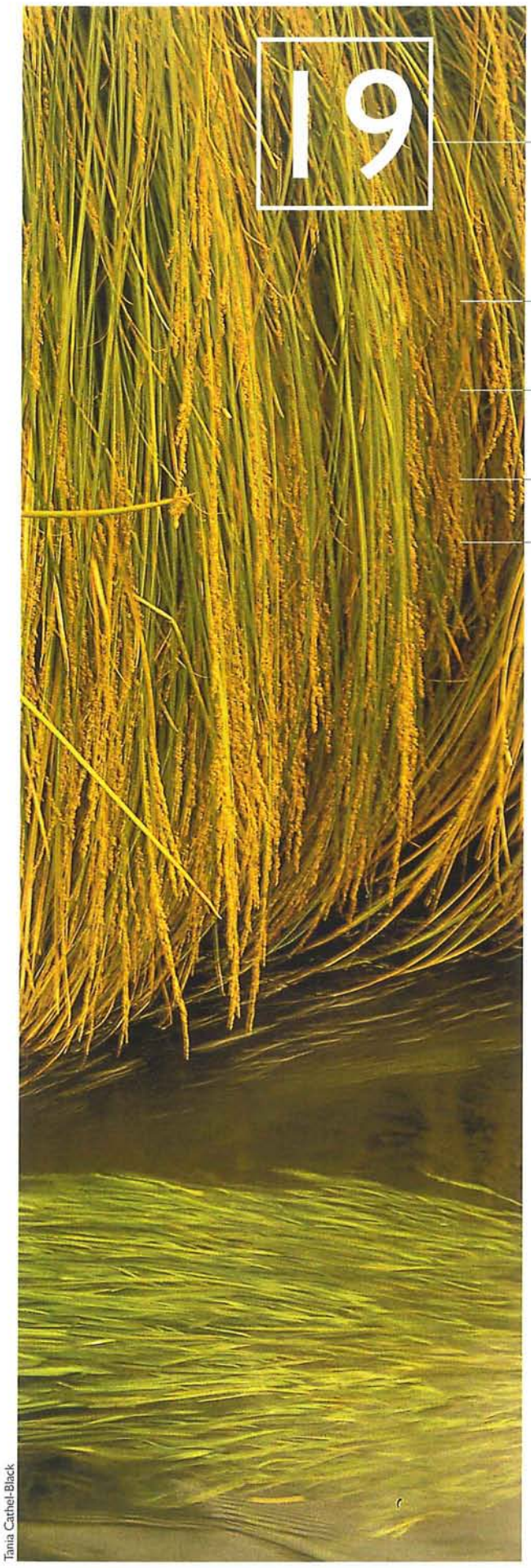

Tania Cathel-Black

19 Operation and Maintenance

A Christchurch City Council maintenance team at work in the Heathcote River/Ōpāwaho

Rachel Barker

19.1 Objectives and Benefits of Operation and Maintenance

Sustainable waterway and wetland design solutions require careful attention to all operation and maintenance (O&M) issues. The application of "life cycle" design principles, including short-term and long-term maintenance and renewal considerations, is required to deliver solutions that meet community level-of-service expectations, are environmentally sustainable, and economically affordable.

For waterways and wetlands, maintenance activities for control of bank vegetation, aquatic vegetation, litter, nuisance, and sediment need to be carried out regularly. The Christchurch City Council budgets $3.5 million on its annual maintenance activity.

Ongoing maintenance is arguably the single most important factor in determining long-term success and sustainability of any works on waterways and wetlands. To be sustainable the following conditions will need to be met:

- ongoing maintenance is affordable and practical
- landscape and ecological values and other values are retained or enhanced
- a positive attitude and stewardship by owners is fostered
- long term management roles for the site are clarified and documented.

The importance of "O&M friendly" design and appropriate ongoing O&M activity cannot be over-emphasised.

