




Caring for Urban Streams

Auckland Council Technical Report TR2013/020

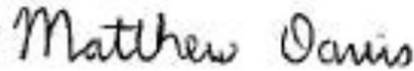


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FOREWORD

This document was produced to help private property owners manage urban streams. It highlights the benefits of streams, outlines environmental information on stream health, provides solutions for stream issues, lists legislative responsibilities, and offers general guidance to inform urban stream management. Caring for Urban Streams includes this technical document, information on developing a stream management plan (Appendix A), individual guides addressing particular aspects of stream management (Appendix B), and a quick reference guide for readers (Appendix C). To get an overall understanding of the issues related to stream management it is recommended that people read through the complete set of guides.

This information is important as property owners are legally responsible for maintaining the streams passing through or on the boundaries of their property. Landowners also need to remember to check whether any works in a stream are legally compliant, require consent, or require professional input.

Urban streams, whether flowing permanently, intermittent, or ephemeral, perform important ecosystem functions. They also offer many social, economic and environmental benefits to individuals and the wider community, and all these benefits are interconnected.

Auckland urban streams have been highly modified by urban development. As the city has developed, impervious surfaces have increased the speed and volume of flows, causing flooding, erosion and sedimentation and affecting water quality. We can tell the quality of a stream's health through a number of key signs such as clarity, flow volume and velocity, oxygen levels and biodiversity. Careful maintenance and enhancement, including simple solutions at a local scale, can improve the health of urban streams, with benefits to all.

Fortunately there are a number of organisations and community groups already monitoring and maintaining Auckland urban streams and these may offer useful advice and assistance.

Choosing stream management solutions depends on the issues, risks to people and property, site-specific constraints, stream character and available funds and resources. The six guides which have been developed help identify problems and offer general solutions. Structural engineering solutions may be avoided if issues are addressed early but sometimes professional advice is required for more complex issues.

Several sections of local and national government legislation control what physical works and activities can occur in streams, and good intentions around the environment don't remove the need for people to check legal compliance and seek advice from Auckland Council before undertaking works in or near a stream.

Good stream management protects landowners, the community and the environment, and reading and following the advice in these documents is a great start in helping Auckland become the city that we want it to become. Private landowners can make a significant difference – many small gains at the individual property scale have the potential to achieve much larger gains on a catchment scale, both in the short and long term.

For access to this report and to find related information sheets, search for "Caring for Urban Streams" at www.aucklandcouncil.govt.nz

If you have any questions about this information sheet please contact Auckland Council on 09 301 0101

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GLOSSARY

Aquatic	Living in the water
Aquatic macroinvertebrates	Invertebrates that are visible to the naked eye and that live in freshwater for part or all of their lives
Baseflow	This is the longer-term discharge of water into a stream from natural areas of storage (such as groundwater and seepage), which keeps streams flowing between rainfall events. Sustained baseflows are critical to stream health.
Channel migration zone	The area a stream naturally moves across over time. This can be identified by abandoned side channels, oxbows, or wetlands in the floodplain.
Culvert	A pipe set in a stream to convey water under a specific structure such as a path or road
Ecology	The study of the relationships between animals and plants and their environment
Emergent plant	Plant with roots below water surface but extending above the water level, or in an area that is periodically submerged
Ephemeral stream	A stream channel that carries water only during and immediately after periods of rainfall, with a channel always above the groundwater table
Erosion	The process by which soil and rock is removed from the Earth's surface by the flow of water
Flood Plain	Any nearly flat land area bordering a stream that may become covered by stream overflow during storm flows
Gabion Basket	A large wire mesh basket filled with rocks, used to protect and/or stabilise banks
Habitat	The natural home of an animal or plant
Hydrology	The study of water on or under the earth's surface
Hydrophilic plants	Plants having a strong affinity for water, growing successfully in wet conditions
Impervious	Hard surfaces that either prevent or retard the entry of water into the soil. Common impervious surfaces include: building roofs, footpaths, patios, driveways, parking areas, concrete or asphalt paving, gravel roads, and packed earthen materials
Intermittent stream	A stream which carries water a considerable portion of the time, but which ceases to flow occasionally or seasonally
Low flow channel	The section of the streambed usually always wet from water flows
Permanent stream	A stream or portion of a stream that flows year-round and for which baseflow is maintained by seepage from groundwater Auckland Regional Plan: Air, Land, Water definition: Downstream of the uppermost reach of a river or stream which meets either of the following criteria: (a) has continual flow; or (b) has natural pools having a depth at their deepest point of not less than 150 millimetres and a total pool surface area that is 10m ² or more per 100 metres of river or streambed length;
Retaining Wall	A wall built to support the land behind it
Riparian zone	The banks and floodplains of a natural watercourse, including the full range of aquatic, semi-aquatic, floodplain and channel migration habitats
Sediment	Small particles of solid material, both mineral and organic
Stormwater	Rain once it has fallen on the ground and begins to flow overland
Streambed	The bottom, or base, of the stream, usually covered by water
Stream Channel	The course followed by water in a stream
Stream Cross-Section	The view across the streambed and banks
Tangata whenua	In relation to a particular area, the iwi or hapu that hold mana whenua over the area
Terrestrial	Living on the land
Thalweg	A deeper, narrower channel within the streambed that stays relatively deep even in times of low flow
Toe of Stream Bank	The point where the streambed meets the bank in the low flow channel area
Waterway	A way or channel for conveying water
Watercourse	A continually or intermittently flowing body of fresh water

