instances where the maximum take has been exceeded, these have been infrequent and have not resulted in any identified impacts on the Springs River environment. These non-compliances have occurred due to the fact that King Salmon had no access to real-time springs flow data, thereby affecting its ability to rapidly respond to dropping water levels in the springs.

Following the 2004 monitoring report to Council, the Council agreed, at King Salmon's expense, to provide daily springs flow data on the Council website. This data is now updated twice daily, enabling King Salmon to have more direct knowledge of springs flows at any particular time. Furthermore in 2009, an alarm was fitted to the farm flow monitor providing an instant alert when the maximum 4 m^3/s is exceeded. These technological enhancements have together meant there has been no exceedance of the water take parameters since December 2005.

The current water permit also requires that the water take is limited to actual needs, with no water taken being permitted to bypass the farm facilities used. Furthermore the water taken is not to exceed the minimum required for the salmon held at that time. While salmon biomass held at the farm has reduced over the life of the current permits, King Salmon considers that the full take is required within the permit parameters provided for. Information in regard to this was provided to the Tasman District Council in its 2004 consent monitoring report. The amount of water required for the salmon held is addressed in **section 9.0** of this assessment.

Aside from maintaining in-stream ecological health, and natural, cultural, and aesthetic values, the current restrictions on the water take reflect minimum flows required to enable recreational drift diving in the Springs River. Condition 7 of the current permit also enables drift divers to request a reduction in the water take of up to 25% for 30 minutes once per day. This ability for reduced abstraction has not been exercised over the life of the current consents, and drift diving in the springs and river has been prohibited by the Department of Conservation since 2006. Further, one of the two dive clubs involved in the 1997 permit renewal, namely the Golden Bay Underwater Club, no longer exists.

8.3 Water Quality

In describing the existing environment, it is the quality of the water downstream of the discharge compared with that upstream, which is of particular relevance to the current applications. These characteristics are reflected in the existing discharge permit conditions and include measures of visual clarity, visible solids and macroinvertebrate communities within the river downstream of the discharge.

The current discharge permit conditions also include measures of suspended solids, dissolved oxygen, and biochemical oxygen demand. However these parameters are measured at the point of discharge and not within the in-stream environment after mixing. Accordingly these parameters are not indicative of measureable impacts in the receiving environment. Rather they are a means to ensure that the quality of the effluent at the point of discharge does not result in significant downstream impacts. Measures of suspended solids, dissolved oxygen and biochemical oxygen demand are therefore not addressed here in describing the existing environment. There are however discussed in **section 9.0** in addressing the effects of the discharge for which consent is sought.

8.3.1 Visual Clarity in Springs River

As outlined in **section 4.0**, the water from the Waikoropupu Springs is of remarkable visual clarity. In rivers, visual clarity is often measured as the distance at which a black disk is visible when viewed horizontally through the water (Davies-Colley 1988). Measurements of the visual clarity in Waikoropupu Springs (63 m) are the highest reported for a freshwater system and are close to the theoretical maximum for optically pure water (Davies-Colley & Smith 1995). Such high natural visual clarity in the Waikoropupu Springs results in the water in Springs River also having high visual clarity relative to other rivers in New Zealand.

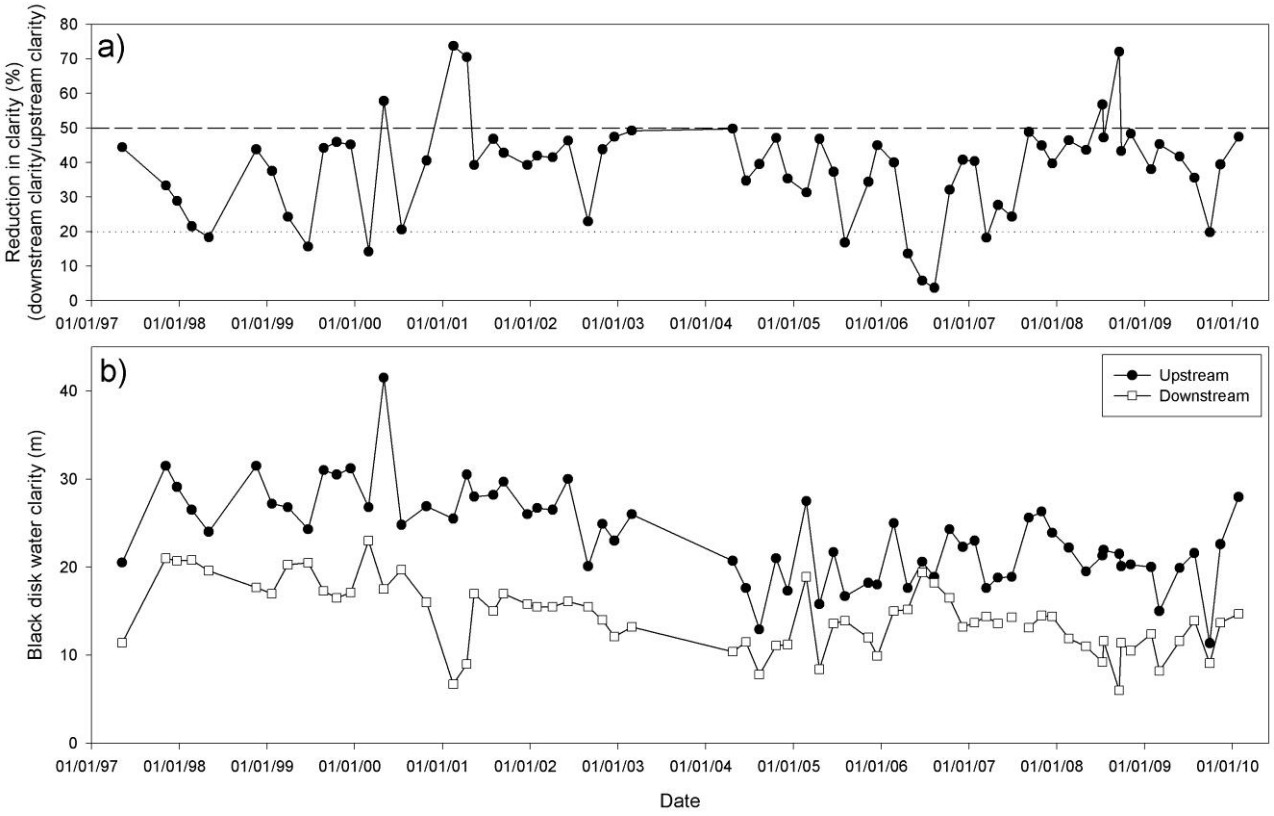
The current discharge permits **NN940175** and **NN940183** require that beyond a mixing zone 200m downstream, the discharge is not to result in a reduction in visual clarity of more than 50% compared with that above the discharge, using the black disk method. This is monitored 2 monthly with results being reported annually to the Tasman District Council. The permits also require that the consent holder use best endeavours to implement steps within 7 years of the granting of the permit to meet a no more than 20% decrease in visual clarity below the discharge.

Monitoring of upstream clarity is undertaken at a point in the Springs River just upstream of the farm discharge channel (Site 3). While downstream monitoring is required to be undertaken 200m downstream of the discharge, monitoring has in fact been undertaken upstream of this point. This is due to the 200m monitoring point coinciding with a deep pool in the channel, and difficult access. Accordingly black disk monitoring over the consent period has been undertaken in a more accessible point further upstream, within the mixing zone some 80m from the point of discharge. Consequently, the discharge is unlikely to have been fully mixed at the point of measurement, thereby negatively influencing monitoring results.

Comparison between upstream and downstream clarity and the contribution the salmon farm makes to any decrease in clarity is further impacted on by the presence of the Bell Creek discharge into Springs River, which is below the upstream monitoring site (site 3) but also below the discharge and within the mixing zone. These additional factors are discussed in more detail below.

In preparing this application, Cawthron Institute (Cawthron) has reviewed the effects of the discharge on visual clarity in Springs River. Cawthron has compiled information on the monthly monitoring of visual clarity undertaken by Envirolink for King Salmon. This is depicted in **Figure 3** below.

Figure 3 - Visual clarity of water in Springs River over the period 1997- 2010



a) *Reduction in visual clarity downstream of the farm discharge, expressed as a percentage of clarity upstream of the farm discharge. The dashed line represents the maximum reduction in visual clarity allowed under existing resource consents (50%) and the dotted line indicates a 20% change in visual clarity.* ***b)*** *Visual clarity (as measured using a black disk – Davies-Colley 1988) in Springs River upstream and downstream of the discharge from the salmon farm.*

As shown in **Figure 3** above, measurements of visual clarity in the upper Springs River have ranged from 11.4 m to 41.5 m over the period 1997 to present. Visual clarity has been consistently higher upstream of the discharge from the farm than downstream over the consent period.

The monitoring undertaken over the consent period has identified five instances of non-compliance with the 50% clarity reduction standard. The specific dates of the monitoring where these non-compliances were detected are shown in **Figure 4** below:

Figure 4 – Non-Compliance in Downstream Visual Clarity – 1997 - 2011

Date	% Reduction in visual clarity downstream
1 May 2000	57.7%
15 February 2001	73.7%
14 April 2001	70.5%
9 July 2008	56.8%

17 September 2008	72.1%

Reasons for these non-compliances with the standard are not readily identified. However downstream non-compliance is not necessarily indicative of the effects being solely from the farm discharge, owing to a range of factors influencing downstream clarity. For instance, in a January 2011 report for King Salmon, Cawthron has noted that the clarity of water is expected to naturally decline in Springs River due to suspension of particles and inflows from other sources, such as tributaries. This includes Bell Creek which enters Springs River downstream of the discharge and upstream of the downstream monitoring point. A copy of Cawthron's January 2011 report is attached as **Appendix 5.**

Another factor influencing downstream clarity is that monitoring has been undertaken in a location prior to the discharge being fully mixed which is likely to have negatively influenced monitoring results. Due to these additional natural influences on water clarity, and the uncertainty as to their extent, it has been difficult for King Salmon to aim to achieve a no more than 20% reduction in downstream clarity (as sought through the current consent conditions).

