Assessment of threat of the aquatic weed elodea at Piriaka, Whanganui River

NIWA Client Report: HAM2008-035
March 2008

NIWA Project: ELF08225

Assessment of potential threat of aquatic weed (elodea) at Piriaka, Whanganui River

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Prepared for

Horizons Regional Council

NIWA Client Report: HAM2008-035
March 2008

NIWA Project: ELF08225

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Contents

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Executive Summary

Elodea (*Elodea canadensis*, an invasive aquatic plant often called oxygen weed) was identified at Piriaka in the Whanganui River and subsequently found downstream at Cherry Grove, Taumarunui. The Whanganui River is of high priority for Horizons Regional Council as it has significant cultural, economic and aesthetic values. The presence of an aquatic plant pest invading the river raised concerns that prompted Horizons Regional Council to engage NIWA to:

- Assess the current status of elodea near Piriaka.
- Assess the threat of further spread in the Whanganui River and likely impacts.
- Consider issues and options to enable development of a Management Plan for elodea control if needed.

This work was requested by Horizons Regional Council and funded from an Envirolink grant through the Foundation for Science, Research and Technology, Contract 443-HZLC47.

A delimitation survey of submerged aquatic weeds was undertaken in mid-January 2008 within much of the Whanganui River Catchment. Waterways were assessed by viewing from above water, dredging with a rake, snorkelling and by SCUBA where appropriate. Areas searched included: the Whanganui River headwaters including Lakes Otamangakau and Te Whaiau; streams and water bodies near Piriaka, including Waiwherowhero, Mangarautawhiri and Ngararahuarau Streams and nearby quarry ponds; the Ongarue River up as far as Ongarue; the Whanganui River through Taumarunui, the Whanganui River from Whakahoro to Pipiriki (by canoe) and from Pipiriki to Wanganui (accessible by road).

Elodea was the only submerged aquatic plant (macrophyte) found in the Whanganui River and it was only found at Piriaka where the river was impounded by three weirs and water velocities were favourable for plant growth in only part of this impoundment. Elodea was also found in the Ongarue River at Cherry Grove at its confluence with the Whanganui River and about 20 km further upstream (in the Ongarue River) near the township of Ongarue. It was also present in Lakes Otamangakau and Te Whaiau that discharge periodically into the Whanganui River headwaters, but was not found anywhere else. Lagarosiphon (another invasive oxygen weed) was also found in the these lakes, in an ornamental pond in the main street of Taumarunui and in an impounded pond in the Tuhua Domain Golf Course that feeds into the Whanganui River.

The threat of spread of elodea within the Whanganui River was considered to be negligible as habitat requirements for aquatic plants were not met throughout the length of Whanganui River. High flows

(often > 1 m sec^{-1}), an armoured rocky bed or a mobile river bed, large variations in water levels and poor water clarity (low light penetration) in lower sections do not provide conditions conducive for elodea growth with the exception of Piriaka.

Control \ eradication measures are discussed for the elodea at Piriaka.

1. Introduction

Elodea (*Elodea canadensis* or oxygen weed) is an invasive aquatic plant and was identified by Landcare Research herbarium in September 2007, from a sample taken from the hydro dam impoundment at Piriaka, in the Whanganui River. Local residents said it had been present there for about four years (Robert Bashford, Horizons RC pers. comm.). It has subsequently been located downstream at Cherry Grove, Taumarunui, and was thought to have spread to this location from Piriaka.

Protection of the Whanganui River is of high priority for Horizons Regional Council as it has significant cultural, economic and aesthetic values. The presence of an aquatic plant pest invading the river raised concerns that prompted Horizons Regional Council to engage NIWA to:

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2. Methods

A delimitation survey of submerged aquatic weeds was undertaken in mid-January 2008 within much of the Whanganui River Catchment. Waterways were assessed by viewing from above water, dredging with a rake, snorkelling and by SCUBA where appropriate. Areas searched included: the Whanganui River headwaters including Lakes Otamangakau and Te Whaiau; streams and water bodies near Piriaka, including Waiwherowhero, Mangarautawhiri and Ngararahuarau Streams and nearby quarry ponds; the Ongarue River up as far as Ongarue; the Whanganui River through Taumarunui, the Whanganui River from Whakahoro to Pipiriki (by canoe) and from Pipiriki to Wanganui (accessed by road).

