DRAFT Flocculation Management Plan

Southland Wind Farm, Southland

RILEY

DRAFT Flocculation Management Plan

Report prepared for:	Contact Energy Ltd
Report prepared by:	Justin Cameron, Civil Engineer
	.....
Report reviewed by:	Luke Gordon, Principal Civil Engineer, CPEng
	.....
Report approved by:	Don Tate, Project Director, CPEng
	.....
Report reference:	220372-J
Date:	10 July 2025
Copies to:	Contact Energy Ltd c/- Roaring40s Wind Power Ltd — Electronic copy
	Riley Consultants Ltd — Electronic copy

Issue	Details	Date
0.1	Draft	27 June 2025
0.2	Final Draft	10 July 2025

Contents

DRAFT Flocculation Management Plan

1.0 Introduction

1.1 Purpose and Scope

This Flocculation Management Plan (FMP) has been prepared by Riley Consultants Ltd (Riley) at the request of Contact Energy Limited. The purpose of this plan is to determine whether chemical treatment will enhance the efficiency of sediment retention ponds (SRPs) and decanting earth bunds (DEBs) as per draft consent condition CM3B.

1.2 Objectives

The objectives of the plan:

- Responsibility for operation & maintenance of the flocculation treatment system
- Analysis of common water treatment chemicals i.e. flocculants
- Potential methods for the application of chemical treatment i.e. flocculation systems
- Bench testing methodology
- Monitoring and maintenance requirements of flocculation system

The FMP will be applicable for the duration of the earthworks phase of this project, and it will complement the Erosion and Sediment Control Plan outlined in the Earthworks Management Plan (EMP).

1.3 Implementation and Operation

The contractor will be in charge of implementing and operating the chemical treatment systems across the project life cycle. The earthworks contractor personnel responsible for the operation and maintenance of the flocculation treatment system are presented in Table 1.

Table 1: Erosion and Sediment Control Personnel [Placeholder]

Name	Role	Email	Phone Number

2.0 Water Treatment Chemicals

Typical flocculants used widely in New Zealand include Polyaluminium Chloride (PAC), PolyDADMAC (PDM) and Anionic Polyacrylamide (APAM) products. The first two are liquid flocculants and can be used in rain-based systems, whilst APAM products typically come in a solid form and are used more in passive flow-based systems. APAM products are generally

considered safe and non-toxic to aquatic life at approved doses. Coagulants (e.g. Alum/PAC) and Cationic PAM's (flocculants) will not be considered for the project, due to their toxic properties and risk of changes to pH levels in the receiving streams and wetlands.

3.0 Application Methodologies

3.1 Introduction

To enhance the effectiveness of the SRPs and DEBs on-site, the introduction of flocculants can be considered to increase the rate of settlement of fine soil particles. Chemical treatment will be targeted (subject to soil conditions present) for sediment control devices which will be located within 50m of a wetland, or for SRPs servicing a catchment > 1.5ha.

3.2 Rainfall Activated Dosing

This system typically involves the use of a Floc shed, situated near the entry point of an SRP or DEB. A Floc shed is designed with a rainfall tray to capture rainfall, with the size of this tray being determined by the catchment area and the optimum dosage rate. The principles by which this works are rainwater lands on the rainfall tray and is subsequently piped to the rainwater header tank. From here, it falls into a displacement tank which floats in a large tank containing flocculant. As more rain falls, the displacement tank sinks and displaces flocculant through the outlet and into the "sediment-laden" diversion channel before it enters the SRP or DEB. The header tank is designed to provide no dosing for the first 12mm of rainfall. The dual outlet of the header tank acts to attenuate flow of flocculant during the early stages of a storm as well during the latter stages.

See Figure 1, for more details.

