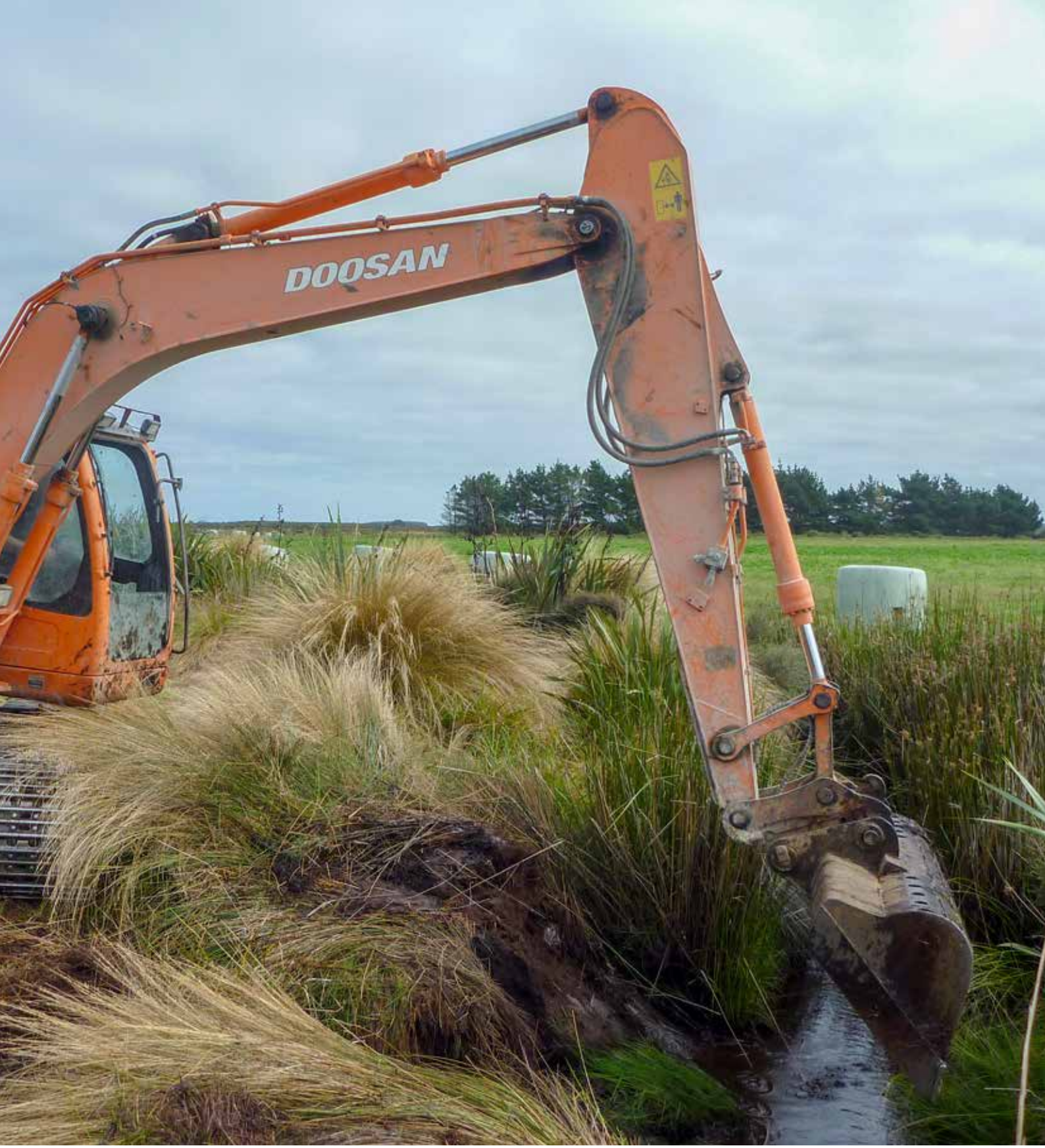
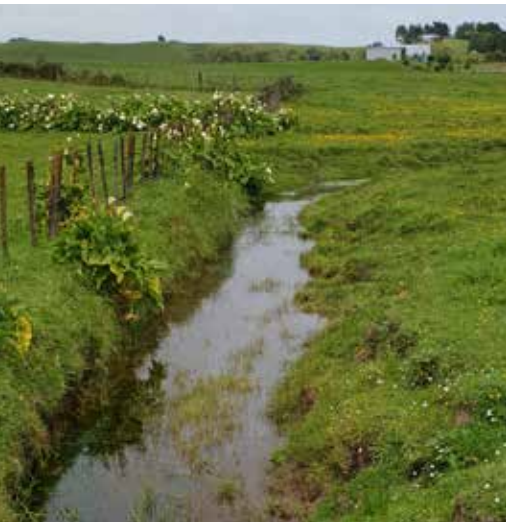
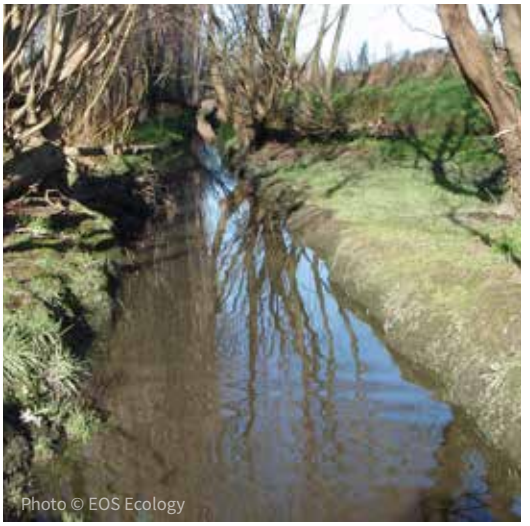


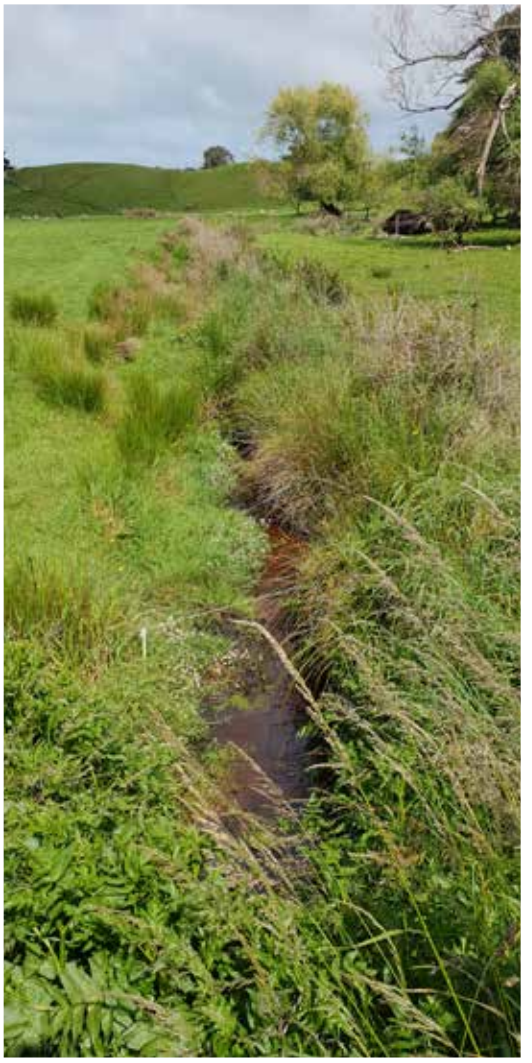
Guide for landowners & excavator operators

