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Raingarden Operations & Maintenance Manual (Draft)

Arataki Project

CDL Land New Zealand Limited

86, 108 & 122 Arataki Road, Havelock North



**Substantive Application
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Document Control

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1.0 Introduction

This operations and maintenance (O&M) manual details the proposed raingarden design for the Arataki development by CDL Land New Zealand Limited (CDL). The raingarden locations are shown in Figure 1.

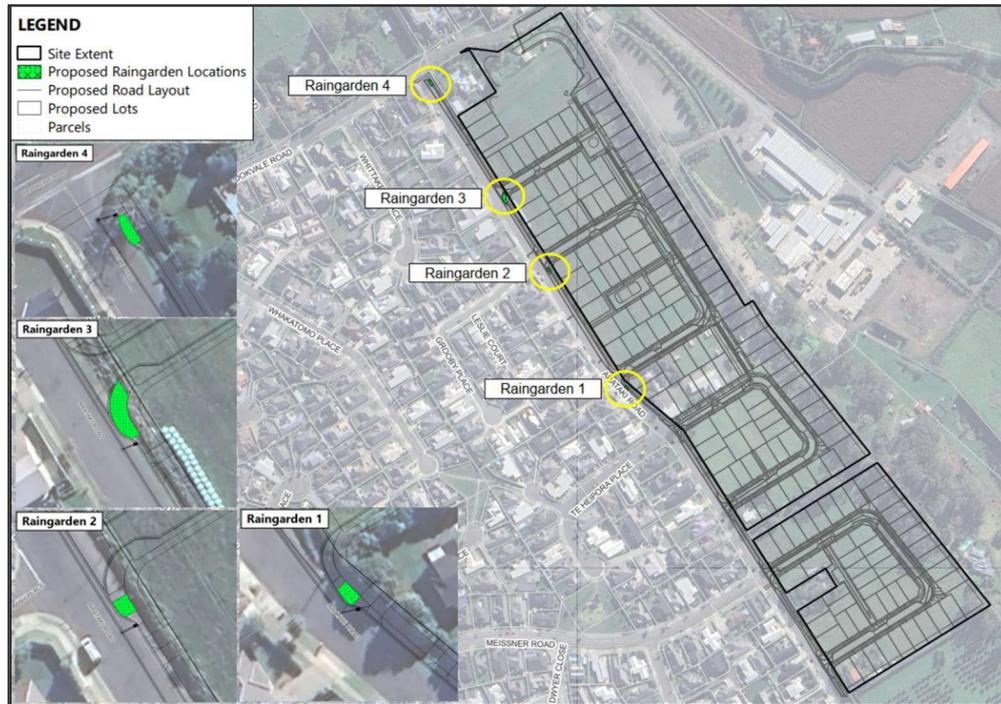


Figure 1: Proposed raingarden locations

It is intended that this O&M manual provides:

- Background information on the stormwater treatment and detention facilities at the raingardens;
- Basic background information on the contributing stormwater catchment;
- Design details for the stormwater treatment and detention system; and
- O&M details

This manual excludes information on the stormwater reticulation system within the contributing catchment area.

This manual is to be updated following consent and construction with final O&M to be provided with CCC.

1.1. Contact Information

A summary of the contact information relating to the ownership, maintenance manager and designer for the raingarden are included in Table 1. This is yet to be confirmed.

Table 1. Contact Information

Asset ID		Resource Consent Number	
Location:		Development Name / Legal Description:	
Asset Owner Details:			
Name:		Address Private Bag 92300, Auckland 1142	
Telephone Number:			
Email:			
Maintenance Manager Emergency Contact Details:			
Name:			
Telephone Number: (Daytime)			

Telephone Number: (Out of Hours) Email:		
Designer Details:		
Name: Telephone Number: Email:		
Applicant Details:		
Name: Telephone Number: Email:		
Landowner Details:		
Name: Telephone number: Email:		
Notes / Restrictions / Access		

2.0 System Description

2.1. Design Philosophy

The purpose of the proposed raingardens is to provide stormwater treatment and detention for the contributing catchments. The raingarden was designed to improve urban waterways by controlling and treating stormwater runoff during rain events by reducing pollutants. Stormwater runoff is diverted to these devices, detained and treated before entering the stormwater piped network.

2.1.1. Key Features

The raingardens have been designed to meet the following design requirements.

Water Quality:

- The raingardens are designed to treat the first flush of low storm events. High flows through a raingarden device can cause scour, undermining media and damaging planting.

2.1.2. Timeline

Construction is not yet completed. This section will be completed after the raingardens are constructed and vested.

2.1.3. Critical Levels as per approved Design and As-built Data

The design has not yet been approved. This section will be completed once the design of the raingardens has been approved.

