Minutes of Fish Barrier Workshop

Held 27 May 2009 at DOC Waikato Area Office

Attendees
Blair Thornburrow(SKM), Neville Laverack (SKM), Brendan Hicks (University of Waikato), Adam Daniel (University of Waikato), Dave Rowe (NIWA), Dave West (DOC), Mike Lake (DOC), Amy McDonald (DOC), John Gumbley (DOC) , Bruno David (EW), Keri Neilson (EW), David Speirs (EW), Murray Mulholland (EW), Tony Roxburgh (Waipa DC), Tracie Dean-Speirs (Water-Ways), Erena Watene-Rawiri (Tainui)

John Gumbley welcomed everybody to the workshop

Participants introduced themselves and their expectations of the workshop.

Tracie Dean-Speirs presented the objectives of the WCEET project and the purpose of the workshop.

Michael Lake gave an overview of the Serpentine/Rotopiko lake complex, the issues that exist there and the actions that are being undertaken by management agencies. He touched on the following matters:

- The high ecological value of the lakes (particularly the native macrophytes, but also the unfished shortfinned eel population)
- The overarching management "plan" for the lakes and the work that has been undertaken to date
- The current fish control programme
- The possibility of attempting an experimental rotenone operation at the lake complex in future to eradicate invasive fish (including potential difficulties).

After this presentation the following issues were discussed:

- The legality of the existing board weirs was questioned – and in particular whether a resource consent should have been obtained for their installation and use. Participants were informed that the landowner has installed them to maintain water tables in the peat soils. A concern was voiced that the board weirs could have implications for barrier design if too much water was held behind them.
- The purpose of the current weir was questioned. Keri Neilson clarified that the structure was installed to protect minimum summer water levels and should not affect maximum lake levels. The present weir height was chosen following 3-4 years water level monitoring. EW selects a height that is naturally exceeded 80% of the time over that monitoring period. The difficulty with the Serpentine weir was that the weir location was several hundred metres from the water level recorder. Therefore there was some uncertainty about the relationship between water levels in the lakes and in the outlet (where the weir is located). If winter water levels are found to increase flooding on adjoining land this winter, EW may reduce the height of the weir. This can be done easily by cutting the timber v notch down.

Brendan Hicks gave a presentation that summarised what is known about the ecology of the pest fish species that occur at the Serpentine/Rotopiko lakes.

Following Brendan's presentation the following matters were raised:

- That little seems to be known about the degrees of connectivity between the Rotopiko/Serpentine lakes and the Waikato River
- That little is known about which species occur in L.Rotomanuka and how much fish movement occurs between the lakes. Keri Neilson advised that the drain was often dry however.
- The idea of increasing the treatment area to include L. Rotomanuka with rotenone was also canvassed. ML informed the group that the Serpentine lakes were likely to be very challenging on their own and that even if this approach was adopted, a barrier would still be required as the treatment of the lakes would need to be staged.

After some discussion it was resolved that the connecting drain would need to be part of any rotenone treatment area.

The following knowledge gaps were identified in relation to fish ecology

- **Detailed knowledge of rudd and catfish movement is lacking**
- **An understanding of what fish utilise the drain when full**
- **Survival of rudd, catfish and goldfish eggs out of water (wildfowl spread)**
- **Are the smelt in the lakes are lacustrine? (otolith microchemistry to confirm)**

David Rowe gave his presentation about fish barrier designs and options for the Serpentine/Rotopiko lakes. He briefly introduced the wider management considerations[1], then discussed the full range of barrier options and why he concluded that many of them were not appropriate at the Serpentine/Rotopiko lakes.

Dave discussed a number of site issues, including:

- The location of the culvert at site 1 where the sill height of the culvert holds water back and may exacerbate flooding. *There was some discussion about whether replacing this culvert with a longer one would increase the amount of head sufficiently to construct a barrier near the existing weir*.
- The current drainage network at the lake outlet and information availability. *No data is available about the seasonal variability and range of water levels that occur along the length of the drain.* Keri Neilson confirmed that Environment Waikato could install water level recorders in the drain if this data is required.
- Whether the existing weir could be modified to act as a barrier. *Tony Roxburgh and Brendan Hicks both considered that the current weir was not designed to act as a barrier, and that different structures were appropriate for each purpose.*

[1] Including: vectors for fish re-introduction; native fish passage; climate change implications; and permitting and consent requirements.