Good Practices for the Mechanical Management of Highly Modified Waterways

Greater Wellington
Te Pane Matua Taiao

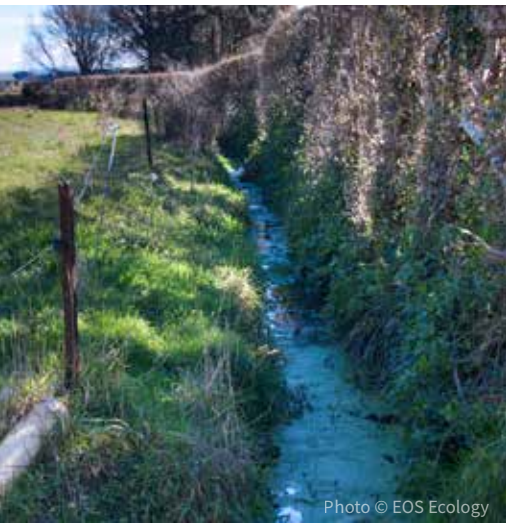


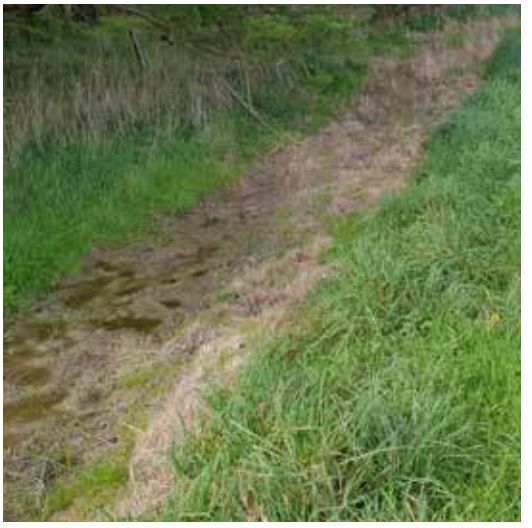


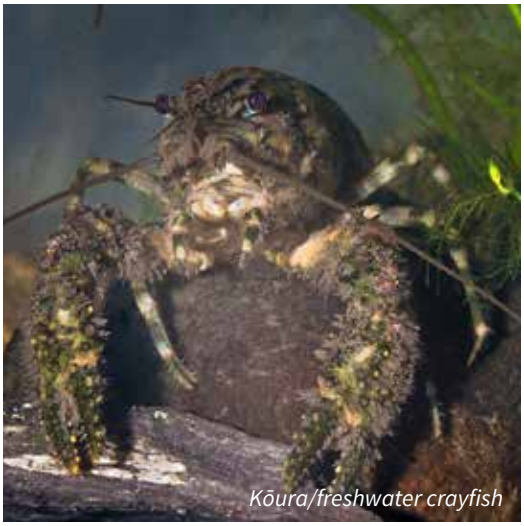


Value of highly modified rivers and streams

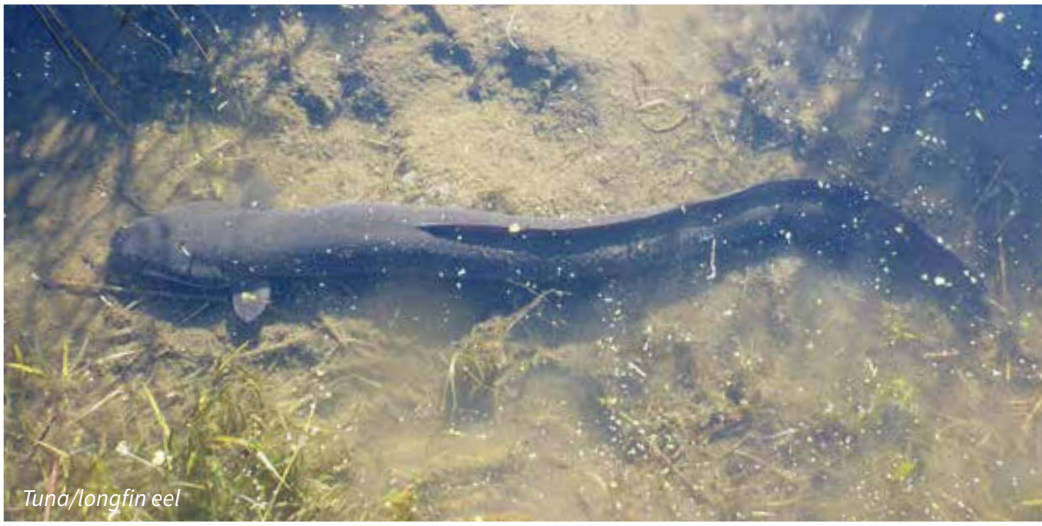
The highly modified rivers and streams that make up drainage networks are often thought to be of little ecological value. This is due to their "unappealing" appearance, the intensively developed state of the landscapes they flow through, and the fact that they're often considered to be infrastructure, rather than natural water courses. However, these waterways—commonly referred to as drains—are important aquatic habitats for native fish and invertebrates (insects, worms, crustaceans, etc).