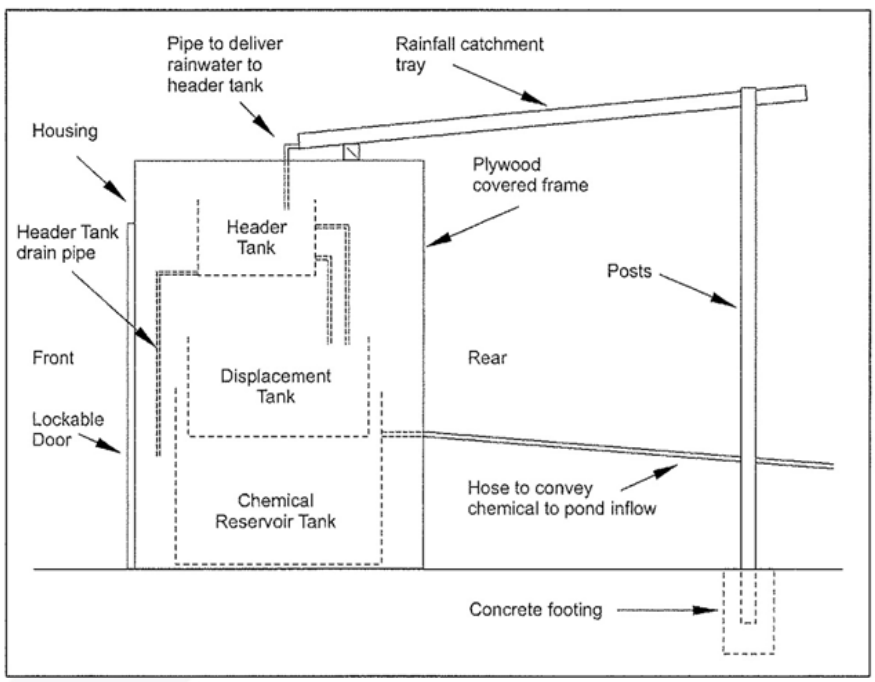

Figure 1: Schematic of typical floc shed

For a DEB with a catchment of less than 0.3ha, a mini floc shed, or floc box (see Figure 2) may be preferable.

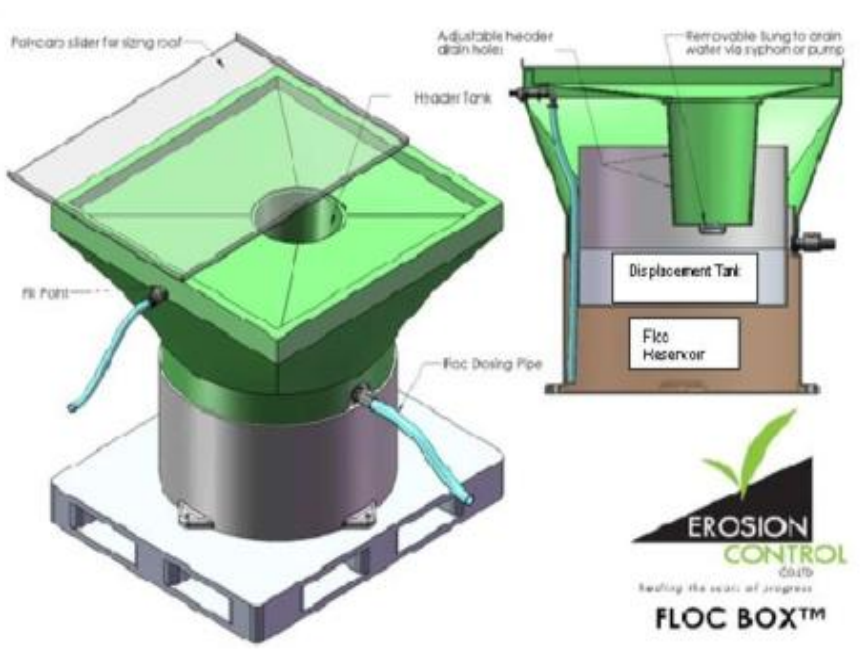

Figure 2: Alternative to floc shed (floc box)

3.3 Passive Flow-Based Dosing

Another method of chemical treatment is passive flow-based dosing. This involves placing Floc logs in series within a "sediment-laden" diversion channel before it enters the SRP forebay. As the "sediment-laden" runoff flows through the channel, the logs dissolve over time. If using APAM Floc logs, the Wai Mā Solutions APAM Application Guide 2024 recommends 1 Floc log per 190-265 litres per minute of flow (for flows < 3000L/min) with a minimum of 4-6 logs to be used per application. When logs are fully dissolved, they should be replaced. Floc logs can also be used within culverts leading into SRP forebays (see Figure 4).