Previous studies commissioned by King Salmon have indicated that the natural reduction in visual clarity between the upstream monitoring point and the downstream monitoring point (site 7) is likely to be in the order of 20% (Roberts 1996; Kemp 2003). Accordingly King Salmon considers any such natural decrease in clarity should be taken into account when assessing the impacts of the farm discharge on water clarity for the future. This will enable visual clarity standards to be imposed on King Salmon's discharge which are reflective of its actual impact.

In preparing this application, Cawthron has undertaken additional research into the actual effects of the farm discharge on downstream visual clarity versus the influence of other factors from in channel processes and other tributaries. A copy of Cawthron's February 2011 report is attached as **Appendix 6**.

Cawthron's research involved calculating visual clarity by transmissometry readings at seven sites in Springs River, within the discharge and Bell Creek, on 10 February 2011. Further readings were also taken upstream of the discharge, within the discharge, and from Bell Creek on 11 February 2011 during a period of pond cleaning. Results for visual clarity were calculated, enabling other influences such as Bell Creek and in-channel processes to be excluded. It should be noted that the calculated visual clarity readings are directly comparable to those using the black disk method.

Cawthron has estimated that the natural decline in visual clarity between the upstream and downstream monitoring sites is 12.8%. The report notes however that additional data would need to be collected to enable a more robust estimate of the rate of decline. Cawthron has also estimated that Bell Creek results in a 10% reduction in visual clarity in Springs River.

Excluding these natural influences, the reduction in visual clarity at the downstream monitoring site (site 7), as a result of the farm discharge, was estimated as being just 11% during normal operations. During pond cleaning however, Cawthron estimated that visual clarity was reduced by more than 50% for much of the duration of the cleaning and reaching as high as 60%. Clarity improved again to normal levels within 30 minutes of cleaning operations being completed. The 60% reduction in Springs River alters the median visual clarity from 19.7 m upstream of the discharge to 8.0 m below the discharge which is still exceptional in comparison to other New Zealand rivers (as discussed below in more detail).

The combination of the reduction in natural clarity (22.8%), and that caused by the operational discharge (11%), therefore results in a total change of 33.8% between upstream and downstream monitoring points. In half of the consent compliance monitoring occasions since 1997, the observed reduction in clarity between the upstream and downstream monitoring sites has been between 32% and 46%. The Cawthron report notes that the reduction observed during its survey is at the lower end

of this range. The report notes that this may be due to the locations at which the downstream monitoring has been conducted – i.e. within the mixing zone as opposed to beyond it.

Overall, it can be concluded from the research that it is not appropriate for the current visual clarity standard to be applied without first excluding natural influences from in-channel processes and tributaries. If such factors had been specifically excluded in monitoring the current permit conditions, it is considered likely that King Salmon would have complied in all instances during normal operations (putting pond cleaning aside). It can be concluded from the research however that pond cleaning operations presents an issue in terms of downstream visual clarity. This is discussed further in **section 9.0.**

Notwithstanding the above, it should be noted that even downstream of the King Salmon discharge, water clarity is very high by national standards. The January 2011 Cawthron report notes that the median visual clarity reading at the downstream site is 14.2 metres, with 6% of readings being below 8.4 metres. In comparison, the highest recorded visual clarity in the '100 Rivers survey' of water clarity in 96 New Zealand rivers under baseflow conditions was 10.8 metres with a median value of 3.2 metres and a 95th percentile of 8.4 metres (Davies-Colley & Close 1990).

Monthly measurements of water clarity have also been taken at 77 sites nationally from 1989 to present as part of the National River Water Quality Network (NRWQN) (Smith & McBride 1990). The NRWQN site with the highest water clarity was in the Motueka River Gorge (NN2), which had a median visual clarity reading of 9.8 m (5th to 95th percentile: 0.8 m–16.9 m) (data courtesy of National Institute of Water & Atmospheric Research [NIWA], downloaded from the Water Quality Information System (WQIS): https://secure.niwa.co.nz/wqis/index.do). Other NRWQN sites with very high visual clarity (the top 5% of NRWQN sites for visual clarity) include the Tarawera River at the outlet of Lake Tarawera (median: 5.6 m), Monowai River below the control gates (median: 6.2 m) and the Waikato River at Reids Farm (near Lake Taupo) (median: 8.1 m). So it can be seen that, even downstream of the current farm discharge, the Springs River retains very high levels of water clarity compared with other rivers in New Zealand which have high visual clarity.

8.3.2 Visible Solids in Springs River

The current discharge permit **NN940175** requires that the settling pond is to be operated and maintained such that visible deposits of solids do not occur downstream. This is monitored on a two monthly basis with results reported in Envirolink's annual report to Tasman District Council.

Monitoring is undertaken in the Springs River immediately downstream of the discharge (site 5) and prior to reaching the confluence with Bell Creek. Dense macrophyte beds are present at this site, and at normal flows, the water is quite deep close to the bank. Photographs are taken of the bed of the river and provided together with a summary in the annual report.

No visible sediment build-up that may be attributable to the farm discharge has ever been observed on any of the sampling occasions. Accordingly, the operation of the farm has had no measurable impact in terms of visible deposits on the bed of Springs River during the current consent period.

8.3.3 Macroinvertebrate Community Health in Springs River

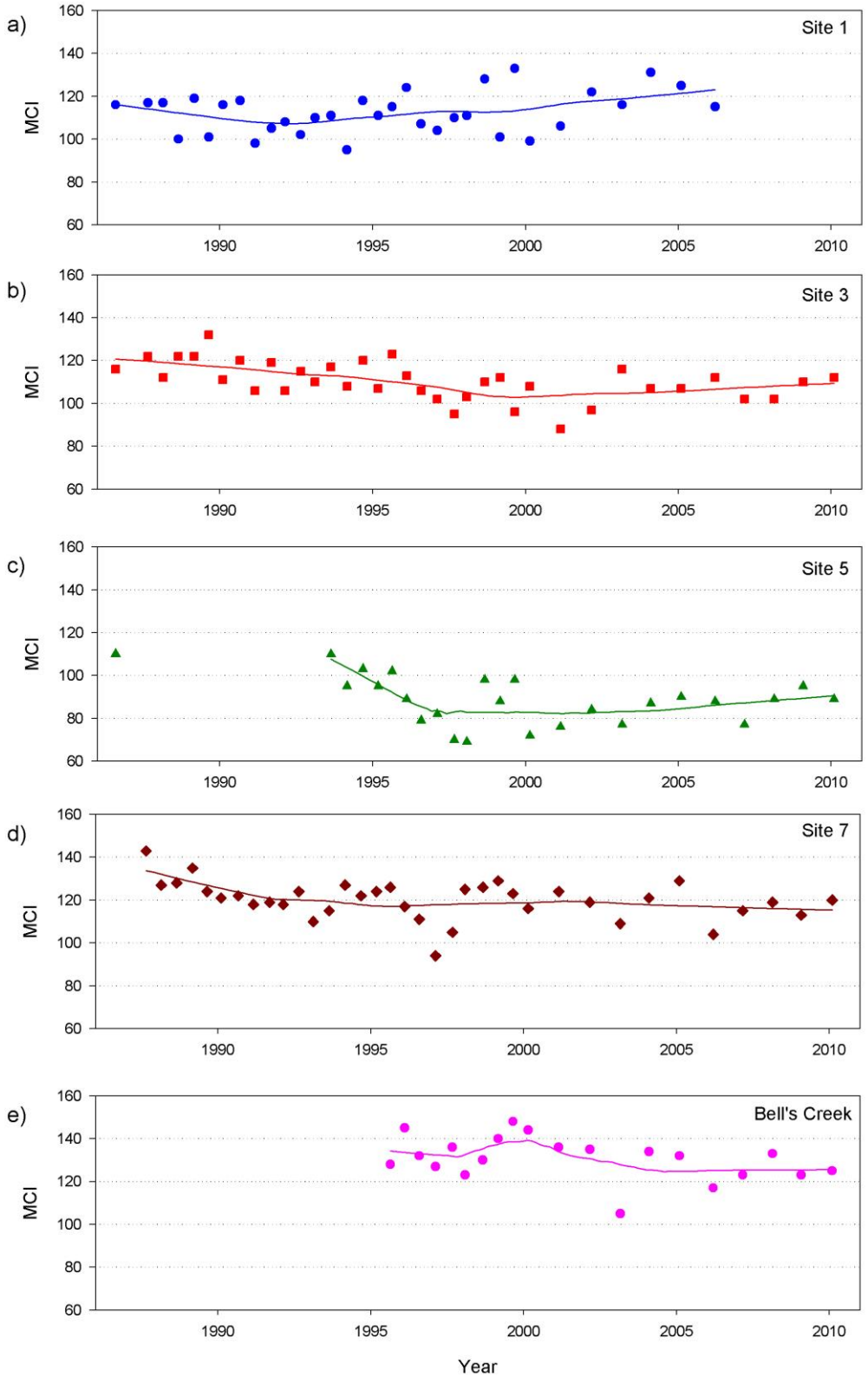
Discharge permit **NN940175** also requires monitoring of the ecological health of Springs River above and below the discharge by monitoring the Macroinvertebrate Community Index (MCI) and a visual inspection. This was initially required to be undertaken on a 6 monthly basis. However with the agreement of the Tasman District Council, since 2000, it has occurred annually (in February)l. **Appendix 7** contains a copy of the most recent MCI monitoring in February 2011 undertaken by Stark Environmental.