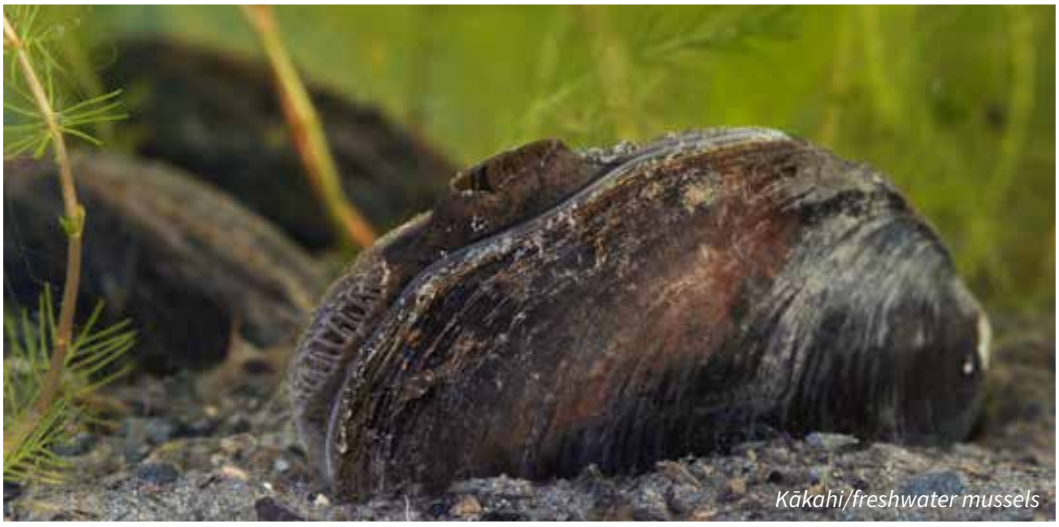




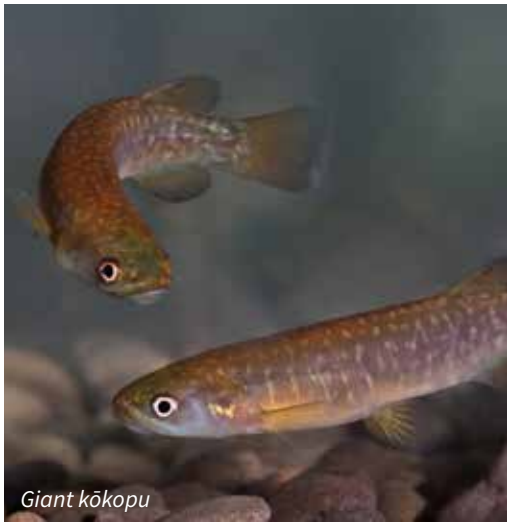
Kōura/freshwater crayfish



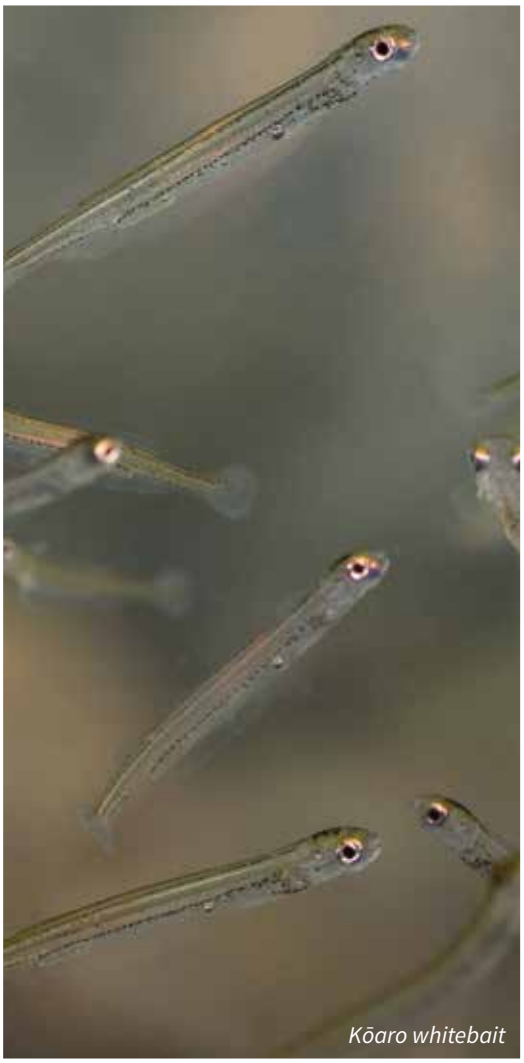
Tuna/longfin eel



Kākahi/freshwater mussels



Giant kōkopu



Kōaro whitebait

The majority of New Zealand's migratory fish species use waterways that have been highly modified as corridors. Consequently, these waterways provide vital temporary habitats for a large proportion of our native fish community, including eels and members of the whitebait family. They also provide permanent fish habitat, especially where more natural habitats have been lost or degraded.

More than 25 native fish species live in these waterways, and they are particularly important for wetland species, such as the giant kōkopu and brown mudfish, as they are often the only habitat available in catchments where wetlands have been converted to pasture.

Highly modified waterways also support a wide range of aquatic invertebrates, including kākahi/freshwater mussels and kōura/freshwater crayfish, and frequently contain over 30 species, often at high densities.

This guidance is based on a report prepared by:
Dr Michael Greer, Senior Scientist – Fresh water, Aquanet Consulting Ltd.

Contents

Waterway maintenance activities – vegetation and sediment removal

Without maintenance, most highly modified rivers and streams eventually become blocked by sediment and excessive aquatic plant growths. This impedes drainage, resulting in a higher water table and an increased risk of surface flooding during rainfall. This issue is generally the result of:

- elevated nutrient concentrations,
- an absence of shade, and/or
- high sedimentation rates.

Therefore, long-term improvements in drainage are best achieved by managing land-use and riparian vegetation to reduce the amount of light, sediment and nutrients reaching the water. However, the effects of land and riparian management will take some time to be achieved and, until they are, it is likely that mechanical excavation of aquatic plants and sediment (waterway clearance) from watercourses will still be necessary.

While often necessary to prevent flooding, waterway clearance does have significant adverse effects on water quality and ecology (see further discussion in pages 5–17). It is therefore vital to reduce its impact by following the good management practices set out in **Rule R134 of the Natural Resources Plan (NRP),** as explained in this document.

Controls on waterway clearance:

Removing vegetation or bed material and associated sediment from a **highly modified river or stream** within an **individual property** is a permitted activity, so long as the good management practices specified in Rule R134 and explained in this document are followed.

A **resource consent** from the Greater Wellington may be required to remove vegetation or bed material and associated sediment from a waterway in the following situations:

- the waterway does not meet the definition of a 'highly modified river or stream', or
- the clearance activities will take place in a highly modified river or stream across **more than one property** (e.g., the waterway is being managed as part of a **stormwater network**), or
- the waterway is a **water race**, or
- the waterway runs through a **natural wetland**.

Rule R134 can be found within Chapter 5.5 of the NRP:

- https://www.gw.govt.nz/assets/Documents/2023/07/Chapter-5.pdf

Controls on managing these activities have been strengthened in the NRP due to:

- the high level of concern raised by local iwi and other members of the community regarding the negative impact of waterway clearance activities on habitat and aquatic life,
- a number of examples of waterway maintenance activities that have had devastating impacts on fish life, particularly eels, that live in these waterways.

Is my waterway "highly modified"?

A highly modified river or stream is one which:

- has been channelled into a single flow, and
- the channel has been straightened, and
- the channel is mechanically formed with straight or steeply angled banks, and
- it exhibits these characteristics for at least its entire length through the property in which the activity is being carried out, and
- it is not managed as part of a stormwater network and is not a water race.

To check if the waterway on your property is considered to be 'highly modified', refer to this map:

- http://gwrc.maps.arcgis.com/apps/webappviewer/index.html?id=87a85d0ad2a3493fbeccb789eac79773

If you are in an area that has not been mapped, contact Greater Wellington for assistance.

Good management practices

1. Maintain the stream bed profile

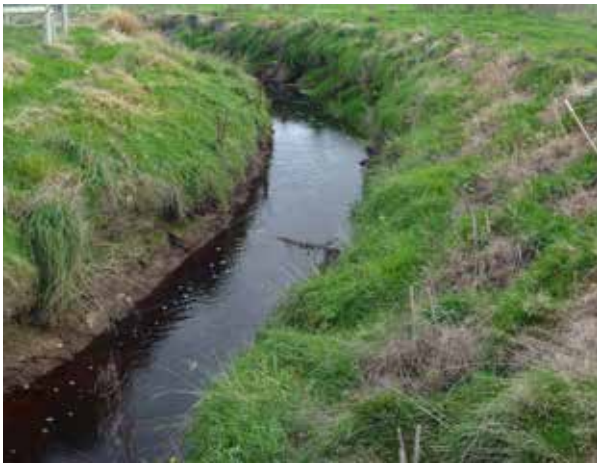
Why good practice is needed...*Repeated clearing can lead to channels becoming too wide and/or too deep, slowing water movement and detrimentally altering the structure of an aquatic habitat. Changes to the shape of the beds and banks also decreases bank stability, which increases the risk of bank collapse.*

Good practice required by the NRP:

Do not ALTER THE WIDTH OR DEPTH of the channel

> **The practice of maintaining the stream bed profile is required by clause (f) of Rule R134:**
> ***Any works to alter the depth or width of a highly modified river or stream shall not excavate any deeper or wider than the original grade or cross section of the channel, unless the widening or deepening is for the purpose of constructing or maintaining a sediment retention trap or a fish refuge bay"***

To minimise the adverse effects of waterway clearing on aquatic habitat and bank erosion, it is good practice to maintain the channel profile by only removing unconsolidated fine sediment that has been deposited on the bed since it was last cleared. In most instances, an experienced excavator operator should be able to tell the difference between deposited fine sediment and the underlying original bed. Even in soft bottomed streams, the sediments that make up the "original" bed are generally more consolidated than those deposited on top of it.