- The hydrology of the site and where most fall could be obtained. *Tony Roxburgh confirmed that the farm track was likely to be the last line of defence since it is not flood prone.*
- Drain management. *Neville questioned whether vegetation management in the drains was likely to be an issue. Keri confirmed that the landowner generally maintains the drains very well and that drainage bylaws govern planting and spraying of the drains.*
- Engineering considerations, particularly in relation to construction on peat. *Keri/Murray advised that EW conducted penetrometer tests prior to constructing the new weir and that 8 m poles anchor the current weir into clay.*

Dave then presented the five preferred options from his report and discussed each of them in more detail. These were:

1. Perched Culvert

This was presented as an option to increase head height. While Dave initially dismissed the option because of possible impacts on stock and vehicle movements, participants considered that these effects would be minimised if the culvert followed the drain line. It was also suggested that multiple culverts (stacked on top of one another) could be used.
Bruno suggested a perched culvert at site 13.
The culvert at site 1 was discussed – it is already perched to some extent and could possibly be elevated or modified?

Existing culverts and sizing options require assessment

2. Self-Cleaning Screens

Rotating drum screens were discussed in detail. Dave advised that he did not consider that they were feasible for the following reasons:

- they would be relatively costly to construct (incl. construction of a substantial concrete foundation for them to sit in),
- require continuous power,
- that the brushes would need regular maintenance and may not seal adequately to exclude fish of all life stages
- that they were vulnerable to overtopping in flood flows.

Adam Daniel was able to report on his experience with rotating drum screens in Washington State which were installed to exclude carp. He advised that these structures were expensive to install and that brushes required regular monitoring and replacement (including weekly checks and annual replacement). He also advised that secondary high flow screens are often installed in addition, and that rotating drum screens will only handle a certain amount of submergence.

3. Coanda Screens

Dave presented the information from his report on Coanda screens. There was some interest in the potential to combine the Coanda screen with a modified weir.

The following questions/issues arose from the discussion

- **What happens in high flow events?**
- **How substantial are the foundations (poss. lightweight fibreglass options?)**
- **Patents need clarification**
- **Costs**
- **What is experience with these structures after several years? e.g. longevity (since relatively new)**
- **Could pressed s/steel be used to reduce the weight of the structure**

Adam Daniel offered to follow up on some of these issues while he is in the USA and report back.

4. Higher Weir with a standpipe water intake to drain

It may be useful to incorporate a standpipe into any future weir structure as a means of manipulating the lake levels (e.g. prior to rotenone operation)

5. Higher Weir with a Pumped Outlet

This option was discounted on the basis of the issues associated with installing and maintaining pumps at the site.

After presenting the options, Dave clarified that he considered that the current weir offered 0.5m head and that a maximum fall of about 1.5m head was probably achievable at the site. (*Flooding information is a key gap however and a 0.5 m head is not anticipated during high flows).*

He also advised that the amount of fall should be less of an issue if a shallow apron and anti jump bars are installed in combination (providing that there is not significant flooding).

The issue of flooding is critical as the low maintenance options are preferred but are only realistic if the risk of back up is low.

The following information gaps were identified with respect to flooding:

- **Downstream flood levels & the potential for water to back up to the base of any structure**
- **Exacerbating effects of the structure for upstream/back flooding**
- **Future flood events (plan for higher future rainfall events)**

Flood events and (drain) water levels were discussed by the group. It was agreed that it would be preferable to model the hydraulics of the catchment rather than wait for water level data to be physically collected (due to time constraints and urgency).

There was general concensus that Lake Rotomanuka plays a key role in determining the water level in the drain. Tony advised that Rotomanuka will only push water up to site16 or even 13-

14. He also raised the possibility of diverting the water from the Serpentine/Rotopiko lakes straight into Mystery Creek (thereby avoiding L.Rotomanuka) through an "old drain" that flows through an old lake bed. He suggested that ponded water might be a future issue in this scenario. Keri indicated that she was concerned about the implication of removing flow from L. Rotomanuka (in terms of hydrology and water quality).