3. Results

Elodea was the only submerged aquatic plant (macrophyte) found in the Whanganui River and it was only found at Piriaka (Fig 1) where the river was impounded by three weirs and water velocities were favourable for plant growth. Elodea was also found in the Ongarue River (a tributary of the Whanganui River), at Cherry Grove, at its confluence with the Whanganui River and was also found about 30 km further upstream near the township of Ongarue. It was also present in Lakes Otamangakau and Te Whaiau that discharge periodically into the Whanganui River headwaters, but was not found anywhere else. Lagarosiphon (*Lagarosiphon major*, another invasive oxygen weed) was also present in the lakes. Lagarosiphon was also found in the ornamental pond in the main street of Taumarunui and in an impounded pond on a stream in the Tuhua Domain Golf Course that feeds into the Whanganui River.

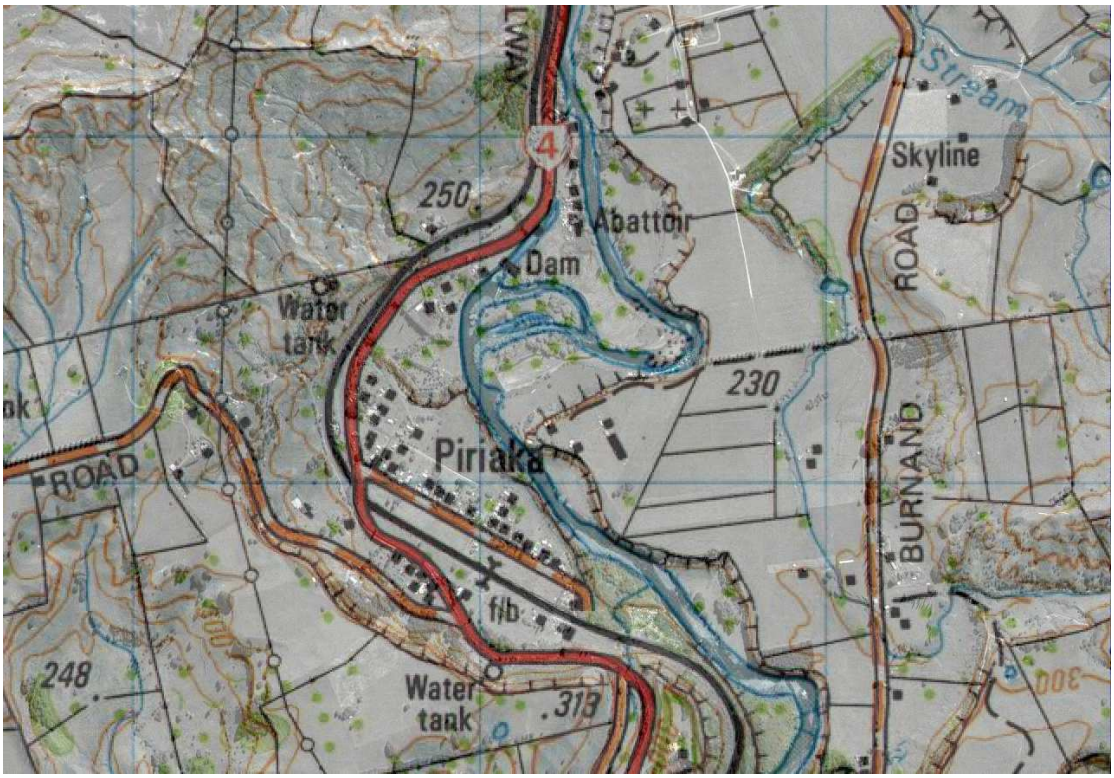

Figure 1: A hydro-electric dam is located at Piriaka on the Whanganui River.