Example of where repeated clearing has led to significant deepening and widening of the channel. Recent drainage works contributed to this issue as you can see by the under-cutting on the left bank caused by the excavator bucket.

Photo: Michael Greer

2. Retain vegetation on the bank

Why good practice is needed... *Scraping the banks with the excavator bucket during waterway clearing significantly increases the risk of erosion by removing the vegetation holding the topsoil in place and exposing soils that are prone to surface wash. Such bank erosion can have a significant impact on habitat structure, sediment transport, channel shape and hydrology.*

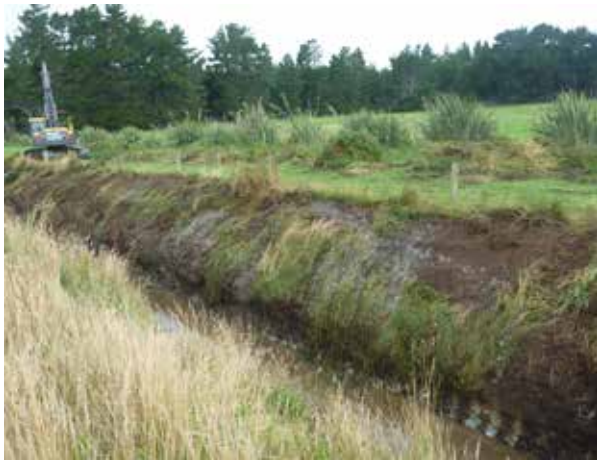
Good practice required by the NRP:

Do not REMOVE VEGETATION from the dry banks

The practice of retaining bank vegetation is required by clause (g) of Rule R134:

> *"An intact vegetation cover (excluding weeds) shall be retained on the banks of the watercourse"*

To minimise the adverse effects of waterway clearing on bank erosion, it is good practice to retain vegetation cover on the banks of the channel by avoiding contact between the cutting edge of the excavator bucket and the dry bank, especially when working in deeply incised, steeply-banked channels.



Poor practice: The vegetation has been scraped off the bank with the bucket.

Good practice additional to that required by the NRP...

Stabilise soil exposed on the bank during weed control

While clause (g) of Rule R134 allows for the removal of weeds from the banks of a watercourse, this activity still has the potential to increase the risk of bank erosion when conducted with an excavator during waterway clearing operations.

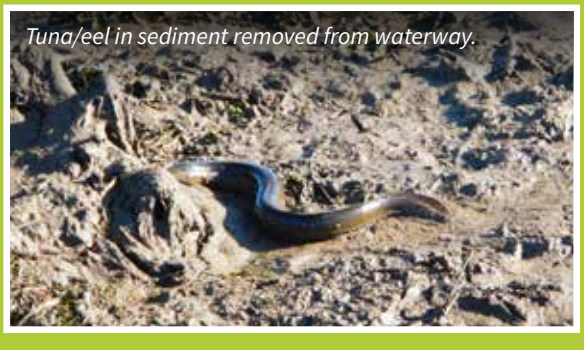
Reseed or replant areas of bare earth

Good practice: The vegetation on both banks has been left untouched by the excavator.

3. Reduce the effects of fish stranding

Why good practice is needed...

During waterway clearance large numbers of fish and invertebrates can be removed with the vegetation and, while some will make their own way back to the waterway, the majority of stranded individuals die.



Tuna/eel in sediment removed from waterway.

Good practice required by the NRP:

Conduct FISH RECOVERY

> **Fish salvage is required by clause (h) of Rule R134:**
>
> *"Any fish (except identified pest species), kākahi and kōura removed from the highly modified river or stream during maintenance works shall be returned to highly modified river or stream at a site upstream of the works as soon as practicable, and no later than one hour after its removal"*

To minimise the adverse effects of fish stranding during and after waterway clearance, salvage fish in the following way:

1. Search thinly spread spoil for fish, kākahi and kōura as soon as it is removed from the waterway.
2. If possible, return recovered fish (except pest species* which should be disposed of appropriately and humanely), kākahi and kōura immediately to the waterway above the upstream extent of the clearance works.
3. If it's not possible to return them immediately, place them in a bucket/fish bin containing clear water sourced from the waterway being cleared. Keep water in the bucket/fish bin well aerated and below 18°C by:
   a) using an aquarium bubbler, or
   b) providing manual aeration by frequently stirring up the water or pouring new water in from a height of at least one metre, and
   c) placing the bucket/fish bin in the shade and replacing the water as often as necessary.

   If the fish are obviously stressed in the bucket (gasping at the surface or dying) then release them immediately.
4. Hold fish, kākahi and kōura for no more than one hour before returning them to the waterway above the upstream extent of the clearance works.
5. Periodically re-examine the spoil throughout the day, at the end of the day and the next morning for any remaining fish, kākahi and kōura. Store and return recovered aquatic life to the waterway using the process described above.

* To identify pest fish species refer to:
- www.doc.govt.nz/nature/pests-and-threats/animal-pests/fish

If in doubt as to whether a fish is a pest species, take a photograph and notify Greater Wellington, but return the fish to the waterway as soon as possible.

Good practice additional to that required by the NRP...

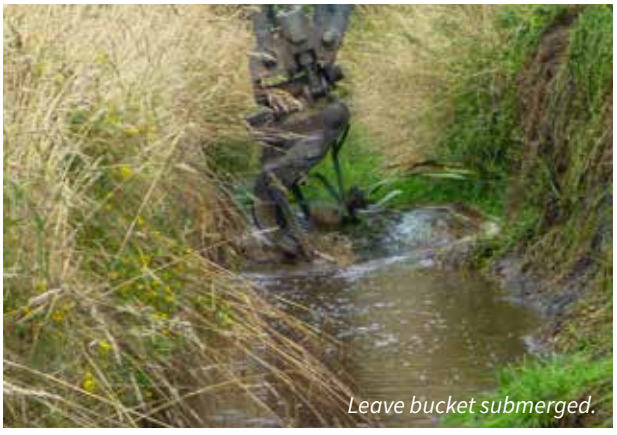
Use a weed rake in hard-bottomed waterways

Weed rakes (rake type excavator buckets) allow fish and invertebrates caught in the spoil to escape back into the channel. These rakes are especially useful in hard-bottomed waterways known to contain species such as longfin eels that use plants for cover, or in areas where rare or threatened species are present.

Weed rakes are inefficient at removing sediment and are not appropriate for use in operations where silt removal is a primary objective. If large amounts of fine sediment are present in the channel, the use of a weed rake may increase the adverse effects of the clearing by stirring up the silt without removing it. Consequently, use weed rakes only in gravel bed streams, or waterways with very little deposited fine sediment on the bed.

Leave the bucket submerged at the end of each scoop

Fish and invertebrates are often able to swim out of the bucket of the excavator while it is still in the water. Where large numbers of native fish are being removed with the spoil, operators should ensure that the bucket is submerged long enough at the end of each scoop to allow fish to escape.



Leave bucket submerged.

Photo: Michael Greer

Example of excavators with weed rakes attached. Fish are able to swim through the large gaps and are less likely to be caught than if a standard bucket was used.