1.0 BACKGROUND

This document has been prepared to help private land owners take care of urban streams on private property. It highlights social, economic and biodiversity benefits that good urban stream management offers individual landowners and the wider Auckland community. It provides landowners and occupiers with environmental information on the hydrological and ecological functions of urban streams. It also provides management advice to reduce the risk of flooding and erosion, improve amenity values, and create a healthier stream environment overall.

1.1 WHO MANAGES URBAN STREAMS?

Property owners are legally responsible for maintaining the streams passing through or on the boundaries of their property. There are six guides in Appendix B of this document that help identify problems and offer general solutions and guidance for stream flooding, erosion, water quality, planting and animal life. It should be noted that this document is intended as advice only, and it is the responsibility of the private landowner to ensure that all activities undertaken are legally compliant and suitable for the stream. It is recommended that a suitably qualified professional oversee the planning and implementation of any works.

1.2 WHAT IS AN URBAN STREAM?

Streams are channels of flowing water, generally freshwater, feeding into rivers and lakes or directly into the sea. Streams are riparian ecosystems, with plant and animal communities adapted to dry and wet habitats, and transitional habitats between land and water. Streams may be permanent (with year round flows or permanent pools), intermittent (with times during the year when water does not flow in the streambed due to lack of groundwater and rainfall) or ephemeral (when water only flows for a short time after large storms). All three types of stream perform important ecological functions.

Most Auckland urban streams receive flow from extensive hard surfaces like concrete, roofs and roads. Urban areas have networks of pipes that collect rain, or stormwater, from these hard surfaces and pipe it directly into streams to eventually flow into the sea (and onto beaches) or lakes. Stormwater flows to urban streams faster and in greater quantities than in non-urban areas because less water is able to soak into the

soil, drain to groundwater, or be used or intercepted by plants. It is also frequently warmer as thermal energy from heated surfaces is transferred into stormwater runoff, and this water has not had the time to cool down before it reaches the stream. Stormwater also carries pollution - rubbish, small solid particles, and dissolved substances. All these factors cause damage not only to the stream environment but also to the coastal environment as the two are intrinsically connected.

Therefore, good urban stream management on individual properties, on both private and public land, helps improve the health of stream ecosystems on a catchment scale, from the headwaters at the source of the stream to the sea that it flows to.



2.0 THE BENEFITS OF HEALTHY URBAN STREAMS

A healthy stream system is an asset to landowners, the wider community, and the natural environment. Well managed streams play a vital role in New Zealand's ecosystems, performing important environmental functions. Streams provide direct and indirect social, economic, and ecological benefits. As detailed below, these benefits often interconnect – for instance, environmental benefits also offer economic and social benefits.