MCI monitoring has been consistently undertaken at four sites in Springs River. Monitoring at the same sites and same time year to year reduces any complications resulting from different habitats being monitored and any seasonal variation. Site 3 is a control site located upstream of the discharge from the farm. It provides an upstream baseline against which to assess the effects on macroinvertebrate communities downstream of the discharge. Previously samples were also collected at Site 1 adjacent to the farm intake channel. However monitoring at this site was curtailed in 2007 with the agreement of the Council, so as to prevent the introduction of Didymo into the springs.

Site 5 is located immediately below the discharge and within the path of the settlement pond outflow. Site 7 is located further downstream past the Bell Creek confluence. Samples are also collected from within Bell Creek to assist in the interpretation of data collected at Site 7. Monitoring at this site is intended to ensure that patterns of change occurring at Site 7 are not due to the influence of enrichment, pollution, or sedimentation from Bell Creek. The assumption is that if Bell Creek remains healthy, then it is unlikely to be implicated if degradation at Site 7 is detected.

MCI results for all sites have been collated by Cawthron for the period 1986 – February 2010. The results for the most recent monitoring undertaken in February 2011 have not been included, as they were not available at the time of the report. Results are displayed in **Figure 5** below.

Figure 5 - Macroinvertebrate Community Index (MCI) values at the Five Biomonitoring Sites in Springs River and Bell Creek



Sites 1 and 3 are control sites, samples taken at Site 5 are taken directly within the discharge plume and Site 7 is approximately 140 m downstream of the discharge. Trend lines are LOWESS smoothed curves (tension = 0.5).

The impact of the discharge is assessed by comparing the MCI between sites upstream and downstream of the discharge. The graphs in **Figure 5** show that MCI scores at Sites 1 and 3 (both control sites) were similar, indicating that Site 3 alone is appropriate as a control site given that Site 1 is no longer sampled.

In the most recent February 2011 macroinvertebrate monitoring report, Stark Environmental has noted that a statistically significant trend of decline was detected at Site 3 from 1986 to 2010. However the report notes that the decline at this site is upstream of the discharge and therefore cannot be attributed to enrichment from the farm. It notes that this also suggests that part of the MCI decrease at sites further downstream could be natural and not solely attributable to the farm.

From **Figure 5**, Cawthron has noted that the MCI value at Site 5 (mean MCI = 88) was significantly lower than that at Site 3 (107) indicating an ecological impact of the discharge at this point. However, the mean MCI value at Site 7 (118) was significantly higher than that at Site 5 (88), indicating that any impact of the discharge was localised and did not extend as far downstream as Site 7. As noted by Stark Environmental, there has also been a trend to recovery of Site 5 since 2000. This suggests there has been a marked improved in stream health at this site. This may be attributed to changes in stocking densities and improved feed technology.

The mean MCI value at Site 7 is also significantly higher than that at Site 3, a result considered by Cawthron to suggest a longitudinal change in macroinvertebrate community composition, possibly as a result of the contribution of Bell Creek. Cawthron notes that MCI values in Bell Creek were high on almost all sampling occasions, suggesting that water quality in Bell Creek is very good. Cawthron considers it likely that the high MCI values observed at Site 7 result from invertebrates drifting from Bell Creek into Springs River.

Stark Environmental notes that over the past 10-15 years, although there has been year to year variation, monitoring data suggest there has been no change in the impact of the farm operations on the Springs River.

8.4 Existing Environment Conclusions

Having reviewed the influences of the existing farm operation, the following conclusions have been drawn:

1. While there have been a small number of actual water take non-compliances over the life of the current consents, these were due to an unavailability of real time flow data for the springs. Technological improvements have resulted in there being no water take non-compliances since 2005.

2. There have been no identified effects on the Springs River environment from the water take or the five non-compliances during 2001 - 2005. The environmental health of the river at Site 1 (adjacent to the water intake) and Site 3 (downstream of the intake but upstream of the discharge), as assessed by the MCI, are similar.

3. While the monitored reduction in visual clarity downstream of the discharge has exceeded 50% on five occasions (between 1997 and 2011), such results are likely to have been impacted by a combination of natural factors. These include reduction in clarity as a result of in-channel processes and from Bell Creek. The uncertainty as to the influence of these factors has made it difficult to achieve the desired downstream reduction in visual clarity (of no more than 20%) as specified in the permits.

4. Notwithstanding the above, the recent research by Cawthron has identified that of the measured 34% reduction in visual clarity during normal operations, only 11% was due to the farm discharge.

5. Cawthron's research has identified that during cleaning operations, visual clarity is reduced by up to 60% by the farm discharge, with the median reduction being 55%, and recovery within half an hour of the cessation of cleaning.

6. Downstream of the farm discharge, water clarity remains very high by national standards.

7. At no time on any of the sampling occasions have any visible deposits been observed that may be attributable to the farm discharge.

8. While MCI monitoring of in-stream health has identified year to year variation, monitoring data suggests there has been no change in the impact of the farm operations on the Springs River. In particular, there has been an improvement in MCI at Site 5 downstream since 2000, and MCI values at Site 7 remain higher at Site 3 above the discharge.

9.0 ASSESSMENT OF ENVIRONMENTAL EFFECTS

This section outlines the environmental effects of the activities for which consents are sought on downstream water quantity and quality. It addresses issues raised from the review of the condition of the existing river environment, and identifies means, including volunteered conditions, to avoid, remedy, and mitigate any such effects where required.

9.1 Positive Effects

Continued operation of the Takaka farm is central to the continued viability and success of King Salmon's business. Loss of the ability to operate the farm would severely impinge on the ability of King Salmon to supply its offshore farms with juvenile salmon, and meet market demand for its products.

In this regard, operation of the Takaka farm along with King Salmon's other operations has significant positive economic and social effects. Such effects are derived not just locally, but also within the wider Tasman/Marlborough area, and nationally.

In an economic sense, demand for King Salmon's products is continuing to grow annually, with 7500 tonnes of salmon per annum currently being produced for total sales of $110 million. 50% of the salmon produced is currently exported, producing significant export income for the area and country. King Salmon can only continue to thrive and deliver these returns if it has operational flexibility and the ability to meet a growing demand for safe, healthy and nutritious food products – i.e. salmon.

The approval of these applications will therefore assist in delivering these significant positive economic and social effects and result in continued economic benefits. The ability to continue to operate from this site will also enable operational flexibility for King Salmon. Approval of the applications will also assist with managing the Company's cost of production. It will not result in King Salmon being a low cost producer of fish (relative to the global salmon superpowers) but will ensure that it can produce a higher value product at the best possible cost whilst enhancing New Zealand's reputation for premium sustainable food production.

The operation of the Takaka farm and consequently King Salmon's other facilities also contributes to economic and social wellbeing through the continued employment of a significant number of workers, as well as through directly supporting local and national services which support the salmon industry. Furthermore King Salmon continually invests in seafood industry training programmes to add value to its team. King Salmon is committed to developing a safe and highly skilled workforce through investing in people, and by doing so supports the economic and social wellbeing of the local community.

By operating in remote areas of rural New Zealand King Salmon also assists in maintaining viable communities and so counter some of the effects of a general population drift to the urban centres. In addition to these direct social impacts King Salmon is regularly contacted to undertake promotional tours with visiting television programme makers and other VIPs who visit the region. Participating in these promotional activities allows King Salmon to assist with lifting the profile of Tasman / Marlborough within New Zealand and overseas and promoting New Zealand's 'clean and green' image. King Salmon also supports community events, normally with product for functions and raffles. It is also a sponsor of the Golden Bay High School annual prize giving, accepts students on work experience and mentoring programmes, and undertakes school educational visits.

In recent years King Salmon has increased its participation in environmental based initiatives in the Tasman / Marlborough region as this fits well with its sustainability ethos.

Approval of these applications will therefore enable King Salmon to continue to contribute to maintaining and improving the economic and social wellbeing of the local and regional community by ensuring the continued viability and success of its business. In so doing it will enable King Salmon to further invest in social initiatives such as education, community events and environmental sustainability

9.2 Water Quantity

As outlined in **section 6.0**, consent is sought to take a maximum of 4 m^3/s of water from downstream of the Waikoropupu Springs, in line with the parameters set out in the current water permit NN840174; and to use that water for salmon farming.

Section 8.2 outlines that as a result of the existing water take, there have been no identified impacts on the Springs River environment over the life of the current permit.

Flow restrictions under the current permit were only in place for approximately 6% of the time over the current consent period. This, together with the fact that the minimum 1.1 m^3/s take was approached but not reached over the current consent period, indicates that the parameters of the current permit are appropriate. Furthermore, there have been no changes in the existing environment which affect the quantity of water available for the use of the farm – i.e. there have been no permits granted for the upstream consumptive take of water from the springs.

There has been a good record of compliance over the life of the current permit. The majority of non-compliance has been of a technical nature owing to the influence of other factors, namely the backing up of flow at the flow recorder, or the discharge bypassing the recording owing to the bypass channel being in use. There have only been four actual non-compliances[7], where the quantity of water taken exceeded that allowed when flow restrictions were in place. This was due to the lack of real time flow data being available from the TDC springs flow recorder. This has since been rectified and as a result there have been no instances of flow non-compliance since December 2005.

In seeking renewal of its existing water permit, it is important to address whether the maximum quantity of 4 m^3/s sought is limited to actual needs. King Salmon acknowledges that over the life of the current water permit, the amount of salmon biomass held at any one time has reduced from a peak of 300 tonnes in 1997, to 180 tonnes currently. Nevertheless, King Salmon considers that the maximum take of 4 m^3/s is still required for the purposes of hatching and grow out of salmon at Takaka.