Distribute spoil so that eels can return to the water

Eels are often able to make their own way back to the waterway from the spoil, provided it is deposited correctly. Spoil should be spread evenly along the bank, not placed in discrete built-up mounds. To increase the chances of stranded eels returning to the waterway, spoil should be placed as close as possible to the waterway but not so close that it can re-enter the channel during heavy rain (see pages 12–14). Eels can travel long distances on wet grass but tend to move downhill. If the bank is built up and sloped on both sides, spoil should be placed on the 'ridgeline' to encourage eels to move towards the waterway rather than adjacent dry areas.

4. Preserve and/or create aquatic habitat

Why good practice is needed... *Habitat loss after waterway clearing reduces the abundance and diversity of fish and invertebrates. Aquatic plants play an important role in increasing habitat complexity in streams, as fish use them for cover and spawning. Waterway clearing removes the majority of plants from the waterway, eliminating habitat for fish and invertebrates. Waterway clearing can also smooth the sides and floor of the waterway, further reducing the range of habitats available.*

Good practice required by the NRP:

PARTIALLY CLEAR plants from the waterway and Installing ARTIFICIAL FISH REFUGES

Partial clearance is required by clause (j) of Rule R134 unless artificial fish refuges are provided:

> *If mechanically clearing, to provide fish refuge areas, either:*
>
> ***(i) only one side of the highly modified river or stream shall be cleared at any one time, and the other side may only be cleared at least three months following completion of the initial works, or***
>
> ***(ii) if clearing both sides of the highly modified river or stream, for every 200m length of highly modified river or stream cleared either:***
>
> ***1. at least a 10m length, or 5% bed area, of intact aquatic vegetation cover is retained (and may not be cleared for at least three months), or***
>
> ***2. a constructed fish refuge that is at least 1m² is provided"***

Plants provide important habitat for invertebrates and fish in soft-bottomed streams and it is good practice to maintain at least some vegetation to minimise the impact of waterway clearing on aquatic fauna. This can be achieved by the following:

- **Clearing one side of the waterway at a time** – where restoration of hydraulic capacity is of the utmost importance and leaving entire sections of the waterway undisturbed is not an option, limit plant removal to one side of the waterway at a time, leaving a strip of vegetation along the opposite bank to provide refuge habitat for fish. The intact vegetation on the opposite side of the channel should be retained for at least three months. It may not be possible to use this method in narrow water courses.
- **Retaining sections of intact aquatic vegetation at regular intervals** – where high value species are present and full restoration of hydraulic capacity is not required, a staggered approach to clearing should be undertaken, retaining short uncleared sections of aquatic plants at regular intervals along the length of the cleared reach. At least 10m of intact aquatic vegetation cover should be retained for every 200m cleared and this vegetation should not be cleared for at least three months.

- **Constructing a fish refuge** – If partial clearance is not an option, fish habitat lost during waterway clearance can potentially be replaced with simple artificial refuge structures. These structures are likely to be used by cover-loving species, such as giant kōkopu and eels, and help reduce the number of fish leaving in search of habitat. Artificial fish refuge structures are permanent, so are available each time the waterway is cleared – unlike partial clearance, which requires alternative habitat be found each clearance. However, constructing artificial refuge structures can be expensive, is largely untested, and may require resource consent (depending on the design). Thus, in most cases, partial clearance is likely to be the best method of maintaining habitat after waterway clearance.

  Research into the design and benefits of artificial refuge structures in New Zealand is still in its early stages, and further research is needed to establish optimal design criteria and installation rates. However, providing at least 1m^2 of complex artificial habitat every 200m cleared will ensure that the availability of in-stream cover is not reduced by 100 percent and that the distance between refuge areas does not exceed what species, such as giant kōkopu, can travel in a 24-hour period.

  Improperly designed refuge structures may not provide appropriate habitat and may result in bank erosion. We recommend that expert ecological and engineering advice is sought if considering this option.

Two examples of artificial fish refuges. Note: the research into the design and benefits of artificial refuge structures is still in its early stages, and further work is needed to establish optimal design criteria.

Photos: Bruno David, Waikato Regional Council

A series of case studies trialling various types of artificial habitat can be found at:

- www.doc.govt.nz/nature/habitats/freshwater/freshwater-habitat-restoration
  - *Creating instream cover by adding artificial fish habitat devices*
  - *Naturalising banks to enhance instream habitat*
  - *Enhancing habitat for native fish by riparian planting*

Retain WOODY DEBRIS

> **The retention of woody debris is required by clause (l) of Rule R134:**
> *"Any maintenance works in the bed of a highly modified river or stream shall not remove any woody debris with a diameter greater than 0.2m from the highly modified river or stream unless it is causing, or has the potential to cause a flood or erosion threat, or a threat to infrastructure."*

Woody debris provides habitat complexity, cover and shade for aquatic life and in some cases it contributes to bank stability. Consequently, removing it during drain clearing can impact fish and invertebrate populations and lead to erosion. Before undertaking works, inspect the targeted area for areas of woody debris and ensure these areas are retained, unless considered to pose a risk for flooding, erosion or infrastructure.

Good practice additional to that required by the NRP...

Avoid clearing all waterways in a property at once

Aquatic ecosystems recover more quickly from disturbances, such as waterway clearing, when there is undisturbed habitat close by for fauna to move into. Where possible, avoid excavating all the waterways on a property or in a catchment in any one year. If the waterways require clearing every five years, clear one-fifth annually.

Avoid removing gravel

Gravel provides valuable habitat for fish and invertebrates and has the added benefit of being a poor root environment for recolonising weeds. Where possible, only remove fine sediment from the channel.

Maintain variability in stream bed profile

Small variations in stream bed profile have minimal effect on hydraulic efficiency and provide important habitat diversity. It is therefore necessary to avoid excessive levelling of the stream bed.

To find out more about native fish habitat and artificial refuge structures go to:
- www.doc.govt.nz/nature/habitats/freshwater/freshwater-fish-habitat
- www.doc.govt.nz/nature/habitats/freshwater/freshwater-habitat-restoration

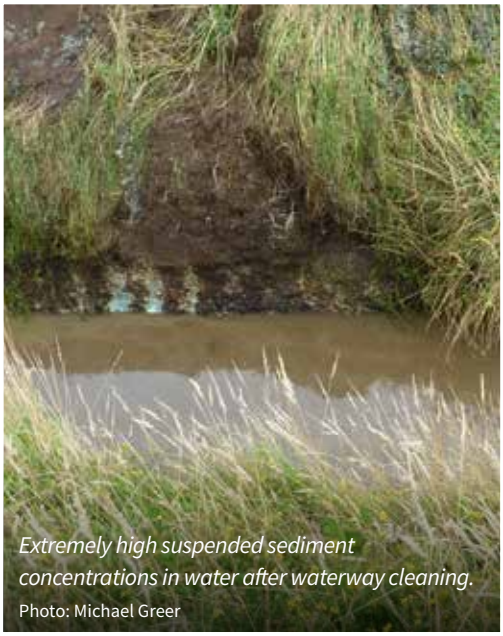
As in this example, in-stream cover for fish and invertebrates is usually removed by waterway clearing.