2.1 SOCIAL BENEFITS OF STREAMS

- Involvement in community projects and co-management of streams often promotes healthy neighbourhoods and a collective enjoyment of the environment, whilst also offering an educational resource and open space for recreation.
- Well-managed stream environments offer recreational and educational opportunities by improving the overall health and appearance of waterways, creating safer and more enjoyable environments, and promoting active use of the stream and its surrounding habitats.
- Maori have strong cultural and spiritual links to streams. Streams are spiritually important (mauri), a source of kaimoana, and contribute to the identity of tangata whenua (people of the land).
- Healthy streams are less likely to create nuisance problems such as algal blooms (eutrophication), mosquito problems, flies, and weed infestation.
- Vegetation in and adjacent to streams (the riparian zone) filters stormwater runoff, provides shade, improves air quality, and makes the urban landscape more attractive - these all contribute to enjoyment of the environment.
- Stable stream banks minimise erosion and slumping, and this can help safeguard the stability of nearby buildings, roads and other infrastructure, improve safety, and preserve aquatic habitats.

2.2 ECONOMIC BENEFITS OF STREAMS

- Property values can increase with stream enhancements by providing a healthier environment, improved safety, improved privacy, increased birdlife, natural amenity, and a litter-free environment).
- Healthy streams are vital for a sustainable coastal marine environment – they



- prevent sedimentation of estuaries and safeguard recreational activities and livelihoods such as white-bait, fishing and shellfish harvesting.
- Natural floodplains and stream channels decrease flood risks to both the natural and urban environment by slowing flow rates, increasing storage of flood waters, and promoting absorption of stormwater into the ground. This reduces the likelihood of property damage, safety issues, and insurance liabilities.
- Important marine fisheries can be affected by pollution accumulating in shallow marine areas. Healthy riparian areas and streams filter and trap these pollutants.
- The positive impact of healthy streams on the wider environment leads to greater appeal and liveability of the catchment area, attracting positive investment to Auckland.
- Land insurers require landowners to take reasonable measure to prevent natural disaster damage – stream management is a key intervention.

2.3 ECOLOGICAL BENEFITS OF STREAMS

- Streams are natural ecologically important drainage networks in the landscape.
- Streams improve water quality by filtering harmful pollutants that wash off urban and agricultural land, reducing downstream degradation of lakes, rivers and marine areas.
- Well managed headwaters can reduce the effects of heavy rain downstream by slowing runoff, minimising downstream erosion and recharging groundwater supplies.
- Streams and planted streamside margins (riparian planting) filter and contain sediment which would reduce water quality, negatively impact on aquatic animal life cycles, and affect the growth of macrophytes and biofilms further downstream.
- Healthy streams provide shelter, food and breeding grounds to New Zealand native fish species. There are more than a dozen species of freshwater fish that migrate between freshwater and saltwater during their life cycles (including eels and whitebait species).
- Streams and their planted margins link important ecological corridors, creating natural pathways for land and water life to move from the coast into inland areas.
- Planted streamside margins - riparian planting - cools stream waters, which is important for the survival of stream life.
- Riparian plants provide organic materials (such as large woody debris, leaves and twigs from trees) that provide food, shelter, and habitat for stream life.
- Streams are crucial habitats to complete the life cycles for many invertebrate species including many insects. These insects form an important component in the diets of many native birds, connecting the land to the stream.



Regular stream visitor – Tui

Photo by Geoff Moon



Native fish – Giant Kokopu

Photo by Stephen Moore

3.0 AUCKLAND URBAN STREAM HEALTH

The Auckland region has a complex and extensive stream network. As Auckland grows, streams are at risk of becoming degraded if not well managed. Urban growth and development can cause problems for natural streams. However, if well managed, these streams have the potential to deliver valuable benefits (ecosystem goods and services) to the wider community.

3.1 URBAN GROWTH AND DEVELOPMENT

Poor management of streams can cause problems in urban areas. Urban growth and development has significant impact on the natural character of our streams. Between 2000 -2008, around 80 kilometres of Auckland streams required resource consents for stream disturbance. Water flows in urban areas are affected by increased areas of hard (impervious) surfaces, and habitats are consequently changed, resulting in a loss of stream life and vegetation around and within streams. Although erosion, slumping, sedimentation, and flooding are natural stream processes, urban development and associated activities accelerate the extent and rate of these processes.

3.2 IMPERVIOUS SURFACES

Impervious surfaces such as buildings, driveways, parking areas, roofs and patios cover about 40% of residential land area and as much as 80% of commercial or light industrial areas. These surfaces prevent water from seeping into the ground, reduce the amount taken up by plants through evaporation and transpiration, and speed up flows of rainwater to streams. Impervious areas cause stream flow rates to increase rapidly during a storm, creating higher volumes, making peak stream flows up to three times greater than in natural stream flows. These faster, larger flows can lead to more frequent and severe flooding and erosion causing ongoing environmental damage. In between storms, urban streams can have lower baseflows, particularly during the dry season, as less water is stored in surrounding topsoil and subsoils, and streams receive less water flowing from groundwater, interflow and aquifers. Runoff flowing across impervious surfaces also collects harmful contaminants including heavy metals, hydrocarbons (oil and grease), cleaning chemicals, nutrients, pathogens, litter, and sediment. This all contributes to stream degradation.