The amount of water required to grow fish is not simply linked to the number or biomass of fish that are grown. It is necessary to consider the quality of the incoming water, especially with regards to four fundamental parameters: temperature, dissolved oxygen (DO), dissolved carbon dioxide (CO_2) and ammonia. For all of the above, the water supply at Takaka is reasonably consistent, which allows for good planning and management. However, although the water quality is consistent, it is consistently low in DO (7.5mg/l or 70% saturation) and consistently high in CO_2 (> 7mg/l). Salmon have a lower limit of 6mg/l of DO and an upper limit of 20mg/l of CO_2 before fish health is compromised. The optimum DO level is 10.5ppm, or 100% saturation.

A fifth parameter, pH, must also be considered, as this is important with regards to the toxicity of both CO_2 and ammonia. The relationship between pH, CO_2 and ammonia is critical in freshwater aquaculture. If the pH is low (acidic conditions) then toxic CO_2 levels increase, but so does non-toxic

[7] The third and forth non-compliances occurred when flow restrictions were not in place and related to a take in excess of the 4 m^3/s limit.

ionised ammonia (NH_4). If the pH is high (alkaline conditions) then CO_2 decreases but the level of toxic unionised ammonia (NH_3) increases. Therefore, a stable and neutral pH is ideal. Unfortunately for King Salmon, this is not the case at Takaka, where the pH fluctuates according to seasonal and diurnal influences.

King Salmon therefore considers that the incoming water quality at Takaka is not fully optimal for growing salmon. In order to create the best conditions possible it is necessary either to make best use of the available natural resource or employ artificial means. The natural method involves using adequate water to provide a buffer against fluctuations in the key parameters discussed above. The artificial method requires the installation of technology such as oxygenation systems, CO_2 degassers, pH buffering equipment, monitors, alarms and secure backup systems.

Over the last 14 years, since the operating biomass at the farm has decreased, the salmon have benefited from flows that have ensured a good clean environment, free from excessive CO_2 and toxic ammonia, and one in which available oxygen has not become a limiting factor. In particular the following changes to the growing environment have been possible:

- The number of fish per pond has decreased, thus significantly reducing the density of biomass per pond.
- Improved fish health associated with reduced densities. Bacterial gill infections and ragged fins, common on farms with a high density and high ammonia loading, do not occur at Takaka. This results in top quality juveniles being sent for on-growing at sea, and premium breeding stock available for spawning.
- Improved growth and feed conversion rates. Low density stocking results in better performance, with a reduction in the amount of feed required to achieve growth targets, and therefore a reduction in the effluent being produced. The average weight of the mature broodstock, for example, has more than doubled from 5kg in 1998 to 10.5kg in 2011, yet with a reduced feed conversion.

The alternative means of achieving optimum salmon growing conditions is to utilise artificial means. It is not uncommon for fish farms to employ technology to assist in production. This usually occurs when there is the need to produce more biomass than the natural water resource can sustain, or when the supply is unreliable in quantity and/or quality.

The risks associated with technology are high, and unique to aquaculture, owing to the specific requirements of fish in water. Where the survival of fish is controlled by technology, a system failure can put the commercial viability of the operation into question as a result of mortality, and can have a significant impact on fish welfare. Therefore, where there is a reliable supply of good quality water that is adequate to maintain production at commercially viable levels, King Salmon considers it is not sensible to replace that resource with technology which increases the risk to fish stocks. Use of the sustainable natural resource also fits with King Salmon's approach towards its product.

Finally, it is important to note that the impact on salmon stocks when the water supply drops below 4 m^3/s is significant. While the salmon do not die (King Salmon have contingencies to remove stock from the site if the flows drop too low), there are effects on production and fish welfare. These include:

- Impact on growth, resulting in an increase in feed conversion and therefore an increase in effluent; and

- Deterioration of environmental conditions as the water velocity in the ponds slows down. This increases the residual time for effluent in the ponds and ammonia in the water.

Given the above, King Salmon considers that the ability to use its currently consented water permit up to its full 4 m^3/s has benefits for the environment and fish welfare. As such, it considers that the maximum 4 m^3/s take sought in this application is limited to actual needs.

King Salmon considers that the renewal of the current water take regime will continue to ensure that sufficient environmental flows are retained in the river at all times but in particular at times of low flows, so as to maintain ecological health, natural, cultural, and recreational values.

Appendix 8 contains a list of conditions volunteered by King Salmon in seeking renewal of its water permit. These largely mirror the current conditions imposed under permit NN840174, and include means to ensure any adverse effects associated with the taking of water are avoided, remedied, or mitigated.

To address the ongoing issues of flow monitoring described earlier, including drowning of the flow recorder site, King Salmon considers it would be an appropriate step to look at relocating the flow measurement recorder from the discharge weir to the water intakes. In other words, the incoming flow into the farm would be monitored, as opposed to outgoing/discharged flow. The practicalities of this are currently being investigated. Some initial testing is underway to assess the suitability of the intake measurement point by comparing results with the current recorder. This involves a temporary water level recorder being set up in both intake channels and run for a period of one month with results compared with those for the current weir recorder.

Assuming results confirm the suitability of the intake measurement locations, then King Salmon would install permanent monitoring equipment at the intakes. However no alteration to the current condition of consent is required as a result of any relocation of the flow monitoring point, should it occur. Should the relocation not be possible a minor amendment is made to the current condition to address the drowning of the current take monitoring point by downstream water level increases.

Compared with the conditions of its current water permit, King Salmon seeks that the frequency that flow monitoring data is forwarded to TDC be changed from 3 monthly to annually. This reflects current practice, meaning that flow data is included in the annual report which also addresses discharge parameters. If deemed necessary, King Salmon would accept that monitoring data be provided on an “as required basis”, in addition to data being forwarded annually.

The conditions volunteered by King Salmon do not include provision for drift diving activity within the Springs River. The flow regime under the current permit in part resulted from the need to provide sufficient residual flows in the river to facilitate recreational drift diving. The current permit enables dive clubs to request a 25% reduction in the take on a daily basis for 30 minutes. However since 2006, such activity has been prohibited by the Department of Conservation to prevent the introduction of Didymo. Furthermore, the provision for requesting reduced flows has never been exercised by the dive clubs. Accordingly, King Salmon considers that no such provision is necessary and the condition requiring this has been deleted from the draft conditions presented in **Appendix 8**.

Finally, King Salmon seeks a term for the water permit of 25 years. This is on the basis that salmon farming has occurred from the site since 1976, and since 1984 a significant farm has been in operation. In particular King Salmon has demonstrated over the current 14 year consent period, that its water take has had no identified effect on the Springs River environment. There is no reason to impose a shortened term of consent given what is known about the environment and the effect of the salmon farm on that environment. King Salmon’s volunteered conditions include provision to provide Council with a written assessment of all monitoring, identifying any trends or problems, at the 8 and 16 year anniversaries of any permit granted.

9.3 Water Quality

As outlined in **section 6.0**, consent is sought to discharge salmon farming effluent via a settling pond to the Springs River; and to discharge salmon farming effluent via a bypass channel to the Springs River only when the settling pond is being emptied, cleaned, and maintained, in line with the parameters set out in the current discharge permits NN940175 and NN940183.

9.3.1 Visual Clarity in Springs River

Section 8.3 describes that the water from the Waikoropupu Springs is of remarkable visual clarity. Measurements of the visual clarity in the springs (63 m) are the highest reported for a freshwater system and are close to the theoretical maximum for optically pure water. Such high natural visual clarity in the Waikoropupu Springs results in the water in the Springs River also having high visual clarity relative to other rivers in New Zealand. Measurements of visual clarity in the upper Springs River have ranged from 11.4 to 41.5 m over the period 1997 to present. Even downstream of the discharge, water clarity in the Springs River remains very high by national standards. The median visual clarity reading at the current downstream measuring site is 14.2 m, with only 6% of readings being below 8.4 m. In comparison, the highest recorded visual clarity in the '100 Rivers survey' of water clarity in 96 New Zealand rivers was 10.8 m, with a median value of 3.2 m and a 95th percentile of 8.4 m.

The monitored reduction in visual clarity in the Springs River downstream of the discharge has generally complied with the maximum reduction in visual clarity allowed under existing permits (50%), and has exceeded 50% only on a few occasions. However, as discussed in **section 8.3**, these results are significantly influenced by various natural factors also occurring in the river. These include reduction in clarity as a result of in-channel processes within Springs River as well as the discharge from Bell Creek and other inflows. The measurements have also been undertaken within the mixing zone of the discharge, rather than downstream where the discharge is fully mixed within the river's flow.

The currently monitored reduction in visual clarity does not provide a direct measure of the actual reduction resulting from the salmon farm discharge alone. Nor does it provide a measure of the reduction in visual clarity once the discharge is fully mixed within the river. As summarised in **section 8.3**, recent research by Cawthron, using transmissometry (rather than black disc method), has identified that the farm discharge itself resulted in a reduction in visual clarity, after full mixing, during normal operations of just 11% (a reduction in visibility distance from 19.7 m upstream of the discharge to 17.5 m downstream). This is well within the Ministry for the Environment's guideline of 20% reduction in water clarity for Class A waters where visual clarity is an important characteristic.[8] In addition, observations by King Salmon and Cawthron personnel have confirmed that there is no conspicuous change in colour or visual clarity in Springs River, as a result of discharge under normal operations, once the discharge is fully mixed, 200 metres downstream within the river's flow.