The effect of drain modification on peat soils was raised. Murray advised that the hydraulics of the drain could be assessed to predict peat impacts and that it should be possible to increase the drain capacity (e.g. widening) without causing further peat shrinkage. It would appear that EW are well placed to undertake this work.

The following information is required about the nature of the drain downstream of the lakes:

- **Drain width/depth (cross-sections)**
- **Drain and catchment hydraulics (modelling)**
- **Modification options and impacts on peat shrinkage (esp. between sites 1-5)**

The location of any future structure was also discussed. Dave Rowe suggested that it may be possible to modify or install a different structure at the current weir location and then install a secondary structure further downstream in order to spread the risk. Any downstream structure will require a commitment from the landowner and agreement on the future management of the water levels in the drain. The design of any structure would require an understanding of how the drain water levels are manipulated in practice.

Tony commented that the landowner accepts flooding near the lakes but will not compromise productivity downstream – as a result any future modifications must be sympathetic to the landowner's objectives and may require their buy in (in terms of operating the current board weirs and culverts).

Keri raised the issue of changing landowners and the need to achieve certainty and security for the investment. Tony suggested that an option may be to buy/covenant a section of land from sites 0-1 through to the farm track and confine any structures to this area.

David Speirs observed that direct local knowledge was needed and that it would be best to involve the adjacent landowner (Rob Mourits).

Possible locations and design options were discussed in detail:

- Dave West raised the option of a screen for large fish to be located downstream and a lower head barrier to be constructed near the existing weir.
- The option of modifying the existing concrete structure at site 17 or replacing it altogether to create a barrier was also raised. Concerns were expressed that this option (and other downstream locations) may result in flooding issues on adjoining land. The risks of lateral movement during high flow events in this area would need to be assessed in detail for this option

- Brendan Hicks commented that any structure should be built as close as possible to the lakes in order to reduce the scale of flood events. He noted that there was approx 1m natural fall at sites 13-15.
- David Speirs raised the possibility of building a stopbank/bund on land adjacent to the lake to increase the lake's flood capacity. Keri noted that this option may provide some additional benefit for the lake by providing a degree of hydrological isolation. It was suggested that a stopbank could provide an additional 0.5m of head and that a structure at the current weir location with a long shallow apron of 4-5m may be adequate (providing that the water doesn't back up in the drain).

David Speirs questioned what level of security DOC was wanting to achieve with the barrier, i.e. what flood return period a structure would be designed for? Mike Lake advised that a **50 year return period** was probably reasonable. This is a key component of any future hydraulic model.

Elver passage was also raised as an important issue. The group seemed agreed that most broad crested weirs would pass elvers and that it was essential that elver passage be kept as simple as possible. Rotating drum screens and outlet pumps were not considered to be practical for eel passage.

It was generally agreed that eel passage is an important consideration to be factored into the design of the final structure that is adopted

Participants were given the opportunity to suggest alternative structures. Blair suggested that it may be possible to incorporate a drop tube into the existing (or alternative) weir structure. He proposed incorporating a matrix of barrier bars in the drop tube to prevent fish jumping in the structure. In his design the structure would sit in an enclosed box chamber with a long apron to generate laminar flow at the base of the structure (picture provided on the whiteboard).

Conclusions

At the end of the meeting it was clear that there were a number of potential options for constructing a barrier at the site. The following actions are required:

- Fill critical information gaps in relation to the hydraulics of the site (incl. the drain) and model future flows (hydraulic model). *Murray indicated that this was entirely possible with existing information and is probably 0.5 – 1 days work as a desktop exercise. Cross sections of the drain would need to be surveyed prior to undertaking the modelling exercise.*
- Water level recorders should be installed in the drain this winter to measure actual water levels. In particular, they are required immediately downstream of the weir (site 1), between sites 1 and 5 (prob site 5) and possibly in the flat area between 5-13.
- Communication with the landowners is required in order to involve them in this project

In addition to these actions further actions should be taken to investigate Coanda screens and possible weir designs.

Map showing drain between the Rotopiko/Serpentine lakes and Lake Rotomanuka