3.3 SEDIMENTATION

About 95% of the streams in the Auckland region are naturally soft-bottomed, with clay and silty streambeds. Soft stream beds are therefore not necessarily as a result of sedimentation. Sedimentation is the excessive accumulation of fine soil and plant particles (sediment) in streams and coastal areas from erosion, and also from earthwork activities surrounding waterways. If a stream turns very muddy during rainfall events, then sedimentation may be an issue to consider. The sediment can also hold heavy metals and other pollutants washed off impervious areas. The accumulation of sediment and pollutants cause long-term problems for marine life and people using coastal areas. Sedimentation is one of the biggest problems facing Auckland streams, harbours, and the wider Hauraki Gulf.



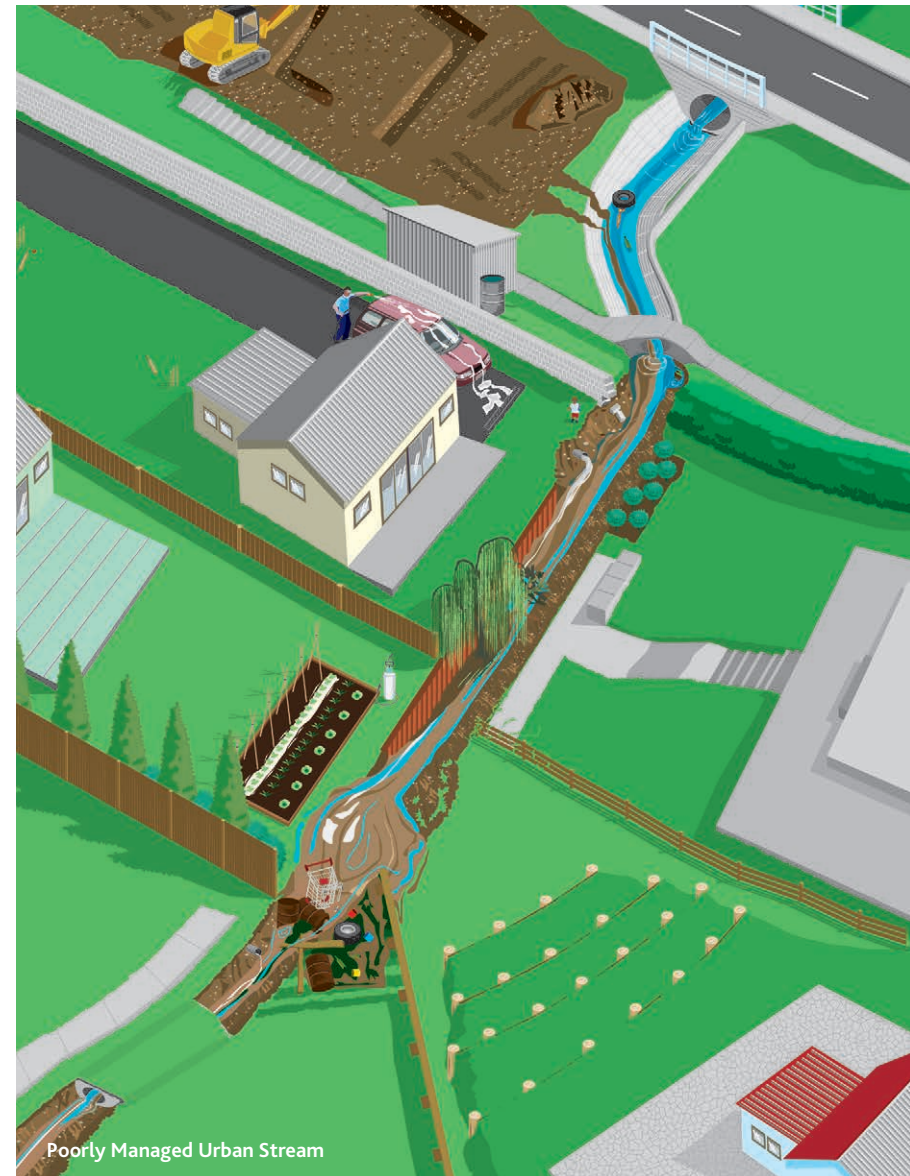
3.4 IMPROVING URBAN STREAM HEALTH

Auckland has suffered large scale loss of and changes to streams. It is important to maintain and enhance remaining streams as far as practicable. Although many urban streams are compromised by surrounding land use, most can be enhanced at a local scale with good results for stream health.