2.2. As-Built Information

To be provided following consent and construction

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2.3. Design Standards and Assumptions

The proposed raingarden is designed to provide water quality treatment

2.4. Ground Conditions

The raingarden shall be constructed as per the recommendations of the geotechnical report.

2.5. Consent Information

To be provided following consent approval.

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3.0 System Components

The mechanical components within the raingarden devices are scour protection, end boards, liners, pipe work and overflow pits in some cases. Each time the gardens are inspected these components should be checked for damage and fixed/replaced as necessary. Pipe work within the raingarden devices is designed to be accessible by CCTV if required. All pipe work replaced must be to Council standards.

3.1. Raingarden Devices Operation & Maintenance Activity Schedule

Raingardens require regular maintenance to ensure they continue to function as effective stormwater management devices and as attractive landscape features.

With the maintenance of the raingardens, it is important that special care is taken around the trees onsite in order to prevent damage and unnecessary removal of trees. This care is particularly important in the removal of top layer of the soils, silt removal and general maintenance.

A barrier should be placed around the trees when working near them, it is recommended that when operating machinery in or around trees, exhaust is to be directed away from trees and shrubs. Machinery is not to be placed under the dripline of trees and all excavation work.

3.2. Inlet Structure Details

The raingardens have a single inlet. The inlet details can be summarised in Table 2 below. Refer to drawings P24-244-00-3950-DR and P24-244-00-3951 for further details.

Table 2. Inlet details

	Raingarden
Inlet structure (2 x kerb cutout) - Roadside	600 mm
Inlet structure (concrete runoff) - Footpath	-

3.2.1. Routine Maintenance

Key routine maintenance actions identified for the raingarden outlet structure is summarised in Table 3 below.

Table 3. Raingarden inlet maintenance actions

Component	Recommended Action
Raingarden Inlets and Energy Dissipation / Erosion Protection Structures	Runoff flowing into raingardens may carry litter and debris with it. Rubbish and debris should be removed regularly both to ensure that inlets do not become blocked and to keep the area from becoming unsightly. Inspect raingardens after rainstorms to ensure drainage paths are free from blockages. The area around the inlet and energy dissipation (e.g. rip rap) structures should also be inspected for erosion and cracks in the structure. Remove debris and litter and fix cracks and erosion as necessary.

3.2.2. Health and Safety Risks Associated with Raingarden Inlet Structure Maintenance

There are a number of health and safety risks associated with working inlet structures. Some of these potential risks are highlighted in Table 4 below.

Table 4. Health and safety risks associated with working around inlet structures

Risk	Mitigation
Flow through inlet making work unsafe (i.e. >0.5 m/s)	Ensure no rainfall has occurred in the last 24 hours and non in forecast

3.3. Outlet Structure Details

The raingarden outlet structure details can be found in Table 5. To be updated following the as-built survey. Refer to drawings P24-244-00-3950-DR and P24-244-00-3951 for further details.

Table 5. Outlet details

	Raingarden
Underdrain (Nova Coil Pipe)	DN150

3.3.1. Routine Maintenance

Key routine maintenance actions identified for the raingarden outlet structure is summarised in Table 6 below.

Table 6. Raingarden outlet maintenance actions

Component	Recommended Action
Raingarden outlets	Inspect raingarden outlets for blockages caused by heavy sedimentation.
Erosion Protection	Inspect areas of erosion protection (reno mattress) to identify any damage or loss of material. Identify any preferential flow paths forming through erosion protection that could be affecting function. Repairs should be carried out as required.

3.3.2. Health and Safety Risks Associated with Raingarden Outlet Structure Maintenance

There are a number of health and safety risks associated with working around waterbodies and outlet structures. Some of these potential risks are highlighted in Table 7 below.

Table 7. Health and safety risks associated with working around raingarden outlet structures

Risk	Mitigation
Flow through raingarden making work unsafe (i.e. >0.5 m/s)	Ensure no rainfall has occurred in the last 24 hours and none is forecast.
Fall Hazard	Use caution and maintain stable footing to prevent slips or falls when carrying out maintenance on the raingarden

3.4. Landscaping

The proposed raingardens will be planted with native vegetation. However, these areas are susceptible to weed invasion and the potential loss of desirable native species

Pest plants can affect raingarden vegetation by outcompeting desirable native species. Due to the large number of pest plant species, refer to the Hawke's Bay Regional Council Pests and Weeds Hub Database (Hawke's Bay Regional Council, n.d.) and the Hawke's Bay Regional Pest Management Plan 2018-2038 (Hawke's Bay Regional Council, 2018).

3.4.1. Routine Maintenance

Key routine maintenance actions are summarised in Table 8 below.