The objectives of a maintenance programme for waterways and wetlands are to:

- ensure that all values for which the system is being managed are retained and enhanced
- ensure that the system component is managed in accordance with the designer's intention
- monitor performance and costs
- meet all consent requirements
- build in a feedback process on performance
- review and improve management design and techniques
- meet community level-of-service expectations
- keep City Council assets in good condition in perpetuity (or until replacement is needed)
- retain flow capacity for both normal and storm conditions, while enhancing the value of the community asset.

All values need to be considered in determining an appropriate maintenance programme. For example, the effect of over vigorous maintenance activity is loss of habitat. Boffa Miskell and Design Services Unit (1992) concluded that the rigorous maintenance regime applied to the Heathcote River/Pūrakaunui and its margins up to 1991 had a serious adverse effect on the river in terms of bank erosion and loss of shade and habitat. Prior to this Baird (1992), and Eldon & Kelly (1992), both recommended an altered approach to the excessive weed cutting management regime of river banks, margins, and beds. Consequently, maintenance regimes more sympathetic of ecological, as well as drainage values are evolving and being applied throughout the entire waterway system.

An audit and review of vegetation control practices by Arts (1996) supported the current cautious agri-chemicals use for vegetation management. Recently the City Council has been working towards more sustainable methods of management, including minimising herbicide use.

The effects of inadequate maintenance include loss of drainage level-of-service, a build up of litter and sediment wherever obstructions or quiescent hydraulic conditions exist, and an increasing number of objections from adjoining owners and the general public about the aesthetic condition of the waterway.

The benefits of an appropriate O&M regime include the following:

- community satisfaction maintained
- general support for the sustainable management of Christchurch's waterways and wetlands
- improved ecosystem health
- growing awareness and appreciation of waterways and wetlands values
- waterside residents participation in the care of and guardianship (i.e. kaitaikitanga) for "their" waterway or wetland.

19.2 Operation and Maintenance Manual Checklist

General O&M considerations common to almost all system components are listed in this checklist. The checklist should be applied to all new system components and whenever amenity components are under review.

O&M aspects that are specific to particular system components can be found within the relevant chapter in this document.

OPERATION AND MAINTENANCE CHECKLIST

For Designers and System Managers

- ❑ Photocopy and use this checklist for all projects.
- ❑ For all questions, consider impacts on adjacent owners/community.

Responsibilities

- ❑ Is it clear who is responsible for the various aspects of maintenance?
- ❑ What is expected of the adjoining owner? What is expected of the Council?
- ❑ Have all the necessary consents been obtained?
- ❑ What is the process for transferring project responsibility between different entities (e.g. between construction, plant establishment, and long-term maintenance phases)?
- ❑ Who should hold the discharge permit and any other consents? Should they be transferred to the Council, and if so, when?
- ❑ If the system component is on private land, have the landowner's needs been taken into account?
- ❑ Have all the written agreements of roles and responsibilities been completed?

Operation and Maintenance Methods and Procedures

- ❑ Have clear O&M strategies, procedures, or guidelines been issued? Are the documents readily accessible to all personnel involved? NB: Operation manuals are always required for wetlands, basins, and ponds.
- ❑ Have the most appropriate maintenance techniques been specified? Are they authorised?
- ❑ Have alternative techniques been considered? Is the preferred technique the most cost-effective?
- ❑ Has satisfactory access for maintenance been provided? What type of machinery, if any, will need to gain access?
- ❑ Do any pools/ponds need to be completely drained for lining repair, sediment removal, etc? Does pond water level need to be managed or completely drained? How can this be achieved?
- ❑ Is access width, space, slope, and surface still suitable during storm emergency conditions?
- ❑ Will the maintenance regime need to change through the life of the project?
- ❑ Has site security and adjoining owners' security been considered? Is there a need for fencing and locked gates?