There are some clear differences between healthy and degraded streams, as illustrated in Appendix C.

The signs of degraded streams may include:

- Muddy water, warm water, an excess of algae, poor water quality, stagnant water with bad odour.
- Reduced flow, especially between rainfall events, with frequent shallow water.
- Few meanders, no defined deeper channel (thalweg), no floodplain.
- Modified stream channel – widened, straightened, diverted, culverts, concrete channels or pipes.
- Eroded stream banks – undercut, slumping, widened.
- Lack of native vegetation on stream banks and edges, or weed species choking native plants.
- Few pools and riffles (shallow gravel or sandy areas) in streambed, with stones and plants covered in silt and algae.
- Rubbish and dumped material in stream, or structures built on the floodplain (sheds, solid fences, walls).
- Lack of plant debris in streambed (logs, sticks and leaves).
- Lack of native fish, reduced variety of water life including insects, shellfish and amphibians.
- Barriers to fish migration - perched culverts, steep slopes, fast flows, shallow and low volume flows.
- Lack of habitat for birds and other animal life alongside streams.



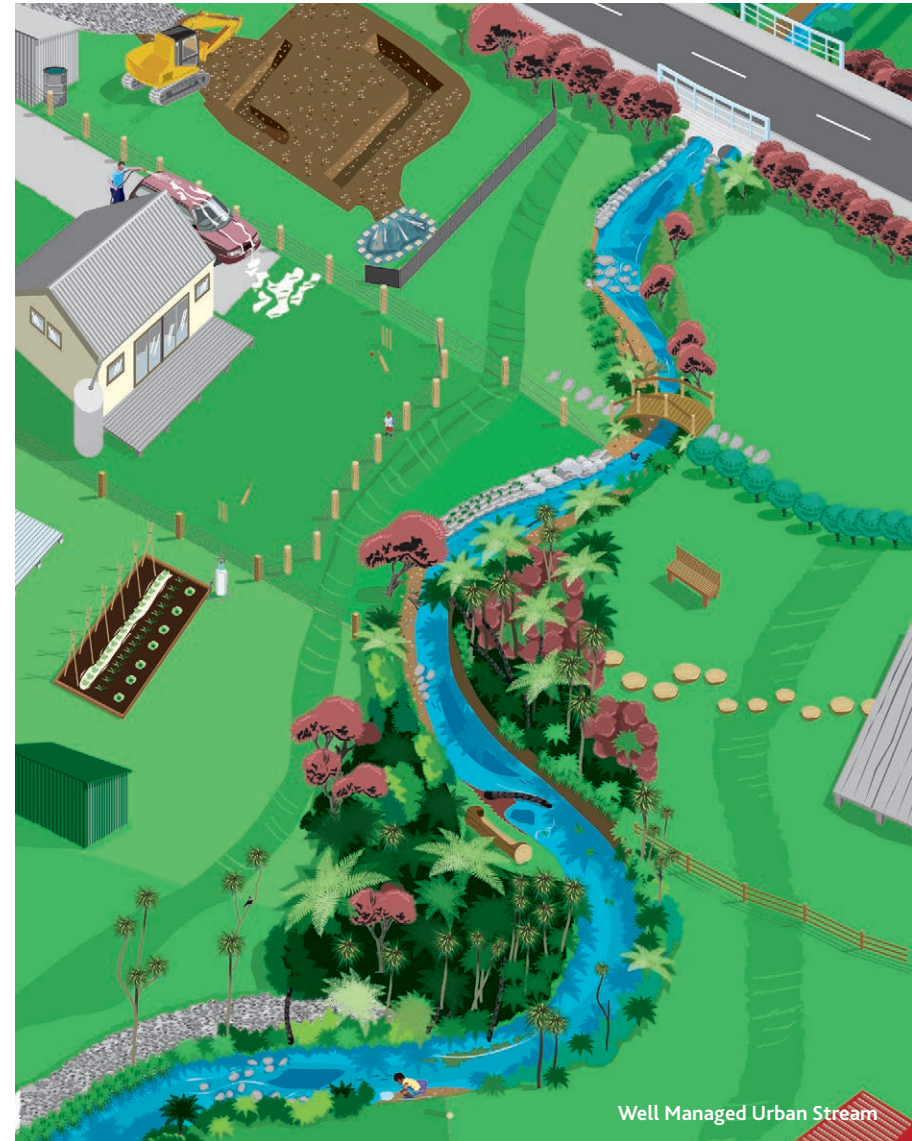
The signs of a healthy stream may include:

- Good water quality, natural algae, clear and cool water.
- Sustained flows between rainfall, with deeper pools and shallow runs and riffles (gravels and sandy sections).
- Natural meandering banks with defined thalweg (deeper channel) and floodplain.
- Stable stream banks with native planting and minimal erosion.
- Lack of rubbish and weeds on stream side and in stream, and no structures (sheds, walls, fences) blocking floodplain.
- Lack of smothering sediment and algae on stream stones and plants.
- Presence of logs, twigs and leaves in streambed.
- Streamside native plants with canopy and understorey as habitat for streamside animal life.
- Presence of native fish, variety of stream animal life including amphibians and aquatic insect populations.

(Refer to Appendix C)

Enhancement of an entire stream can be complex, depending on conditions upstream and downstream, changes to the streambed and floodplains, health and safety issues, and the shortage of space around streams. But there are many solutions that can be used to improve stream health at a local scale, from removing litter and controlling weeds, to improving fish passage and replanting riparian zones. These all help the overall health of a stream.

The best urban stream management solutions safeguard people and property from flooding, erosion, damage or personal injury as well as protecting the natural character of the stream, while improving amenity and ecological benefits. Although this all may seem too difficult to achieve, sometimes simple solutions address many of these issues at once.



4.0 HELP AND ADVICE TO MANAGE URBAN STREAMS

Property owners are legally responsible for maintaining the streams on their property. Working with a group on a stream can make a significant difference to the ongoing health of a stream, however, efforts by individuals also make a difference.

Without assuming responsibility for the maintenance of streams in private ownership, Auckland Council may also be able to assist private landowners with advice and funding, specifically landowners whose properties are at risk of serious erosion and flooding. The level of assistance will depend on the severity of any problem. Please contact Auckland Council Stormwater Operations on (09) 301 0101 if you have any queries.

4.1 CHOOSING STREAM MANAGEMENT SOLUTIONS

When choosing stream management solutions to address problems, the aim should be to achieve as many benefits to stream health as possible. Solutions chosen for a particular stream will depend on the severity of issues, risks to people and property, the constraints of the property, the character of the stream and surrounding catchment as well as available funds and resources.

There are six guides in Appendix B of this document that help identify problems and offer general solutions for streams:

Guide 1: Flooding

Guide 2: Erosion

Guide 3: Stream water quality

Guide 4: Stream side planting

Guide 5: Stream life

Guide 6: Fish passage

Some solutions are simple and inexpensive and can be easily done by individuals, while more complex issues may need professional advice including engineering solutions.

Structures such as concrete channels and retaining walls should only be used if more natural solutions cannot be used. Such more invasive measures may be required if there is ongoing danger to people and property. Unfortunately these can reduce the natural character and ecological benefits of a stream, and can cause other problems. Recognising issues early and taking simple actions can sometimes avoid the need for engineering solutions, or make sure engineering designs also protect stream health.



4.2 GETTING HELP AND ADVICE

It is important to seek advice before working in and around a stream to make the best decisions, and to check if consents are required. As well as Auckland Council, organisations and groups have information and resources to help landowners manage urban streams – see below. Particularly effective community groups comprise “Friends of ...” groups that take adopt streams or sections of streams, generate local interest, and rehabilitate streams through a community-driven approach. Some Council initiatives are outlined below:

- **Wai Care.** This programme helps community groups and schools monitor streams or water bodies. Data collected by each group is used to plan practical ways to restore, enhance or protect the adopted water body. www.waicare.org.nz
- **Project Twin Streams.** Local residents in the west Auckland area work with local community organisations and researchers to develop riparian planting programmes across five catchments and share information. www.projecttwinstreams.com
- **Environmental Initiatives Fund** This provides funding, practical support and advice to Aucklanders to help protect and enhance local environment and heritage. Check application criteria for eligibility. Further information can be obtained by entering ‘Auckland Council Environmental Initiatives Fund’ on internet search engines.