Cleaning of the ponds and/or raceways currently occurs on a daily basis during the week, lasting for approximately 3 hours between 7am and 1pm. Cawthron's research has identified that during cleaning operations visual clarity, after full mixing, is reduced by up to 60% as a result of the farm discharge, with the median reduction being 55% (a reduction in visibility distance from 19.7 m upstream of the discharge to 8.8 m (median) and 8.0 m (maximum) downstream). Cawthron's survey also showed that the effects of the cleaning on downstream visual clarity are, however, short-lived, with clarity recovering rapidly within 30 minutes of cleaning ceasing.

Whilst 55-60% reduction in visual clarity as a result of the discharge is greater than the Ministry for the Environment's guideline of 20%, there are factors associated with the Springs River which mean that the effect of such a reduction is not as adverse as might be anticipated.

Firstly, the extremely high visual clarity of the upper Springs River (upstream from the farm) means that even a small amount of particulates contained in any discharge will result in a substantial percentage (%) change in visual clarity measurements. Even with a 50-60% reduction in visual clarity, the river downstream of the discharge during cleaning (at visibility distances of 8-9 m) is still an extremely clear river by national standards (c.f. the 95th percentile of 8.4 m for visual clarity in the 100

[8] Water Quality Guidelines No 2 – Colour and Clarity, Ministry for the Environment, June 1994.

New Zealand rivers' survey referred to above). The 20% reduction guideline for noticeable change in visual clarity does not mean that an adverse change will necessarily occur with a greater reduction, particularly where the river remains very clear downstream of the discharge, because that is not a guideline for absolute change but rather focuses on *noticeable* change, and Springs River still appears to observers as a very clear river.

Secondly, immediately downstream of the farm, the Springs River starts to change its existing character (irrespective of the farm). Bell Creek joins the Springs River at this point, and immediately downstream again other inflows also occur. Whilst the waters of the Springs River upstream of the farm are principally those sourced from the Waikoropupu Springs[9], with their remarkable visual clarity, and Bell Creek drains the surrounding hill catchments with their range of land uses (including farming and forestry). From this point downstream, the Springs River is influenced by a greater range of catchment environments and land uses, bringing a wider range of influences over river water clarity, compared with the river upstream of the farm. Accordingly, changes in river water clarity downstream, as a result of the farm discharge, are not likely to be as noticeable amongst these wider catchment influences.

King Salmon personnel have observed the mixing of the discharge waters during cleaning operations. This is not easy to observe, but is able to be achieved from King Salmon's land along the true right bank downstream from the discharge outlet. Whilst there was a noticeable change in visual clarity observable in the plume of water discharging from the outlet itself and immediately downstream, at 200m downstream the plume appeared to be fully mixed into the river's flow and there was no visually apparent change in water clarity as a result of the discharge.

King Salmon is also applying to discharge salmon farm effluent via a bypass channel to the Springs River, when the settling pond is being emptied, cleaned, and maintained. This only occurs very infrequently, with consent being sought for a maximum of 24 hours in any 6 month period. Although solids deposited against the bypass channel gate are removed prior to the opening of the discharge channel in order to avoid discharge of these solids into the river, there is still a temporary discharge of residual solids immediately after the opening of the bypass channel gate. However, this clears very quickly and once the bypass channel is flowing properly, the change in visual clarity downstream is not noticeably different from that occurring under normal operating conditions. It should be noted that cleaning of ponds and raceways is not permitted to occur during use of the bypass discharge.

Proposed new conditions, to directly target the effect of the farm discharge on visual clarity in the Springs River, are discussed in **section 9.3.5** below.

9.3.2 Visible Solids in Springs River

As discussed in **section 8.3,** at no time on any of the sampling occasions during the life of the current consents, have any visible deposits been observed on the bed of Springs River that may be attributable to the farm discharge. This situation is not likely to change with the proposed continuation of the discharges.

9.3.3 Macroinvertebrate Communities

As also discussed in **section 8.3,** whilst MCI monitoring of in-stream health throughout the life of the current consents has identified year to year variation, monitoring data suggests there has been no change in the impact of the farm operations on the Springs River. As discussed in the Cawthron report (**Appendix 5)**, although the mean MCI value at Site 5 (located immediately below the discharge and within the path of the settling pond outflow) is significantly lower than at Site 3 (above the discharge) indicating an ecological impact of the discharge within the mixing zone, this impact is

[9] Springs River downstream of the Springs is also fed by Fish Creek coming in on the true right bank.

localised and does not extend as far downstream as Site 7 (located further downstream past the Bell Creek confluence). The mean MCI value at Site 7 is significantly higher than at Site 5. In addition, there has been an improvement in MCI at Site 5 since 2000, and MCI values at Site 7 remain higher than Site 3, although this could be influenced by invertebrates drifting from Bell Creek which has high MCI values. The proposed continuation of the discharges from the salmon farm are not considered to be likely to result in any further changes to the macroinvertebrate communities in the Springs River nor to general in-stream ecological health in the river.

9.3.4 Other Discharge Water Quality Parameters

As described in **section 5.0** current permit conditions for the discharge require the following water quality parameters to be monitored and the following standards to be achieved:

- Suspended solids not to exceed 10g/m^3
- 5-day biochemical oxygen demand not to exceed 3g/m^3
- Dissolved oxygen not to be less than 6g/m^3.

As outlined in the Cawthron Report (**Appendix 5**), during normal operating conditions, measured suspended solids (SS) in the discharge have generally been low, commonly less than 1g/m^3. The 10g/m^3 standard has only been breached on one monitoring occasion during the life of the current consents. This reading was unable to be explained and retesting one week later showed low levels of SS again. Cawthron surveyed SS during cleaning operations in February 2011 (**Appendix 6)** and total SS remained at or below 2g/m^3 throughout the cleaning operation and still well within the current permit conditions.

As also discussed in the Cawthron Report (**Appendix 5**), during normal operating conditions, biochemical oxygen demand (BOD) of the discharge was generally low over the period from 2004 to 2010, with most measurements being less than 1g/m^3 and all below the current permit standard of 3g/m^3. Cawthron also measured BOD in the discharge during cleaning operations in February 2011 (**Appendix 6**), with BOD being below 1g/m^3 in all samples and never exceeding the current permit standard.

The Cawthron report (**Appendix 5**) also notes that recorded dissolved oxygen concentrations in the discharge during normal operations, for the 2 years from February 2008 to January 2010, were all greater than the minimum standard of 6 g/m^3 and the lowest value recorded was 8.86 g/m^3. Dissolved oxygen concentrations measured in the discharge during cleaning operations in February 2011 (**Appendix 6)** were quite high (8.94-10.36g/m^3) and did not approach the minimum standard in the current permit conditions.

King Salmon considers it is appropriate to continue to monitor and achieve the same water quality discharge standards under the proposed consent renewals.

9.3.5 Proposed Discharge Conditions

Appendix 8 contains a list of conditions volunteered by King Salmon in seeking renewal of its discharge permits. These largely mirror the current conditions imposed under permits NN940175 and NN940183, and include means to ensure any adverse effects associated with the taking of water are avoided, remedied, or mitigated. However, King Salmon seeks the following amendments to its current permit conditions.

As with the water take and use permits, King Salmon seeks a term for the discharge permits of 25 years, with provision to provide Council with a written assessment of all monitoring, identifying any trends or problems, at the 8 and 16 year anniversaries of any permit granted.

On the basis of the analysis undertaken by Cawthron, King Salmon wishes to change the method it uses to monitor changes in water clarity in the Springs River as a result of the discharges. Cawthron has recommended the use of transmissometry to measure visual clarity in the Springs River upstream of the discharge and in the discharge itself, and then to use the appropriate equation in the Ministry for the Environment Guidelines[10] to calculate the visual clarity downstream of the discharge after full mixing.

It is proposed to move away from the current measurements using black discs because of the problems described in **section 9.3.1** above regarding the difficulty of separating the actual effects of the discharge itself on visual clarity from the other natural influences on clarity from in-stream processes, Bell Creek and other inflows. The current black disc method cannot separate out the effects of the discharge itself, whereas this can be achieved by the use of transmissometry resulting in a direct analysis of the effect of the discharge. This is considered a more certain, reliable and defensible measure of the effect of the discharge on visual clarity in the Springs River given its exceptionally clear water character.

In addition, there are practical and safety difficulties with using the black disc method in Springs River and in a discharge of 4 m/s^3. It is not possible to obtain safe access into the Springs River at the point downstream of the discharge where full mixing has occurred (200m downstream), as the river is too deep, fast flowing, dangerous and the adjacent bank is steep. It is also not possible to obtain a sufficient continuous path of water to measure the visible distance with a black disc in the discharge channel itself. The high flow in the discharge channel also makes standing in the channel to take black disc measurements unsafe. However, transmissometry requires only small quantities of water and does not require standing in the water stream to obtain the measurements. It is, therefore, a more practical and safe method in the circumstances of this discharge into the Springs River.

With the use of transmissometry, more specific and direct standards can be included in the conditions for the maximum effect of the discharge on visual clarity in Springs River. On the basis of the research by Cawthron, King Salmon seeks to achieve a decrease in visual clarity as a result of the discharge of no more than 20% during normal operations and no more than 60% during cleaning. During the use of the bypass, King Salmon considers that a maximum decrease in visual clarity of 20% can be achieved, once flow through the bypass channel has been fully established. However, King Salmon volunteers a restriction on the frequency of the use of the bypass channel discharge to a total period of not more than 24 hours in any 6 month period.

King Salmon seeks to remove the restrictions on the timing of cleaning operations. These restrictions were imposed on the current permits to cater for drift diving which is currently prohibited. These conditions are no longer considered necessary.

Additional monitoring during pond and raceway cleaning operations is proposed.

King Salmon currently operates a protocol agreement with the Council in the case of any non-compliance with a condition being detected. Under the current agreement with the Council, copies of non-compliance results are sent to the Council as they occur, with King Salmon contacting Council by phone to acknowledge the non-compliance. Re-testing is then undertaken within seven days to confirm if it is an ongoing problem, so that remedial action can be taken. King Salmon volunteers conditions reflecting this current protocol.