5. Minimise sediment release

Why good practice is needed... *Waterway clearance results in a large amount of fine sediment being suspended in the water column. Not only does the excavator cause an immediate spike in suspended sediment concentrations, but as aquatic plants trap and retain sediment, their removal makes it easier for bed sediments to be suspended once waterway clearing is completed. When waterway clearing is conducted over many kilometres, suspended sediment concentrations can remain elevated above background levels for several weeks, especially during floods.*

Suspended sediment release during and after waterway clearing may adversely affect fish and invertebrates:

- *If the sediment suspended by mechanical excavation has a large organic component, the water can become de-oxygenated, killing fish and invertebrates.*
- *When the sediment disturbed by the excavator settles out downstream it can reduce habitat quality and even kill fish and invertebrates by smothering them.*
- *Persistent increases in suspended sediment after waterway clearing may interfere with the feeding and migration behaviour of native fish and trout.*



Extremely high suspended sediment concentrations in water after waterway cleaning.
Photo: Michael Greer

Good practice required by the NRP:

PLACE SPOIL AWAY from the waterway

Placing spoil so that is does not re-enter the waterway is required by clause (i) of Rule R134:

"Any sediment, bed or plant material removed from the highly modified river or stream shall be placed and spread on adjoining land in such a way that it cannot slump and be washed back into the highly modified river or stream or other waterbodies, including wetlands."

It is good practice to place spoil in a way that prevents the sediment removed by the excavator from falling back into the channel during floods or re-entering through surface run-off. This depends on factors such as bank gradient and maximum water height and will need to be determined on a case-by-case basis. However, spoil should not be placed further from the waterway than is necessary to prevent re-entry, as this may reduce the number of stranded eels and other life that are able to return to the channel.

Minimise DOWNSTREAM SEDIMENT transport

> **Actively controlling downstream sediment transport is required by clause (k) of Rule R134:**
> *"Shall be trapped at the downstream end of the cleared reach by either installing a sediment trap or a sediment retention device, or retaining a length of intact aquatic vegetation that is at least 10m in length until, at least:*
>
> *(i) the end of each working day where the reach has been cleared working upstream, or*
>
> *(ii) otherwise the end of the following working day"*

To minimise the risk of sediment impacting fish and invertebrates downstream of the excavator, it is good practice to trap and retain as much disturbed sediment as possible before it moves out of the reach being cleared. There are a number of methods of doing this:

- **Install permanent sediment traps** – sediment traps are wide, short and deep excavated pools. As water flows into these pools, velocity reduces, allowing fine sediment disturbed by the excavator to settle out onto the stream bed. After waterway clearance the fine sediment that has accumulated in the trap is excavated. Permanent sediment traps also have the benefit of controlling sediment transport even when waterway clearance is not occurring, and this may decrease the frequency at which clearance is needed. However, they do require maintenance, and there is a cost associated with their design and installation. While basic guidance on sediment trap design can be found at https://www.wet.org.nz/wp-content/uploads/2012/03/COARSE_SED_TRAP.pdf, it is important that each trap is tailored to the prevailing conditions. We recommend that engineering advice be sought when planning a sediment trap installation.
- **Install temporary sediment retention devices** – sediment retention devices are commonly made by stretching filter cloth across the channel to form a silt fence, or by placing hay bales on the bed and securing them with waratahs. When placed at the downstream end of the cleared reach, these devices may provide some level of sediment control in small waterways. However, while these devices are cheap and easy to install, they can blow out and wash away without frequent monitoring and maintenance. Accordingly, they are ill-suited to large clearance operations in fast flowing waterways.
- **Maintain an uncleared section downstream of the excavator** – leaving an uncleared section of aquatic plant material downstream of the excavator will trap and retain some of the sediment released during waterway clearance. The uncleared section of aquatic plants can then be excavated to prevent the sediment retained within it from moving downstream. If using this method, at least 10m of aquatic vegetation should be retained at any one time, but a distance at least seven times the width of the waterway is preferable. If working in a downstream to upstream direction, this vegetation should not be cleared until at least the end of each working day. If working in an upstream to downstream direction, it should be retained until at least the end of the following working day (this means that at least two uncleared sections will need to be retained at any one time).

Good practice additional to that required by the NRP...

Use a conventional bucket in heavily silted waterways

The removal of aquatic plants reduces bed stability allowing sediment to be continually re-suspended until it is transported out of the cleared reaches or re-emerging plants reconsolidate it. Using a conventional bucket (rather than a weed rake) in heavily silted waterways will remove a significant proportion of the sediment, thereby limiting the potential for sediment suspension and its effects in the following months. As a consequence, the rate of fish stranding will be greater than if a weed rake was used. However, this can be mitigated by thorough fish recovery.

Recover distressed fish from the waterway

Fish mortality resulting from de-oxygenation caused by sediment suspension can be reduced by recovering and relocating fish exhibiting obvious signs of stress (gasping for breath at the surface, floating belly up, etc) within the waterway. This should be conducted in all heavily silted waterways containing healthy fish populations.

An eel suffocating in a recently cleared waterway.
Photo: Mike Lake/Waikato Regional Council

A stranded kōura covered in mud after a recent clearing operation.

6. Time works to avoid native fish spawning and migration

Why good practice is needed...*Īnanga (a key whitebait species) spawn along banks of tidal reaches of creeks and waterways. Eggs are deposited in vegetation on a spring tide and develop out of the water. Removal of vegetation immediately prior to spawning limits suitable habitat available for the deposition of eggs. If excavation is conducted while eggs are developing, they may be crushed or removed from the tidal zone.*

Trout spawn in gravel in cool water streams and juveniles stay in gravel for several weeks after hatching. The removal of coarse substrates during excavation reduces spawning habitat availability. In addition, eggs and juveniles may be crushed or removed from the waterway. Sediment released during excavation also poses a risk to eggs and juveniles, which may be killed by associated oxygen depletion or smothered when the sediment re-settles on the bed.

Good practice required by the NRP:

Avoid clearing īnanga and trout spawning habitat DURING THE SPAWNING SEASON

Avoiding drain clearance in īnanga and trout spawning habitats during their spawning season is required by conditions (e) and (f) of the NRP beds of lakes and rivers general conditions:

> ***(e)*** *in any part of the riverbed identified as īnanga spawning habitat in Schedule F1 (rivers/lakes), no bed disturbance, diversions of water or sediment discharge shall occur between 1 January and 31 May,except that material accumulated at the outlet of the stormwater discharge pipe may be removed between 1 January and 1 March, so long as there is no associated trimming or removal of vegetation (including weeds) on the bed or banks, and*
>
> ***(f)*** *in any part of the river or lake bed covered by water, which is identified as trout spawning waters in Schedule I (trout habitat), disturbance of the bed or diversions of water shall not take place during the spawning period of between 31 May and 31 August"*

To minimise the risk of adverse effects on īnanga and trout spawning it is good practice to:

- avoid clearing waterways identified as īnanga spawning habitat in Schedule F1b of the NRP between January and May inclusive, and
- avoid clearing waterways identified as trout spawning habitat in Schedule I of the NRP between June and August inclusive.