For information on any programmes which may be taking place in your area, call Auckland Council (09 301 0101) and request to talk to the Environmental Programme Advisor in your area. Also, before undertaking stream works, contact Auckland Council to check with Resource Consents (Natural Resources and Specialist Input Unit, Earthworks and Contaminated Land Team) and Building Control. The next section in this document discusses why and when Consents may be required.



Photo by Geoff Moon

5.0 STREAM MANAGEMENT LEGISLATION AND RESOURCE CONSENTS

Most streams in Auckland pass through private land and almost all are deemed private watercourses. Managing private watercourses is the responsibility of the landowner, including any water that is piped from the property to a stream. A landowner should be aware of rules and regulations in order to avoid any penalties and ensure property insurance requirements are met.

Several sections of Central and local government legislation refer to activities in and around streams. Seek advice from Council if you are unsure if proposed stream management plans are permitted or require a consent, and before constructing anything within the stream. Contact the Auckland Council on 09 301 0101, and request guidance from Resource Consents (Natural Resources and Specialist Input Unit, Earthworks and Contaminated Land Team) and Building Control.

5.1 LEGISLATION

Permitted activities in streams in Auckland are set out in Chapter 7 of the Auckland Council Regional Plan: Air, Land, and Water (ALWP), which is available on the Auckland Council website. It is the responsibility of the landowner or occupier to ensure that only permitted activities are carried out, or that resource consents are obtained for any non-permitted activities. General repairs, maintenance and small alterations to existing structures and the stream channel are permitted, as is the building of minor additional structures. This is all on condition that any activities do not adversely affect flooding, erosion, bank instability, fish passage, and the overall functioning of the stream.

The importance of keeping streams free flowing is covered in Section 511 of the Local Government Act (1974) and Section 62 of the Land Drainage Act (1908). These acts authorise the Auckland Council to instruct landowners or occupiers to remove obstructions within streams. A number of Council by-laws also require streams are maintained for stormwater purposes (for example, large blockages must be removed).

Culverts usually require consent. Culverts, bridges or weirs are not exempted within Schedule 1 of the Building Act (2004, updated in 2010). Culverts are only exempted when they are part of a public road or structure. Please consult with Auckland Council Building Control before constructing anything within the stream.

Use of the beds of streams is restricted within Section 13 of the Resource Management Act, 1991 (RMA). This places restrictions on certain uses of beds



Hard bottom stream

of streams, including the placement of structures, introduction of plants, disturbances to the bed, deposition of materials, and reclamation work in any streambeds, and protects the intrinsic value of ecosystems. The RMA goes on to make allowances for the above activities, but only where expressly permitted by a national environmental standard, a rule in a regional plan, a rule in a proposed regional plan, or a resource consent.

Fish passage is covered in the policies, objectives and rules of the ALWP. This requires all in-stream structures do not pose barriers to fish, and measures must be taken to ensure fish passage is provided. The provision of fish passage through in-stream structures is required under Freshwater Fisheries Regulations (1983), requiring the written approval of the Director-General of Conservation for anyone to build a structure that impedes fish passage.

Other legislation to consider includes the National Policy Statement: Freshwater Management (2010), and relevant local District Plans. District Plans may require a resource consent if activities are proposed within defined setbacks from watercourses.

Any person or organisation carrying out works or development activities must comply with the requirements of all of these legislative requirements. Importantly, insurers of land require landowners to take all reasonable measures to prevent natural disaster damage to their property.

Regardless of the legal context, it is in every landowner's interest to maintain and manage our streams - good stream management provides very real benefits, with reduced erosion, flooding and ecological gains good for landowners, communities and ecosystems alike.



Natural stream feature - leave in place



Artificial fish passage barrier - requires improvement

Photo by www.morpnum.com

FURTHER INFORMATION

Six guidelines have been prepared as part of this document (included in Appendix B), to guide activities in and adjacent to streams. Further information on urban streams can also be obtained by entering the following search terms on internet search engines:

- Auckland Council
- Urban streams
- Stream restoration