Given the lack of any significant change in the MCI monitoring results throughout the life of the current consents, and the lack of any adverse change to macroinvertebrate communities as a result of the discharge, King Salmon seeks to change the frequency of the MCI monitoring to every 3 years, rather than annually.

[10] Water Quality Guidelines No 2 – Colour and Clarity, Ministry for the Environment, June 1994.

10.0 ALTERNATIVES

The 4th Schedule to the Resource Management Act 1991 requires a consideration of alternatives where the adverse effects likely to arise from the activity may be significant. Given the effect of the discharge on water clarity and its potential to be significant, particularly during cleaning, it is appropriate for this AEE to describe any alternative methods of discharge, including discharge into any other receiving environment considered.

King Salmon has previously considered alternative options for addressing its discharge and these have been revisited in preparing the current applications.

Currently the farm relies on natural settlement within the settling pond as the means of treatment prior to discharge. King Salmon acknowledges this method is only partially effective, with approximately 15% of contaminants being removed by the settling pond. A March 2004 report by Cawthron for King Salmon **(Appendix 9)**, noted that a high effluent load relative to pond volume, and the positive or neutrally buoyant nature of the suspended solids, contributed to the inefficiency of the settling pond in removing contaminants.

Furthermore the report suggested that, although there is unlikely to be a single cause of any reduced downstream visual clarity, it is likely to be a result of low density amorphous organic matter (including uneaten feed and fish faecal matter). This is as opposed to phytoplankton and other algae originating from the farm ponds or settling ponds. Analysis of the size of this amorphous organic matter and algae present in photomicrographs of water samples taken in the discharge indicate that much of the amorphous organic matter is very small.

These findings suggest that practical treatment options are limited due to the volume of water in the discharge in addition to the small size and relatively low loadings of suspended particles in the discharge. Nevertheless, alternatives that have been considered by King Salmon include the following:

1. Removal of effluent from individual ponds by mechanical means and discharge to land.
2. Removal of effluent at the head of the settlement pond by mechanical means and discharge to land.
3. Create a natural biofilter in the settlement pond that will remove more effluent than at present.
4. Use flocculants in the settlement pond and then dredge this out more frequently.

Option 1 involves removal of effluent from the ponds by mechanical means such as suction cleaning. This is different from the current method of water-blasting the ponds, which results in effluent being flushed through the discharge. While this method would prevent effluent being flushed out during cleaning, it would not prevent the continuous background discharge of effluent from each pond during normal operations. Implementation of such an option would also involve discharge of contaminants to land from the organic material removed. This in itself would require a resource consent to be obtained.

Option 2 would result in the continuous treatment of 100% of the water flow through the farm. Modern drum filters can cope with up to 1 m^3/s of water, and so five filters would be required to cope with flow rates through the farm (allowing one to be out for maintenance at any time). This option has considerable costs with each drum filter costing approximately $120,000 each plus installation. However, more importantly, King Salmon has doubts as to the effectiveness of such treatment at Takaka owing to the small size of the suspended particles in the discharge which are a significant contributor to downstream reductions in visual clarity.

Option 3 would involve the installation of a natural biofilter in the settlement pond. However King Salmon is not aware of the existence of any biofilter that would be effective with flow rates of up to 4 m^3/s, and does not believe it would physically remove 100% of the effluent loading.

Flocculants under Option 4 have been investigated by King Salmon in the past. However the velocity of the flow prevents this from working effectively.

Of all of these options, Option 2 using mechanical treatment it the most comprehensive option as it would allow 100% of the effluent from the farm to be treated, as opposed to the other options. However, as discussed above, King Salmon has doubts as to the effectiveness of mechanical treatment and whether it would have a substantial impact on improving the quality of the discharge and the river environment downstream. This is owing to the small size of the suspended particles in the discharge which are unlikely to be captured by the drum filters currently available.

Accordingly, due to the uncertainty around the effectiveness of the alternative measures currently available, King Salmon believes that any benefits from implementing such measures would not currently outweigh the costs. Furthermore, as outlined in the preceding assessment of effects, King Salmon considers that the impact of its current discharge on the downstream environment is minor and does not warrant the anticipated level of expenditure that would be required in order to achieve a measurable benefit. Nevertheless, King Salmon intends to regularly reassess alternative options to treat its discharge as technology improves, thereby offering new possibilities.

11.0 CONSULTATION

In preparing the current applications, New Zealand King Salmon has undertaken consultation with a number of surrounding landowners/occupiers, agencies, and local iwi. A record of those consulted and any issues raised is as follows.

11.1 Neighbouring and Other Properties in the Locality

Figure 6 below outlines the consultation undertaken to date with neighbouring landowners and occupiers. **Figure 7** outlines the consultation undertaken to date with other wider Pupu Valley landowners and occupiers.

Figure 6 – Consultation Undertaken with Neighbouring Landowners/Occupiers

Name	Address	Nature of Consultation	Issues Raised
Graham Ball and Michelle Osbourne	597 Pupu Valley Road Owns all surrounding farmland. Mr Ball is the President of GB Federated Farmers	Phone conversation	None raised
Gwen Ball	383 Pupu Valley Road	Phone conversation	Seeks tar-sealing of road. Concerned about siren noise from flow alarm.
Nelson and Ranee Bee	246 Pupu Valley Road	Phone conversation	None raised
Nigel and Dawn Shearer	250 Pupu Valley Road	Meeting and subsequent phone conversation	Concerned about siren noise from flow alarm. Seeks long term noise reduction from alarm system.
Phil Thomas and Kerryn Easterbrook	254 Pupu Valley Road	Meeting	Concerned about siren noise from flow alarm.
Gordon and Ann Fletcher	156 Pupu Valley Road	Phone conversation	None raised
Carolyn Rose	SH 60, Puramahoi, Takaka, RD2	Phone conversation	None raised

Figure 7 – Consultation Undertaken with other Pupu Valley Landowners and Occupiers

Name	Address	Nature of Consultation	Issues Raised
Chip and Hess Williams	639 Pupu Valley Road	Phone conversation	None raised
Andy and Ally Gray	623 Pupu Valley Road	Phone Conversation	None raised
John and Theresa Balck	54 Balck Road	Discussion	None raised
Gary and Michelle Balck	77 Balck Road	Phone conversation	None raised
Kevin Smith	152 Pupu Valley Road	Phone conversation	None raised
Jerry and Judy Cerny	147 Pupu Valley Road	Discussion	None raised
Bob and Cynthia Sampson	146 Pupu Valley Road	Meeting	None raised
Vlasta and Jana Mrazek	132 Pupu Valley Road	Phone conversation	None raised
Shane and Maree Fleming	118 Pupu Valley Road	Phone conversation	None raised
Bernal Reilly	Maori Road	Phone conversation	None raised
Deborah Price	639 Pupu Valley Rd, Takaka	Phone conversation	None raised
Peter & Sara Howard	52 Frasers Rd, Rangihaeata	Phone conversation	None raised

A number of those consulted have indicated that they wish to see a copy of the application. King Salmon will provide a copy of the application to those who have indicated they wish to receive one, at the same time as the application is lodged with Tasman District Council.

With respect to the issues raised by the parties above, King Salmon respectfully considers that tar sealing of the road is not a matter that is related to the effects generated by these consent applications. Nevertheless King Salmon is also concerned at the amount of dust that arises from the road and would be happy to engage in further dialogue outside of the consent process in order to address such issues with the relevant authority where possible.

With respect to the audible alarm, which is an issue raised by three of those consulted, this is related to alarms which alert staff when there is an issue as to the flows and water levels in individual ponds and raceways. Currently this audible alarm sounds periodically at all times day and night. King Salmon is currently in the process of installing an inaudible alarm system that will operate outside of working hours. This will be in the form of a remote paging system alerting staff of flow and water level issues. This new system should hopefully address the noise issues of concern to these landowners.

11.2 Stakeholders / Other Agencies

A meeting was held with John Mason of the Department of Conservation on the 2nd of August 2010. A phone conservation was also held with Lawson Davey of Fish & Game. Neither of these agencies have raised any concerns regarding the current operation of the farm or the consent process.

A phone discussion and a subsequent site meeting on the 23rd of February 2011 was held with representatives of the Golden Bay Branch of the Royal Forest and Bird Protection Society Incorporated, Ms Jo-Anne Vaughan, Murray Gavin, and Bob Kennedy. Matters discussed during the course of the site meeting were as follows:

- Limitations on the size of fish to be reared or biomass held.
- Effluent discharge and compliance.
- Monitoring of the discharge during pond cleaning.

In regard to these matters, King Salmon believes that no restrictions on biomass or the size of fish held is necessary. Regardless of the amount of fish biomass held, King Salmon is currently and will continue to be required to comply with a range of consent parameters as to the quality of the farm discharge. Compliance with these parameters will ensure that any effects are appropriately avoided, and mitigated, notwithstanding the quantum of fish biomass held.

As outlined in **section 9.0**, King Salmon has agreed to the imposition of a condition requiring monitoring during pond cleaning.

King Salmon has not consulted with any of the dive or underwater clubs that previously used the Springs River for recreational drift diving activity. This is owing to such activity being prohibited by the Department of Conservation. Accordingly King Salmon no longer considers them to be relevant interested or affected parties for the purposes of this application.

11.3 Iwi / Tangata Whenua

King Salmon was invited to meet with Manawhenua Ki Mohua at their monthly meeting on the 21st of October 2010 at the Onetahua Marae in Golden Bay, to discuss the resource consent renewals for the farm. Manawhenua Ki Mohua represents three local Iwi: Ngati Rarua, Ngati Tama and Te Atiawa.