Table 8. Maintenance actions

Component	Recommended Action
Vegetation/Landscaping	<p>Vegetation maintenance works including staking, trimming, lawn mowing, weed control, and replacement planting (only during planting season). Inspect riparian plant health and any build-up of dead plant material. Remove debris as necessary. Replace unhealthy or dead planting and undergo ongoing maintenance until established. When new planting is being carried out, exposed soil should be protected with mulch or organic matting such as coconut fibre to prevent soil erosion. Maintenance intervals will vary with growth rates and seasons.</p> <p>Identify weeds. Hawke's Bay Regional Council Pests and Weeds Hub Database (Hawke's Bay Regional Council, n.d.). Notify the Hawke's Bay Regional Council Biosecurity Team if pest species present 0800 108 838).</p> <p>Using appropriate control methods for the weed present, undertake weed control around the raingarden and in the wider property using a combination of mechanical control, manual removal and herbicide. Specialist to be contacted if further weed inspection and removal is required. Where soil erosion is observed, repair as necessary. Soil can be eroded from raingarden banks particularly after heavy rainfall and/or where vegetation cover is poor.</p>

3.4.2. Health and Safety Risks Associated with Landscaping

There are a number of health and safety risks associated with working around riparian vegetation. Some of these risks are highlighted in the Table 9 below.

Table 9. Health and safety risks associated with working around vegetation

Risk	Mitigation
Steep and slippery slopes/banks	Take care and avoid wet soil conditions.
Unstable slopes/banks	Avoid standing on unstable banks
Stinging insects	Wear long sleeved clothing and take care during summer months.
Pollen/Dust	Wear respirator while mowing during summer.

3.5. Access and Security

The raingardens are located adjacent to Arataki Road.

A traffic management plan will need to be submitted if the work will prevent:

- Normal use of a vehicle driving or parking lane
- Normal pedestrian access along a path.

A suitable traffic management plan for maintenance will be provided by traffic contractors at the time of maintenance.

4.0 Raingarden Operation & Maintenance Requirements

4.1. Inspection and Maintenance Activities

The following checklists are designed to be used for all maintenance inspections, . The checklist is included in Appendix A. It is recommended that all tables are printed/filled out during all inspections (although only the annual inspection requires every item).

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Appendix A: Maintenance Checklist

Effective long-term operation of the raingardens requires dedicated and routine maintenance tasks performed to a consistent timetable:

Maintenance Activity	Monthly	6 Monthly	12 Monthly	5 Yearly
Remove weeds and replace dead plants. Eradicate noxious/pest weeds and undesirable growth. This shall be completed by competent workmen who have landscape experience. A hoe and weed knife will be required and other weed removal equipment.	✓			
Litter removal. Litter removal will require low skilled workman. Equipment includes a pickup tool claw, rubbish bags and other equipment suitable for the removal of litter.	✓			
Inflow, overflow/outlets – check overflow for clogging. Remove accumulated sediment. Check overflow spillway. This will require specialist materials and competent labour.	✓			
Summer-monitor and water vegetation in extended dry periods. Low skilled labour and watering tools will be required.	✓			
Visually check for damage or missing components of devices such as inspection chamber caps, edge beams and scour protection. Replace/fix as required. Workmen who are competent at identifying broken equipment will be required as well as a site checklist, and other equipment deemed appropriate.	✓			
Pruning or thinning. Low skilled labour and pruning tools are required and other equipment deemed appropriate.		✓		
Compost/Mulch replenishment (first 3 growing seasons). Low skilled labour and safety gear is required, and other equipment deemed appropriate.		✓		
Remove accumulated sediments. Reinstate plants, soil and mulch. Check for ponding/clogging and blockage of filter media. Workers who are competent at unblocking filter media are required, and equipment deemed appropriate is required.		✓		
Inspect trees and shrubs and replace any dead or severely diseased vegetation. A shovel, weed knife, hoe and other equipment deemed appropriate may be required to carry out work.		✓		

<p>Scour/erosion evident: check for erosion signs. Check dams/capping system areas and correct as required. Labourers who are competent in checking for erosion are required and other equipment that are deemed appropriate for job may be required.</p>		✓		
<p>Sump-accumulated sediments not more than 50% full. Labour who are competent in identifying sump accumulation of sediments are required and other tools that are deemed appropriate may be required.</p>		✓		
<p>Check for restrictions/clogging/failures in pipes. Competent workers and pipe work tools are required.</p>			✓	
<p>Scrape off top 100mm of soil and mulch, dispose to landfill, replace. Competent workers are required, and the appropriate gardening tools are required.</p>				✓
<p>Replace the transition layer if warranted. Competent workers are required; small digger and the appropriate gardening tools are required.</p>				✓

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