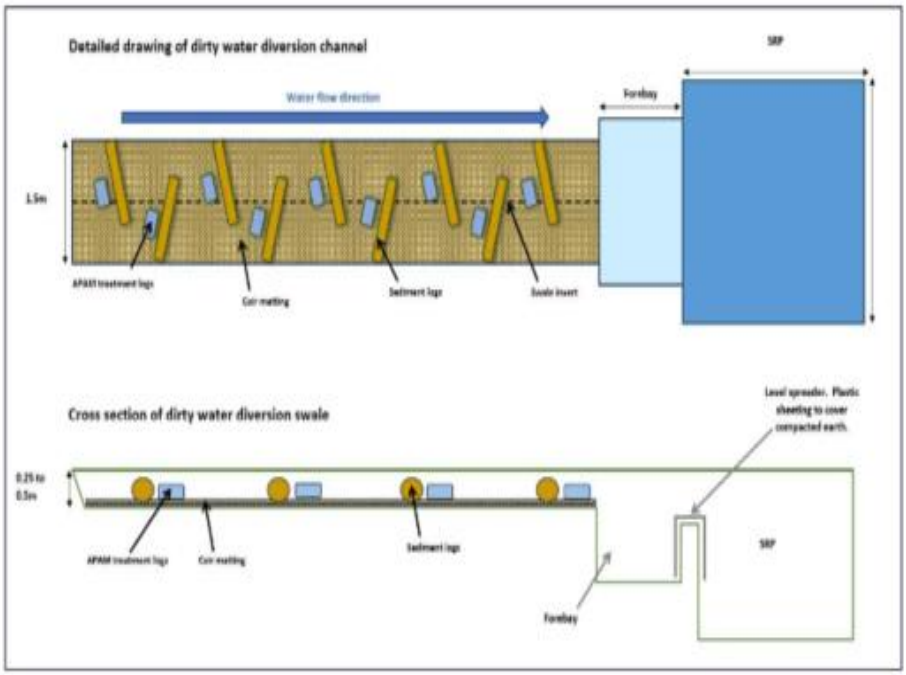

Figure 3: Floc logs placed in series within "sediment-laden" diversion channel

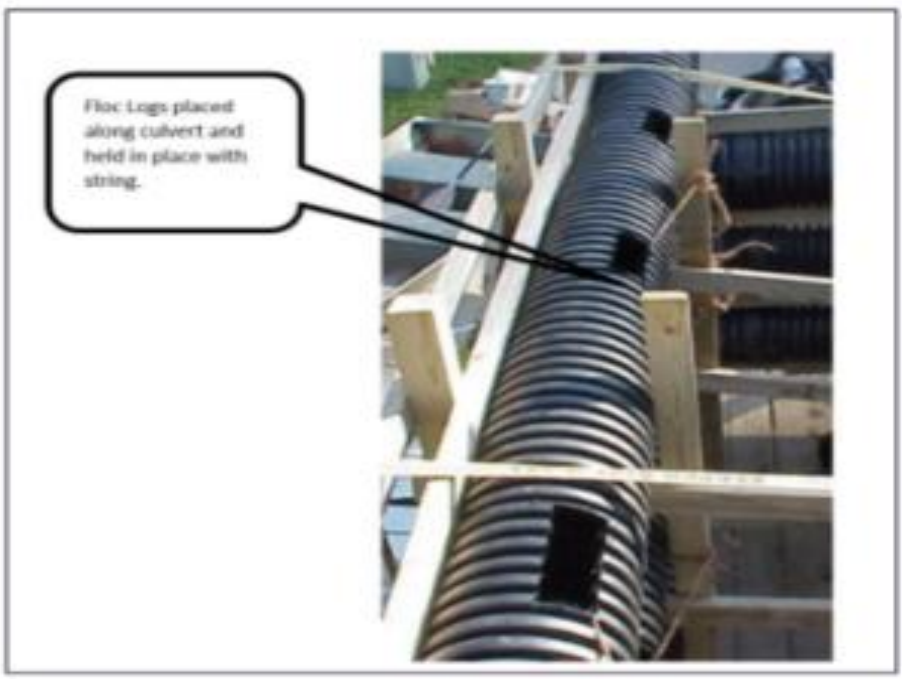

Figure 4: Floc logs placed within culverts

4.0 Bench Testing

Bench testing is the process of testing different chemicals and ultimately the same chemical at a range of concentrations to determine the most effective chemical and optimum dosage for enhancing the effectiveness of sediment removal. The optimum dosage is measured as the amount of chemical in milligrams per litre of sediment-laden water and the concentration derived from bench testing is used to inform the dose rate on-site.

The bench testing will consist of the following:

- Obtain several 1kg soil samples from the site from each representative soil types across the site.
- Follow the bench testing methodology outlined in Appendix F1.0 of the Auckland Council Guideline 2016/005 Erosion and Sediment Control Guideline for Land Disturbing Activities in the Auckland Region (GD05).
- It is important to note that this bench testing method outlined in the GD05 only applies to liquid flocculants.
- Using results from bench testing, select the most desirable liquid flocculant and optimum dosage rate for a range of soil types and catchment sizes.

It is possible that the results of bench testing may suggest that sediments will settle out without the need for chemical treatment, or different chemicals/doses work better in some soils than others. Therefore, bench testing may conclude that chemical treatment is not required for all soil types/catchments – however this will be subject to monitoring of turbidity and total suspended sediment of water within DEBs and SRPs during the early stages of earthworks.