Matters raised during the course of the meeting included:

- Whether reductions in the water taken and discharged may be possible given changes to the farm operation;
- Siren noise from the flow alarm;
- Whether the preparation of a cultural impact assessment (CIA) as part the application is required;
- Investigation of the possibility of using the power supply to the farm to provide power at the springs car park.

At the conclusion of the meeting it was agreed that the next step would be to hold a site meeting to be to discuss matters further. This meeting has been set down for the 4th of April 2011.

Whilst outside the ambit of these consent applications, the potential provision of power to the car park is something that King Salmon is willing to explore further with iwi and further discussions on the feasibility of this idea will be held. The matters of the amount of take required for the health of the salmon has been addressed in **section 9.0** and the noise from the flow monitor alarm is currently being addressed as discussed above.

At the previous meeting, Manawhenua Ki Mohua were uncertain as to the need to prepare a Cultural Impact Assessment to support the current application. Whether a Cultural Impact Assessment is to be prepared is to be discussed at the upcoming site meeting on the 4th of April 2011.

11.4 Council / Community Board

An informal discussion was held with Mik Symmons of the Golden Bay Community Board, who advised that the Board only gets involved in new applications where there may be a local conflict. No particular issues were raised regarding the current operation of the farm or the reconsenting process.

12.0 CONCLUSION

King Salmon seeks resource consents to take and use water from downstream of the Waikoropupu Springs, and discharge water and contaminants to the Springs River, Takaka. The consents sought are associated with the operation of its existing salmon farm located downstream of the Waikoropupu Springs. The applications essentially seek renewal of the existing water and discharge permits under which the farm currently operates.

As outlined in this AEE, the terms of the consent sought to take and use water mirror those of the current consent. Given that no adverse effects have been identified over the life of the current water permit, King Salmon considers that the consent sought will continue to ensure that sufficient environmental flows are retained in the river at all times so as to maintain ecological health, natural, cultural, and recreational values.

In terms of the discharge consents sought, this AEE has identified that the discharge during normal operations will result in a no more than 20% reduction in downstream visual clarity after full mixing. This is both during normal operations and during the infrequent use of the bypass channel. Furthermore while there is expected to be a 55-60% reduction in visual clarity downstream during pond cleaning, there are factors associated with the Springs River which mean that the effect of such a reduction is not as adverse as might be anticipated. For instance Cawthron have noted that the extremely high visual clarity of the upper Springs River (upstream from the farm) means that even a small amount of particulates contained in any discharge will result in a substantial percentage change in visual clarity measurements. Furthermore even with a 50-60% reduction in visual clarity, the river downstream of the discharge during cleaning (at visibility distances of 8-9 m) is still an extremely clear river by national standards

During the life of the current consents no visible deposits have been observed on the bed of Springs River that may be attributable to the farm discharge. Whilst MCI monitoring of in-stream health throughout the life of the current consents has identified year to year variation, monitoring data suggests there has been no change in the impact of the farm operations on the Springs River. Accordingly the proposed continuation of the discharges from the salmon farm are not considered to be likely to result in either visible downstream deposits of solids or any further changes to the macroinvertebrate communities in the Springs River.

Overall, this AEE concludes that the consents sought by King Salmon are unlikely to result in any more than minor adverse environmental effects. A range of conditions have been volunteered by King Salmon which include a volunteered no more than 20% reduction in downstream visual clarity during normal operations. Changes are also volunteered to the current monitoring regime, including introducing water quality monitoring during pond cleaning, and requirements for reporting and retesting in the event of water quality non-compliance occurring.

Appendix 1 - Completed Application Form

Appendix 2 - Certificate of Title

Appendix 3 - Existing Water and Discharge Permits.

Appendix 4 - Envirolink – Examination of Flow data at Bubbling Springs, March 2011.

Appendix 5 - Cawthron - Review of Water Quality at the Pupu Valley Salmon Hatchery, January 2011.

Appendix 6 - Cawthron - Review of Water Quality at the Pupu Valley Salmon Hatchery, February 2011.

Appendix 7 - Stark Environmental – New Zealand King Salmon Ltd – Biomonitoring at Waikoropupu Springs – February 2011.

Appendix 8 - List of Conditions Volunteered by New Zealand King Salmon.

Water Take and Use

1. **Records to be Kept**
   The consent holder shall keep such records of water flows to enable compliance with condition 5 to be monitored, and shall, if requested, supply this information to the Council. If it is necessary to install measuring devices to enable satisfactory records to be kept, the consent holder shall, at its own expense, install, operate and maintain suitable devices.

   In particular, the consent holder shall at its expense continuously monitor and record, electronically, water flows to standards agreed with Council, and supply the data to Council at least annually on the anniversary of the grant of this consent, to ensure compliance with conditions 5 to 6 of this consent.

   Results of data are to be held in a form that can be provided to the Council within 48 hours of any request being received.

2. **Access for Council Staff and Agents**
   Access by the Council or its officers or agents to the land subject to this consent is reserved pursuant to section 332 of the Resource Management Act 1991.

3. **Review of Conditions**
   The conditions of this consent may be reviewed in accordance with sections 127 to 133 of the Resource Management Act 1991, within four weeks of the eighth and sixteenth anniversaries respectively of the granting of this consent, for the purposes of:

   - dealing with any adverse effect on the environment arising from the exercise of the consent;
   - requiring the consent holder to adopt the best practicable option to remove or reduce any adverse effect on the environment;
   - reviewing the monitoring requirements placed on this consent;
   - achieving consistency with relevant policies and rules of a future regional plan covering taking of water or discharging of water or contaminants.

   In particular, within six months before the eighth and sixteenth anniversaries respectively of the granting of these consents, the consent holder shall provide the Council with a written analysis and summary of all monitoring results received since either the grant of consent or (in the case of the sixteenth anniversary report) since the eighth anniversary report, identifying any trends or problems, so that the need for a review of conditions can be determined by Council (including review of quantities of water taken and discharged, and the minimum flow requirements and any methods of taking and discharging).

4. **Malfunctions, Complaints and Farm Works**
   The consent holder shall keep a record of any malfunctions or complaints relating to the exercise of this permit, and any action taken. This record shall be supplied to Council upon request.

   The consent holder shall notify Council's District Resource Analyst or his/her staff, and obtain any necessary resource consents, prior to carrying out excavation or construction works in any channel, pond, intake channel, riverbank or bed.

5. **Restrictions on Flow Take**
If the flow in the Springs River above the salmon farm intakes is between 5.3 and 8.2 m^3/s, the maximum take shall be reduced from 4.0 m^3/s linearly down to 1.1 m^3/s, as determined by the following equation:

MAXTAKE = RIVER FLOW ABOVE INTAKES - 4.2 m^3/s

If the flow in the Springs River above the intake channels is less than 5.3 m^3/s, the maximum take shall be 1.1 m^3/s.

For monitoring compliance with this condition, Springs River flow above the intakes may be calculated as [Flow at Springs River recorder] plus [Flow through salmon farm].

Compliance with the flow restrictions of this permit shall be deemed to have occurred if recorded flow through the salmon farm is no more than 5% more than the maximum take permitted at any one time.

Compliance with the flow restrictions of this permit shall also be deemed to have occurred where it can be demonstrated that high flows in the Springs River have flooded the flow recorder at the discharge weir, where flows are measured at the weir.

6. **Take is Limited to Actual Needs**
No water taken is permitted to bypass the salmon farm facilities unused, and no water taken shall exceed the minimum required for the salmon held at that time.

7. **Monitoring of Flow through Salmon Farm**
All monitoring shall be carried out at the permit holder's expense. The results of all monitoring shall be summarised and reported in writing annually, and audited at the permit holder's expense, by the Tasman District Council, except that the Council shall be informed within 72 hours of any results which breach consent conditions and the steps taken to remedy the situation.

The annual report shall include the following:

- A description of the consent condition requirements;
- A description of the methods used to monitor flows;
- A description of flow monitoring and compliance. Flows for the Main Spring and water take are to be plotted in a hydrograph against the maximum permissible take. Reporting is to be at 2-hourly intervals, +/- 5%;
- Reasons for any non-compliance that occurred.

Discharge via Settling Pond

1. **Records to be Kept**
The consent holder shall keep such records to enable compliance with conditions 5 – 8 to be monitored, and shall, if requested, supply this information to the Council. If it is necessary to install measuring devices to enable satisfactory records to be kept, the consent holder shall, at their own expense, install, operate and maintain suitable devices.

2. Access for Council Staff and Agents

Access by the Council or its officers or agents to the land subject to this discharge permit is reserved pursuant to section 332 of the Resource Management Act 1991.

3. Review of Conditions

The conditions of this consent may be reviewed in accordance with sections 127 to 133 of the Resource Management Act 1991, within four weeks of the eighth and sixteenth anniversaries respectively of the granting of this consent, for the purposes of:

- dealing with any adverse effect on the environment arising from the exercise of the consent;
- requiring the consent holder to adopt the best practicable option to remove or reduce any adverse effect on the environment;
- reviewing the monitoring requirements placed on this consent;
- achieving consistency with relevant policies and rules of a future regional plan covering taking of water or discharging of water or contaminants.

In particular, within six months before the eighth and sixteenth anniversaries respectively of the granting of the consent, the consent holder shall provide Council with a written analysis and summary of all monitoring results received since either the grant of consent or (in the case of the sixteenth anniversary report), since the eighth anniversary report, identifying any trends or problems, so that the need for a review of conditions can be determined by Council (including review of quantities of water taken and discharged, and the minimum flow requirements and any methods of taking and discharging).