To see NRP Schedule F1b (īnanga spawning habitat) go to:
- https://mapping.gw.govt.nz/GW/GWpublicMap_Mobile/?webmap=85393478ca2847f4a37079037e1d79ea

Avoid migrating shoals of WHITEBAIT

Searching for and avoiding whitebait shoals in the whitebait migration zone between 1 August and 31 is required by clause (n) of Rule R134:

> ***For properties located in the whitebait migration zone shown on Map 75, between 1 August and 31 December:***
>
> ***(i) a visual inspection of the works area is undertaken immediately prior to the works and if a shoal of whitebait is present, no mechanical vegetation clearance and sediment removal work shall be undertaken until the shoal passes, and***
>
> ***(ii) mechanical vegetation clearance and sediment removal work shall not occur more than once per reach."***

During the whitebait migration season (1 August to 31 December), shoals of whitebait migrate through the lower reaches of Wellington's rivers and streams. There is a high risk that removing sediment with an excavator during this period will also remove a large number of whitebait in the spoil. To minimise this risk, you should check for whitebait shoals before starting works during the migration season in rivers and streams close to the coast:

1. Check to see whether the stream to be cleared is within the mapped whitebait migration zone* to determine whether a whitebait search is needed.
2. Before beginning works each day, walk or drive the streams to be cleared looking for whitebait shoals. This search should include all reaches downstream of the cleared stream to either the property boundary or its confluence with a larger stream. To improve the chance of detecting any whitebait shoals, use polarised sunglasses and focus your search on areas of open water.
3. If whitebait shoals are found in the search, or a lot of whitebait are found in the spoil, drain clearance should be postponed until the migrating fish pass through.

Whitebait shoal. Photo © EOS Ecology

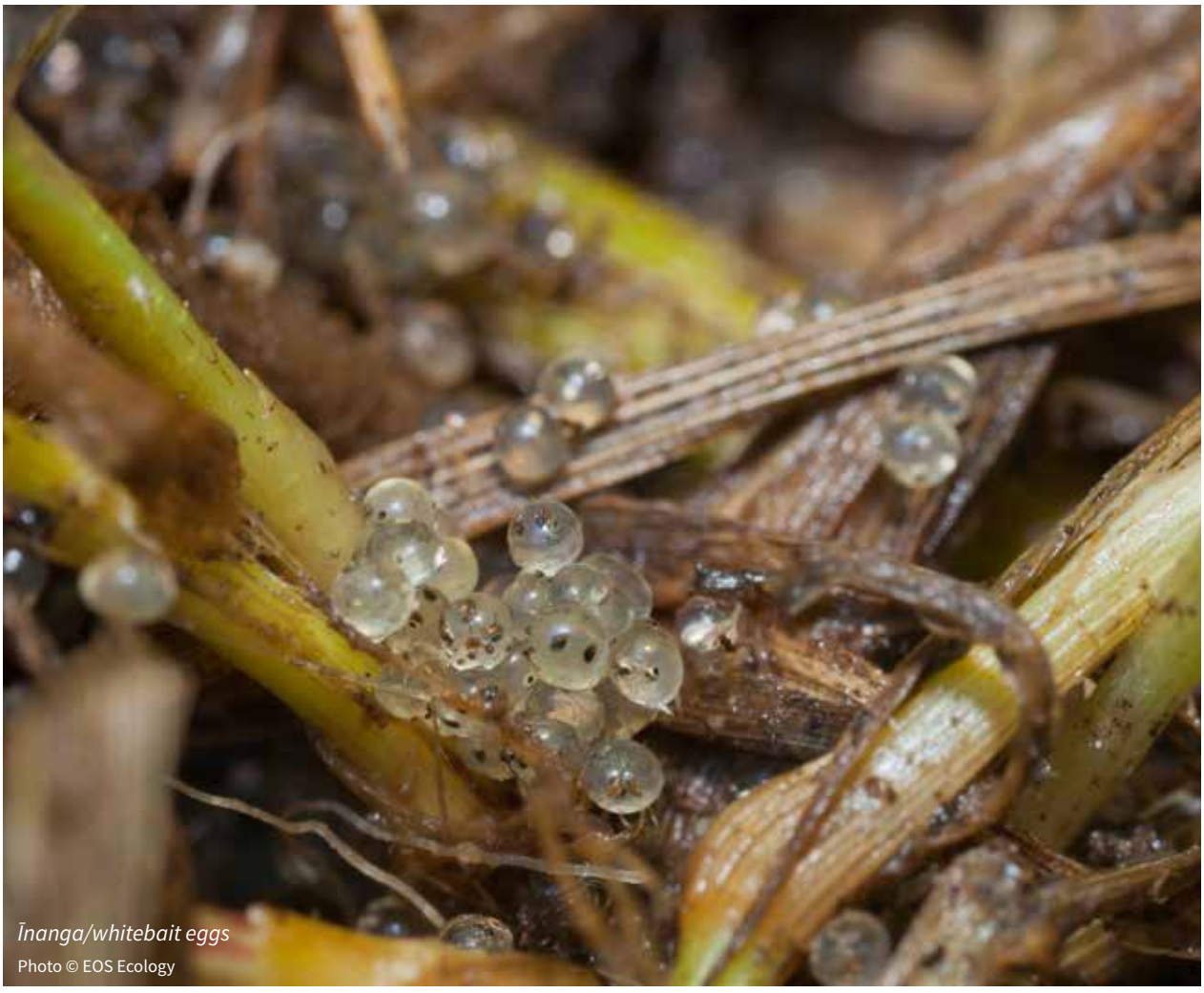
* To view the mapped migration zones look at:

- https://www.gw.govt.nz/assets/Documents/2023/07/Chapter-13.pdf

Good practice additional to that required by the NRP...

Delay works if large numbers of īnanga are being stranded during the spawning season

Īnanga spawning habitat is concentrated in tidal areas, and during the spawning season (March–May) the adult fish form large shoals as they migrate towards the coast to spawn (which occurs only on new and full moon nights). If an excavator intercepts one of these shoals and strands a large number of fish, waterway clearance should be postponed, allowing migrating fish to pass by. Waterway clearance can then generally be resumed the following day.



Īnanga/whitebait eggs
Photo © EOS Ecology

7. Reduce the frequency of waterway clearance

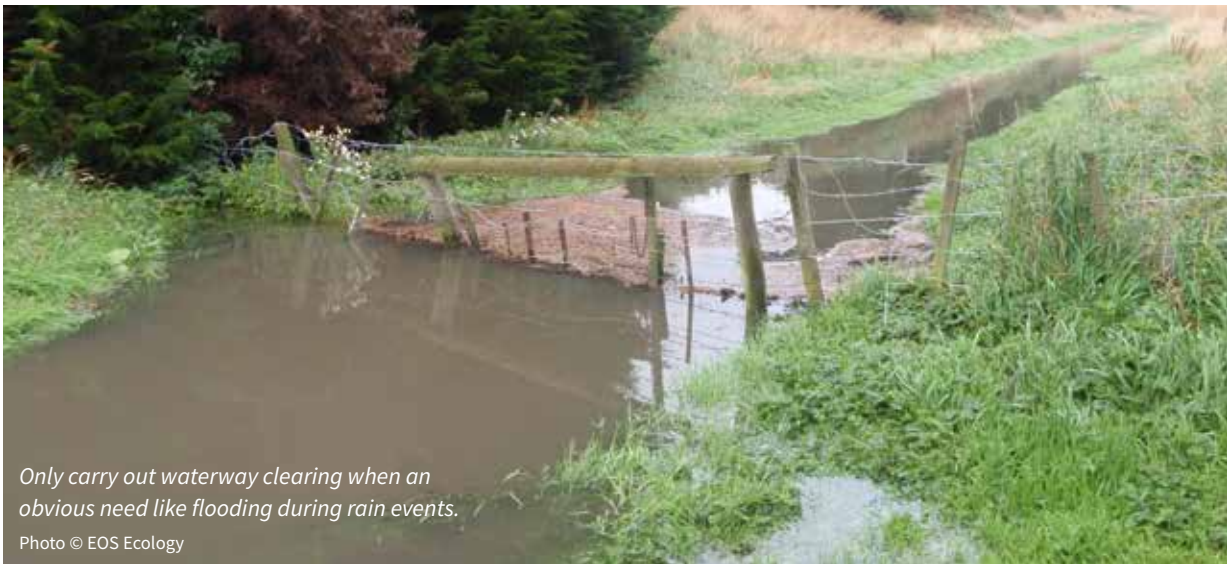
Why good practice is needed... *The good management practices described in pages 5–16 will provide some level of protection to fish and invertebrates during and after waterway clearance. However, when carried out over long distances the adverse effects on water quality and aquatic life are still likely to be significant. Put simply, waterway clearance is an intentionally destructive activity; it is not possible to fully mitigate the effects of using an excavator in a stream. Accordingly, the best method of minimising the effects of waterway clearing is to reduce its frequency.*

Good practice...