3.1 The headwaters to Piriaka

The headwaters of the Whanganui River had no submerged plant growths (Fig. 2) but both Lakes Otamangakau and Te Whaiau are dominated by lagarosiphon and elodea and periodically discharge into the Whanganui River headwaters (Fig. 3). Rocky

substrate and high velocities appeared to be prohibitive for aquatic plant establishment.

Streams and water bodies in the vicinity of Piriaka (including Waiwherowhero, Mangarautawhiri and Ngararahuarau Streams and nearby quarry ponds) did not have elodea or other invasive submerged weed species.

Figure 2: The Whanganui River near Lake Te Whaiau had no submerged plant growths.

Figure 3: Lake Te Whaiau showing the weir which overflows periodically to the Whanganui River nearby and therefore must be a source of elodea and lagarosiphon propagules.

3.2 Piriaka

At Piriaka there is a series of three weirs (Fig. 4) on the Whanganui River that create a small impoundment (about 500 m long by 40 m wide) for the intake to the Piriaka power station. At times of high flow much water overflows the weirs and the left bank of the impoundment is not scoured as flows remain low being determined by the water take through the small (1.2 MW) power station. On the left bank elodea grew intermittently over a length of 461 m (measured by laser) in clumps, the largest being 7 m wide (Figs. 5 and 6) but they were mostly about 2 - 3 m wide. Elodea grew on soft sediment in low flow areas to a depth of 2.2 m and with a maximum height of 0.8 m. The floor of the channel was armoured rock (Fig. 7) with little opportunity for elodea growth, but with the odd plant finding a “foot hold” close to the left bank only (Fig. 8). Above the impoundment, the Whanganui River was of similar width and had suitable fine substrate for plant growth but no submerged plants were present (Fig. 9). Below the weirs there was no suitable substrate for plant growth with the river channel being lined mainly with large boulders and subject to high flows.

Figure 4: A weir on the Whanganui River at Piriaka.

Figure 5: The largest patch of elodea at Piriaka, 7 m wide, growing to 0.8 m tall in up to 2.2 m water depth on soft silt.

Figure 6: The largest patch of elodea at Piriaka, photographed underwater from the deep side.

Figure 7: Armoured rock floor of the canal / impoundment at Piriaka before the power station intake. Net spinning caddis are seen attached to the rocks.

Figure 8: Elodea gaining a “foot hold” on the armoured rock floor of the canal close to the left bank.

Figure 9: The Whanganui River at Piriaka just upstream of the impoundment had no submersed aquatic plants, despite suitable substrate being present. The yellow arrow indicates where elodea growths started.

3.3 Ongarue River

Elodea was located at Cheery Grove, Taumarunui, about 10 km downstream, but it was growing in the Ongarue River and not in the Whanganui River. The Ongarue River had elodea growing about 30 km upstream near the township of Ongarue (Fig. 10). The Ongarue River is another source of elodea to the Whanganui River.

Lagarosiphon (*Lagarosiphon major*, another invasive oxygen weed) was found in an impounded pond on a stream in the Tuhua Domain Golf Course, Taumarunui. The stream flows into the Ongarue River at Taumarunui and is therefore a source of lagarosiphon for the Whanganui River. Also in Taumarunui, the ornamental pond in the main street has lagarosiphon.

3.4 Mid and lower Whanganui River

From Whakahora to Pipiriki (Fig. 11) the river had no submerged aquatic plants. Nor were any found from Pipiriki to Whanganui. The river bed had gravels or was rocky and in combination with high flows and large variations in water levels was unfavourable for submerged plant growth. Within about 10 km of Wanganui the river widens (Fig. 12) and flows become more favourable for submerged plant growth but the water was turbid and low light becomes the likely excluding factor. At the time of the survey (after a long spell of little or no rain) the water had poor transparency with a 0.3 m Secchi Disc (distance a white disc is visible in water), which restricts plant growth to a shallow photic zone (probably <1 m). However water level fluctuations would exceed the range of the photic zone leaving no area with a suitable light climate for submerged plant growth.

Figure 10: TOP Elodea in the Ongarue River confluence; the Whanganui River is in the background beyond the gravel bar; BOTTOM elodea growing in the Ongarue River near the township of Ongarue about 30 km upstream.