Whether or not chemical treatment is deemed necessary for a specific catchment, it will still be appropriate to have flocculants on standby as a contingency measure – i.e. if the runoff being discharged from the SRPs and DEBs is not of a satisfactory standard, and/or during dewatering processes or in the event of a spill. For example, products that can be implemented into sediment laden discharges via passive or controlled dosing systems.

5.0 Bench Testing Results

[Placeholder]

X soil samples were taken from test pits (TPs) across the site to represent the x soil type observed. These x soil samples were bench tested using the flocculants listed in the table below to determine the most desirable flocculant to achieve the TSS discharge limit outlined in the Minimum Standards of Water Discharge – (excerpt from Appendix E of Southland Water and Land Plan – Part A). The locations of the soil samples have been labelled based on the names of the soil samples provided by xx.

Table x: Bench testing results from TP x

Flocculant	IBC concentration %	Standard Dose Volume (mL)	Optimal Dose	Ph at Optimal Dose	TSS at Final Dose (mg/L)	Dose Rate per m³ (mL)
xx						
xx						
xx						

Of the flocculants tested, XX was the most effective at achieving the TSS discharge limit across the soils samples provided.

6.0 Monitoring and Maintenance

6.1 Handling and Storage

Safety measures are necessary for handling the flocculants on site:

- Ensure that the Material Safety Data Sheet (MSDS) is made available and kept with the product at all times
- Use a chemical identification label for storage containers and ensure containers are not filled to more than two thirds of their capacity to reduce risk of spills.
- Ensure site personnel are aware to avoid contact with skin, eyes and clothing. To achieve this, it is advisable for site personnel to wear gloves, eye protection, long sleeves and trousers.
- If flocculants do made contact with eyes or skin, follow MSDS directions.
- Keep stored flocculants in locked shed or container when not in use and at least 20m away from diversion channels.

6.2 Water Quality Monitoring

Regular clarity, temperature, and pH monitoring should also be carried out for outflows from sediment retention devices (at the mixing points with natural water bodies), to confirm that the Mataura 3 receiving quality water standards are being met. Some of the acceptable ranges and limits to be aware of are:

- pH to be between 6 and 9
- If the existing water temperature is 16C or less, the water temperature should not increase by 3°C as a result of a discharge, and additionally if existing water temperature is higher than 16°C, the water temperature should not increase by more than 1°C.
- No more than a 20% change in clarity or colour at the edge of the reasonable mixing zone, relative to the clarity or colour upstream of the discharge point.
- Zero tolerance for oils, sheens, and suspended solids.

6.3 Routine Maintenance

During the construction phase, all chemical treatment systems used on this project should be checked after each rainfall event. During dry periods, weekly checks are appropriate. Additionally, SRPs and DEBs should be regularly desilted after rain events to ensure that the maximum volume of these devices is maintained.

It is also important to regularly check for scouring and erosion at discharge points.

6.4 Spill Response

If more than 10L of flocculant is spilled, the site manager should be notified immediately. Additionally, all site personnel should be kept more than 5m away from the spill unless wearing appropriate PPE.

Steps should be taken to prevent the spill from spreading as soon as possible. Construct bunds if necessary and once contained, remove effected soil from site. If spill contaminates water bodies, Environment Southland (ES) should be notified immediately to reduce the potential for adverse environmental effects.

6.5 Contingency Management

During construction, the chemical treatment system will be progressively reviewed by the contractor and may require ongoing manipulation to ensure the design suits the site characteristics and runoff. Where the pH of the pond stormwater discharges falls below 5.5, chemical treatment will cease.

6.6 Record Keeping

A record of the maintenance carried out on the chemical treatment systems should be kept on site. This is the responsibility of the contractor.

6.7 Chemical Transportation

The Hazardous Substances and New Organisms Act 1995 requires care to be taken with transport of liquid flocculants. The chemicals often come from the supplier in large quantities, 250 to 1000 litres. Suitable vehicles and machinery should be used to transport these containers around site. Care should also be taken to ensure containers are sealed and not able to topple over. Additional information can be found in the Ministry of Transport, Transporting Dangerous Good Safely, An Industry Guide 2008.

7.0 Limitation

This draft Flocculant Management Plan has been prepared for Contact Energy Limited (Contact), to inform the Expert Consenting Panel's consideration of Contact's application for approvals under the Fast-track Approvals Act 2024 and any subsequent regulatory processes.

AUCKLAND
4 Fred Thomas Drive, Takapuna
riley@riley.co.nz
CHRISTCHURCH
22 Moorhouse Avenue, Addington
rileychch@riley.co.nz

riley.co.nz