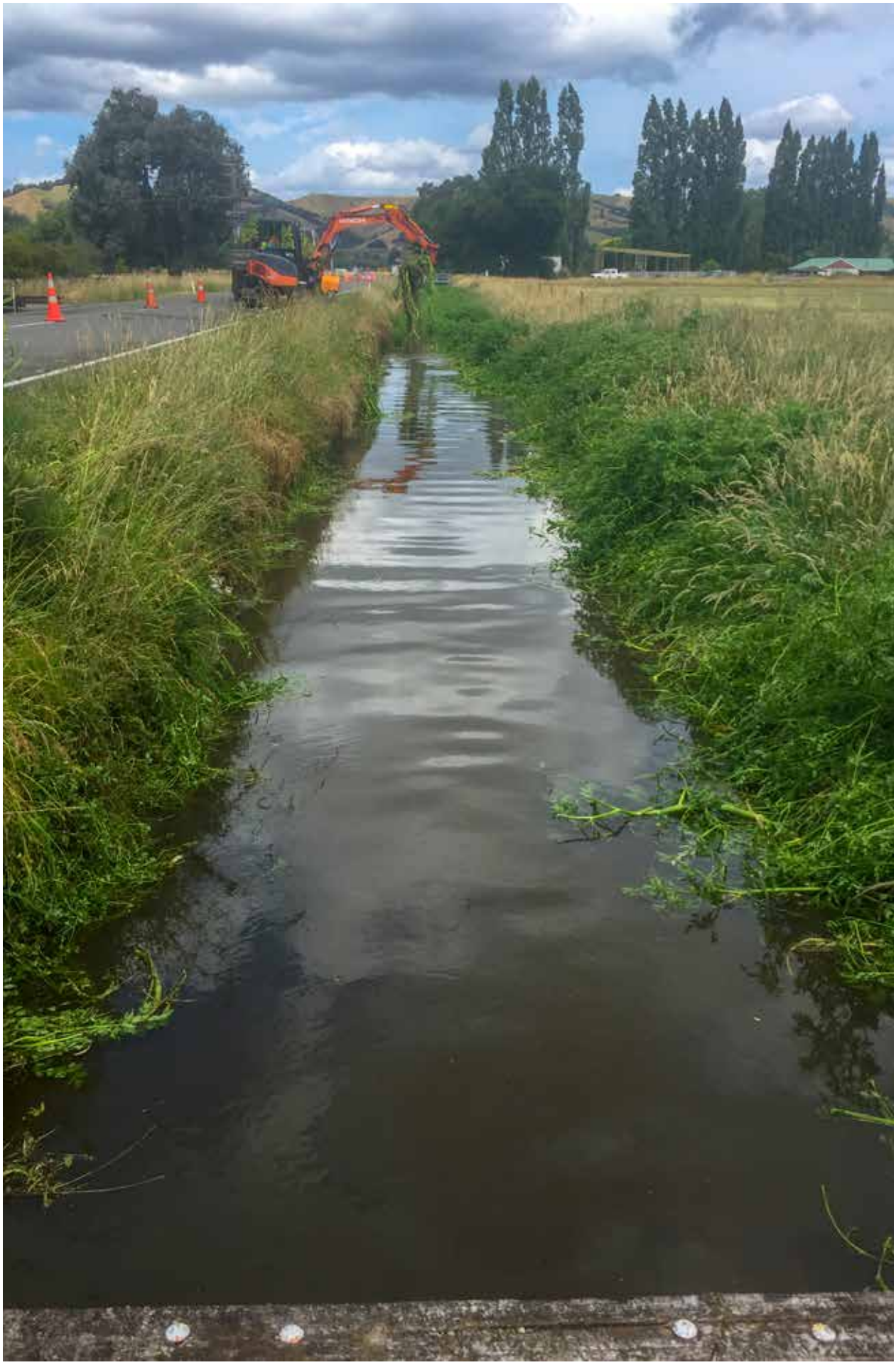
The frequency at which waterway clearing is conducted can be reduced by:

- only carrying out waterway clearing when there is an obvious need (e.g., surface flooding during small rain events, submerged tile waterway outlets, a raised water table) rather than carrying it out at regular intervals or when an excavator is on site for another job,
- avoiding clearing in the growing season when plants are likely to re-establish rapidly,
- extending the time between clearings by spraying plants that grow through or on top of the water, and
- progressively reducing plant growth and sedimentation through land and riparian management practices that decrease the amount of sediment, nutrients and light reaching the water (guidance on how to achieve this can be found at the websites listed below).

https://beeflambnz.com/knowledge-hub/PDF/industry-agreed-good-management-practices-relating-water-quality.pdf



Only carry out waterway clearing when an obvious need like flooding during rain events.
Photo © EOS Ecology



All photos in this document and on front cover sourced from GWRC unless otherwise stated.

Worksite check list
for landowners and excavator operators

1. Maintain the stream bed profile

- [ ] Do not alter the width or depth of the channel

2. Retain vegetation on the bank

- [ ] Do not remove vegetation from the dry banks
- [ ] *Stabilise soil exposed on the bank during weed control*

3. Reduce the effects of fish stranding

- [ ] Conduct fish recovery
- [ ] *Use a weed rake in hard-bottomed waterways*
- [ ] *Leave the bucket submerged at the end of each scoop*
- [ ] *Distribute spoil so that eels can return to the water*

4. Preserve and/or create aquatic habitat

- [ ] Only partially clear plants from the waterway, or
- [ ] Install artificial fish refuges
- [ ] Retain woody debris (>0.2m in diameter)
- [ ] *Avoid clearing all waterways in a property at once*
- [ ] *Preserve specific habitats*
- [ ] *Avoid removing gravel*
- [ ] *Maintain variability in stream bed profile*

5. Minimise sediment release

- [ ] Trap sediment at the end of the cleared reach
- [ ] Place spoil away from the waterway
- [ ] *Use a conventional bucket in heavily silted waterways*
- [ ] *Recover distressed fish from the waterway*

6. Time works to avoid īnanga/whitebait and trout spawning and migration

- [ ] Avoid clearing identified spawning habitat during the spawning seasons:
  1 January–31 May for īnanga and 31 May–31 August for trout
- [ ] During the whitebait migration season, delay works to allow shoals of migrating whitebait move safely through the work area.

7. Reduce the frequency of waterway clearance

8. Prevent the spread of aquatic pests and weeds

- [ ] *Clean your machinery or give it time to dry out before digging in a different waterway*

https://www.fedfarm.org.nz/FFPublic/Policy2/Industry/Factsheets/Keep_it_Clean__Machinery_hygiene_guidelines_and_logbook_to_prevent_the_spread_of_pests_and_weeds.aspx

Greater Wellington
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