Public Safety and Security

- ❑ Have requirements of the Health and Safety in Employment Act been met (i.e. have all the hazards been identified and avoided, remedied, or mitigated against)?
- ❑ Does the system meet the Council's health and safety requirements?
- ❑ Does the proposal conform to the principles of reducing crime through environmental planning and design (refer to Christchurch Safer Community Council 1996)
- ❑ Is open-style fencing needed to improve safety and/or security?
- ❑ Is the system component safe in terms of the Building Act (1991)?
- ❑ Is it safe for adjoining public activities? For example, is ready egress available?
- ❑ Will the facility be available for safe entry and exit for recreation?

Flooding and Other Hazards

- ❑ Does the design storm capacity meet agreed planning criteria?
- ❑ Where is the secondary flow path likely to be? Should it be protected by an easement?
- ❑ Is storm inspection and debris removal needed? If this is so, have all necessary arrangements been made?
- ❑ Is the level-of-service that has been designed for, adequate in view of the importance and susceptibility of the system component(s) during extreme storms?
- ❑ Is uncontrolled growth likely to cause a fire hazard during hot, dry summer seasons?
- ❑ How will the system component perform under each of the Engineering Lifelines (Centre for Advanced Engineering 1997) hazard scenarios? For example, seismic activity, Waimakariri River flooding, local flooding, tsunami, wind, snow, and slope hazards?

Design

- ❑ Have "life cycle" design principles, including project life cycle cost, been considered?
- ❑ Is the design a relatively low maintenance solution in the short-term? In the long-term? Thus is the solution a sustainable one?
- ❑ Have potential flow obstructions, erosion, and sedimentation problems during the early development and establishment phases been identified and provided for in the design?

Vegetation

- ❑ Has the initial planting contract maintenance been defined?
- ❑ Has the establishment transitional maintenance been defined (i.e. while the planting becomes established; usually year 2–4 after planting)?
- ❑ Has the ongoing maintenance from year 5 and beyond been defined?
- ❑ Is there any specific maintenance criteria for the riparian vegetation in the area?
- ❑ How will the terrestrial vegetation growth be controlled—by sickle, weed eater, mechanical mower, or herbicide? Are the contours and space available compatible with the preferred method? What is the likely frequency of growth control measures?
- ❑ Is the area an inanga spawning site, and if so, has bank maintenance been prevented during the inanga spawning and development period (February–May)?
- ❑ Has the removal of aquatic vegetation (both marginal and submerged plants) and all other instream maintenance been prevented during spawning times in known trout spawning areas?
- ❑ Will aquatic vegetation need to be controlled—by handwork, excavator, harvester, or herbicide? How will algal growth be managed?
- ❑ Is there any specific maintenance criteria for the aquatic vegetation (including both marginal and submerged plants) in the area?
- ❑ Is erosion control needed if watering is necessary during plant establishment?
- ❑ What is the acceptable maximum height and density of vegetation that will not compromise hydraulic requirements?
- ❑ Could the selected plant species cause other maintenance problems located downstream? For example, flax and cabbage tree leaves can wrap around the impellers of stormwater pumps.
- ❑ What undesirable terrestrial or aquatic plant species could potentially become established (e.g. willow regrowth or *Egeria densa* in the Avon River/Otakaro and Halswell River/Hūritini)? How will they be controlled?

Debris, Litter, and Sediment

- ❑ Where will debris, litter, and sediment accumulate? What measures will be needed to interrupt and remove it? How often?
- ❑ Are debris grills or trash racks needed?
- ❑ If the system component blocks during a storm, where is the secondary flow path that will divert overflows safely?
- ❑ Should a pond, debris trap, gross pollution trap, vegetative filter, or other interception device be installed upstream?
- ❑ Will sediment need to be removed? Is adequate access provided for this?

Nuisances

- ❑ How will the incidence of pests and nuisances be minimised:
  - ❑ problem insects (blackflies, biting midges, and mosquitoes)?
  - ❑ stagnant water conditions?
  - ❑ smells?
  - ❑ algal blooms?
  - ❑ rats?
- ❑ How will complaints be managed?
- ❑ Will vegetation have adverse effects on adjoining properties?
- ❑ How many dwellings are close enough to be affected by nuisances?

19.3 References

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