4. Malfunctions, Complaints, and Farm Works

The consent holder shall keep a record of any malfunctions or complaints relating to the exercise of this permit, and any action taken. This record shall be supplied to Council upon request.

The permit holder shall notify Council's District Resource Analyst or his/her staff, and obtain any necessary resource consents, prior to carrying out excavation or construction works in any channel, pond, intake channel, riverbank or bed.

5. Discharge Quality

The effluent discharge shall comply with the following water quality standards:

(i) The concentration of suspended solids shall not exceed 10 grammes per cubic metre, and for monitoring purposes both volatile suspended solids and fixed suspended solids shall be measured;
(ii) The 5-day biochemical oxygen demand shall not exceed 3 grammes per cubic metre;
(iii) The dissolved oxygen concentration shall not be less than 6 grammes per cubic metre.

6. Receiving Water Quality

The effluent discharge shall not result in a percentage decrease in visual clarity in the Springs River downstream of the discharge which exceeds the following, after full mixing, when compared with the visual clarity in the Springs River immediately upstream of the discharge:

(i) During normal operations – 20%
(ii) During fish pond and/or raceway cleaning - 60%.

Visual clarity, after full mixing downstream of the discharge, shall be calculated based on the following equation from Ministry for the Environment (1994)[11]:

$y_d = (Q + q)/\{(Q/y_u)+(q/y_{eff})\}$

where:

Q = Springs River flow upstream of discharge

q = discharge flow

y_d = visual clarity of river downstream of discharge (after full mixing)

y_u = measured visual clarity of Springs River upstream of discharge

y_{eff} = measured visual clarity of salmon farm effluent discharge

Visual clarity of the Springs River immediately upstream of the discharge, and of the salmon farm effluent discharge, is to be measured using transmissometry.

Beam attenuation coefficients (c) measured using transmissometry are to be converted to visual clarity using equation 8 of Davies-Colley & Smith (2001)[12] (visual clarity = 4.8/c) if a green wavelength (~550 nm) transmissometer is used; or the equation of Zanefeld & Pegau (2003)[13] (visual clarity=3.7/(c*1.18+0.081)) if a red wavelength (~650 nm) transmissometer is used.

7. Settling Pond Maintenance

The settling pond shall be operated and maintained such that visible deposits of solids do not occur in the Springs River downstream of the discharge. A written statement regarding compliance with this condition shall be provided in meeting the requirements for discharge monitoring outlined in condition 9 below.

8. Use of Chemicals in Water

The consent holder shall keep and make available to Council upon request records of any chemicals, antibiotics or additives which may be applied to or reach waters discharging from the salmon farm, and shall only use such substances as are commonly accepted for use in fish farming and only at rates up to those specified in manufacturers' directions

9. Discharge Monitoring

Monitoring for compliance with conditions 5 to 7 shall be carried out at least every two months during normal operations at the permit holder's expense.

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[11] Water Quality Guidelines No 2 – Colour and Clarity, Ministry for the Environment, June 1994

[12] Davies-Colley RJ, Smith DG 2001: Turbidity, suspended sediment, and water clarity: a review. *Journal of the American Water Resources Association* **37**: 1085-1101

[13] Zaneveld RJ, Pegau W 2003. Robust underwater visibility parameter. *Optics Express* **11**: 2997-3009.

In addition, monitoring for compliance with condition 6 shall be undertaken once per year during pond or raceway cleaning operations. Monitoring shall occur during and up until 1 hour after cleaning operations have been completed.

Where non-compliance with any of the parameters under conditions 5 to 7 are detected, the permit holder is to inform the Tasman District Council's Resource Analyst immediately, and provide results of the non-compliance within 5 working days of the non-compliance being detected.

Resampling of the relevant parameter/s are to be undertaken within 7 working days to confirm compliance. The Council shall be informed of the results and any remedial action undertaken by the consent holder.

The results of all monitoring for compliance with conditions 5 to 7 shall be summarised and reported in writing annually, and audited at the permit holder's expense, by the Tasman District Council.

The annual report shall include the following:

- A description of the consent condition requirements; and
- A description of the methods used to monitor water quality; and
- A description of water quality monitoring and compliance; and
- Reasons for any non-compliances that occurred.

The permit holder shall continue monitoring of the ecological health of the Springs River above and below the discharge by monitoring Macroinvertebrate Community Index and a visual inspection every 3 years. The type, frequency and sites of ecological monitoring may be changed at the discretion of Council's District Resource Analyst but shall not be reduced to less than monitoring every 3 years.

Discharge via Bypass

1. Records to be Kept

The consent holder shall keep such records to enable compliance with conditions 5 – 7 to be monitored and shall, if requested, supply this information to the Council. If it is necessary to install measuring devices to enable satisfactory records to be kept, the consent holder shall, at its own expense, install, operate and maintain suitable devices.

2. Access for Council Staff and Agents

Access by the Council or its officers or agents to the land subject to this discharge permit is reserved pursuant to section 332 of the Resource Management Act 1991.

3. Review of Conditions

The conditions of this consent may be reviewed in accordance with sections 127 to 133 of the Resource Management Act 1991, within four weeks of the eighth and sixteenth anniversaries respectively of the granting of this consent, for the purposes of:

- dealing with any adverse effect on the environment arising from the exercise of the consent;
- requiring the consent holder to adopt the best practicable option to remove or reduce any adverse effect on the environment;
- reviewing the monitoring requirements placed on this consent;
- achieving consistency with relevant policies and rules of a future regional plan covering taking of water or discharging of water or contaminants.

In particular, within six months before the eighth and sixteenth anniversaries respectively of the granting of the consent, the permit holder shall provide Council with a written analysis and summary of all monitoring results received since either the grant of consent or (in the case of the sixteenth anniversary report), since the eighth anniversary report, identifying any trends or problems, so that the need for a review of conditions can be determined by Council (including review of quantities of water taken and discharged, and the minimum flow requirements and any methods of taking and discharging).

4. Malfunctions, Complaints, and Farm Works

The consent holder shall keep a record of any malfunctions or complaints relating to the exercise of this permit, and any action taken. This record shall be supplied to Council upon request.

The consent holder shall notify Council's District Resource Analyst or his/her staff, and obtain any necessary resource consents, prior to carrying out excavation or construction works in any channel, pond, intake channel, riverbank or bed.

5. Discharge Quality

The effluent discharge, no sooner than 15 minutes after the bypass is opened, shall comply with the following water quality standards:

(i) The concentration of suspended solids shall not exceed 10 grammes per cubic metre, and for monitoring purposes both volatile suspended solids and fixed suspended solids shall be measured;
(ii) The 5-day biochemical oxygen demand shall not exceed 3 grammes per cubic metre;
(iii) The dissolved oxygen concentration shall not be less than 6 grammes per cubic metre.

6. Receiving Water Quality

Following the establishment of full flow in the bypass channel, the effluent discharge shall not result in a percentage decrease in visual clarity in the Springs River downstream of the discharge which exceeds the following, after full mixing, when compared with the visual clarity in the Springs River immediately upstream of the discharge:

(i) During bypass use – 20%

Visual clarity after full mixing downstream of the discharge shall be calculated based on the following equation from Ministry for the Environment (1994)[14]:

$$y_d = (Q + q)/\{(Q/y_u)+(q/y_{eff})\}$$

where:

Q = Springs River flow upstream of discharge

q = discharge flow

y_d = visual clarity of river downstream of discharge (after full mixing)

[14] Water Quality Guidelines No 2 – Colour and Clarity, Ministry for the Environment, June 1994

y_u = measured visual clarity of Springs River upstream of discharge

y_{eff} = measured visual clarity of salmon farm effluent discharge

Visual clarity of the Springs River immediately upstream of the discharge, and of the salmon farm effluent discharge, is to be measured using transmissometry.

Beam attenuation coefficients (c) measured using transmissometry are to be converted to visual clarity using equation 8 of Davies-Colley & Smith (2001)[15] (visual clarity = 4.8/c) if a green wavelength (~550 nm) transmissometer is used; or the equation of Zanefeld & Pegau (2003)[16] (visual clarity=3.7/(c*1.18+0.081)) if a red wavelength (~650 nm) transmissometer is used.

7. Restrictions on Use of Bypass

This permit shall only be exercised:

- while the settling pond is being cleaned or maintained; and
- for a total period of not more than 24 hours in any 6 month period; and
- after any solids deposited against the bypass channel gate have been removed to avoid discharge into the river; and
- while there is no cleaning of raceways or ponds occurring.

8. Discharge Monitoring

Records shall be kept of the dates and duration of discharges via the bypass channel.

Monitoring for compliance with conditions 5 and 6 shall be carried out during bypass use at the permit holder's expense.

Where non-compliance with any of the parameters under conditions 5 and 6 are detected, the permit holder is to inform the Tasman District Council's Resource Analyst immediately, and provide results of the non-compliance within 5 working days of the non-compliance being detected.

The results of all monitoring for compliance with conditions 5 and 6 shall be summarised and reported in writing annually, and audited at the permit holder's expense, by the Tasman District Council.

The annual report shall include the following:

- A description of the consent condition requirements; and
- A description of the methods used to monitor water quality; and
- A description of water quality monitoring and compliance; and
- Reasons for any non-compliances that occurred.

[15] Davies-Colley RJ, Smith DG 2001: Turbidity, suspended sediment, and water clarity: a review. *Journal of the American Water Resources Association* **37**: 1085-1101

[16] Zaneveld RJ, Pegau W 2003. Robust underwater visibility parameter. *Optics Express* **11**: 2997-3009.

Appendix 9 - Cawthron – Investigation of Water Clarity Reduction Associated with Discharge from the New Zealand King Salmon Hatchery into the Waikoropupu River – March 2004.

Appendix 10 – Photos of Takaka Salmon Farm