Figure 11: The Whanganui River at Pipiriki is a wider section of the river but had no submerged plants. The river was turbid and the river bed armoured with rocks.

Figure 12: The Whanganui River at Wanganui had no submerged plants and is likely too turbid for them to grow given there are frequent water level fluctuations greater than the depth of the photic zone (c. <1m).

4. Discussion

The delimitation survey found that the Whanganui River receives both lagarosiphon and elodea inocula from several sources. However the only known site of submerged plant growth in the Whanganui River was elodea at Piriaka. The threat of spread of elodea within the Whanganui River was considered to be negligible as habitat requirements for aquatic plants were not met throughout the length of Whanganui River. High flows (often > 1 m sec^{-1}), an armoured rocky bed or a mobile river bed, large variations in water levels and poor water clarity (low light penetration) in lower sections do not provide conditions conducive for elodea growth, with the exception of Piriaka.

At Piriaka it is possible elodea could spread further by expansion of existing clumps. Once clumps are established they act as sediment traps and the more sediment the larger the area of suitable substrate for plant growth. This pattern of colonisation is known in hydro-canals such as in the Rangitaiki Canal (Wells and Taumoepeau 1997). Removal of the weed cover in the Rangitaiki Canal there was necessary periodically to allow erosion of sediment from the central parts of the canal. Re-establishment of weed beds was then slow without significant areas of suitable substrate.

If elodea grew excessively then it could affect generating capacity at the Piriaka Power Station. However at present levels the elodea is possibly of benefit as trout habitat. At least five large trout were seen near the weedy margins and elodea would provide cover and habitat for invertebrates preyed upon by trout. However, alternative food sources such as caddis were plentiful on the rock surfaces.

Elodea, control would not be difficult. Options include: hand weeding / cutting by SCUBA diver, herbicide using diquat application with subsurface injection, suction dredging, or shading.

Hand-weeding / cutting: A diver could disrupt the elodea cover by manually pulling elodea from the clumps or using a long blade to cut off the stems to near sediment level. This would expose the sediment and in areas of high flow erosion may follow and much of the root mass could be washed away resulting in an extended period of control from just one clearance. Two experienced divers could achieve this clearance work in one day. Hand weeding for eradication or a high level of control requires considerable care and experience to extract shoots completely and to remove all dislodged plant material into a catch-bag. Hand weeding is an effective follow-up control option to venturi suction pumping and eradication has been achieved for a

number of lagarosiphon sites in Lake Wanaka by a combination of these two methods (Clayton 1996).

Diquat: Diquat is registered for use in New Zealand as an aquatic herbicide. Sub-surface injection of diquat into the clumps of elodea would be a method of control as elodea is very susceptible to this herbicide given contact times as short as 10 minutes at 2 ppm. As described above, once the elodea cover is disrupted, the underlying sediment is unprotected may be eroded away.

Suction dredging: A diver operated suction dredge could remove the weed, its roots and large amounts of sediment. If the sediment is removed there would be limited opportunity for elodea re-colonisation. It takes about 1 hour to remove 10 m^2 of weed bed with a suction dredge, so there is an estimated 60 hours of suction dredging to remove it the bulk of the weed, provided the flows are not too difficult to work in.

Shading: Shade trees such as overhanging willows would prevent elodea growth, but the trees would be a threat to the hydro-intake with the inevitability of branches entering the water and being caught on the screens.

Elodea eradication could be achieved with repeat suction dredging and hand-weeding until all fragments were removed. It could require several years with possibly 2 suction dredging efforts and 12 hand removal attempts by divers skilled in the procedure. With NIWA guidance, DoC eradicated a site of lagarosiphon in Lake Waikaremoana, and numerous sites of lagarosipon in Lake Wanaka have been removed in this way with less effort (Clayton 1996).

5. References

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Wells, R.D.S.; Taumoepeau, A.T. (1997). Diquat discharges and monitoring in the Rangitaiki Canal. NIWA Client Report: REL 70201 July 1997, 15 pp.