



PHOSPHORUS MITIGATION PLAN



ABOUT YOUR FARM PLAN

This Farm Plan document is the result of a tailored farm environment planning service provided to you through Tiaki Sustainable Dairying. It's part of the advantage you get through Farm Source as a member of the Fonterra Co-Operative. The purpose of this plan is to describe the environmental conditions present on your farm and the management of these conditions. From this, mitigations to potential impacts to water quality are documented and additional mitigations maybe planned, with sensible timeframes. Underpinning this plan, are the agreed national Good Farming Practices that are supported by the agricultural and horticultural sectors. Industry bodies along with Regional Councils and Central Government have developed the Good Farming Practice: Action Plan for Water Quality 2018 in a commitment to swimmable rivers and improving the ecological health of our waterways. The Dairy Industry Strategy (Dairy Tomorrow), as well as the Good Farming Practice: Action Plan for Water Quality 2018, both align with the goal for all dairy farms to have a Farm Environment Plan by 2025. Now that this plan has been created it's the plan owner's responsibility to ensure it is put into action and kept up to date as actions are completed or conditions on farm change. Tiaki Sustainable Dairying is here to help with that implementation and ongoing management through our team of Sustainable Dairying Advisors who can be contacted via the details below.

PHONE: 0800 65 65 68

EMAIL: sustainable.dairying@fonterra.com

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FARM DETAILS

FARM NAME

Woldwide 1 & 2

SUPPLIER NUMBER

32650 & 32651

PLAN OWNER

Albert De Wolde

+64 27 2272537
dewolde@farmside.co.nz

FARM ADDRESS

HUNDRED LINE RD, Winton

LOCATION



REGIONAL COUNCIL

Southland

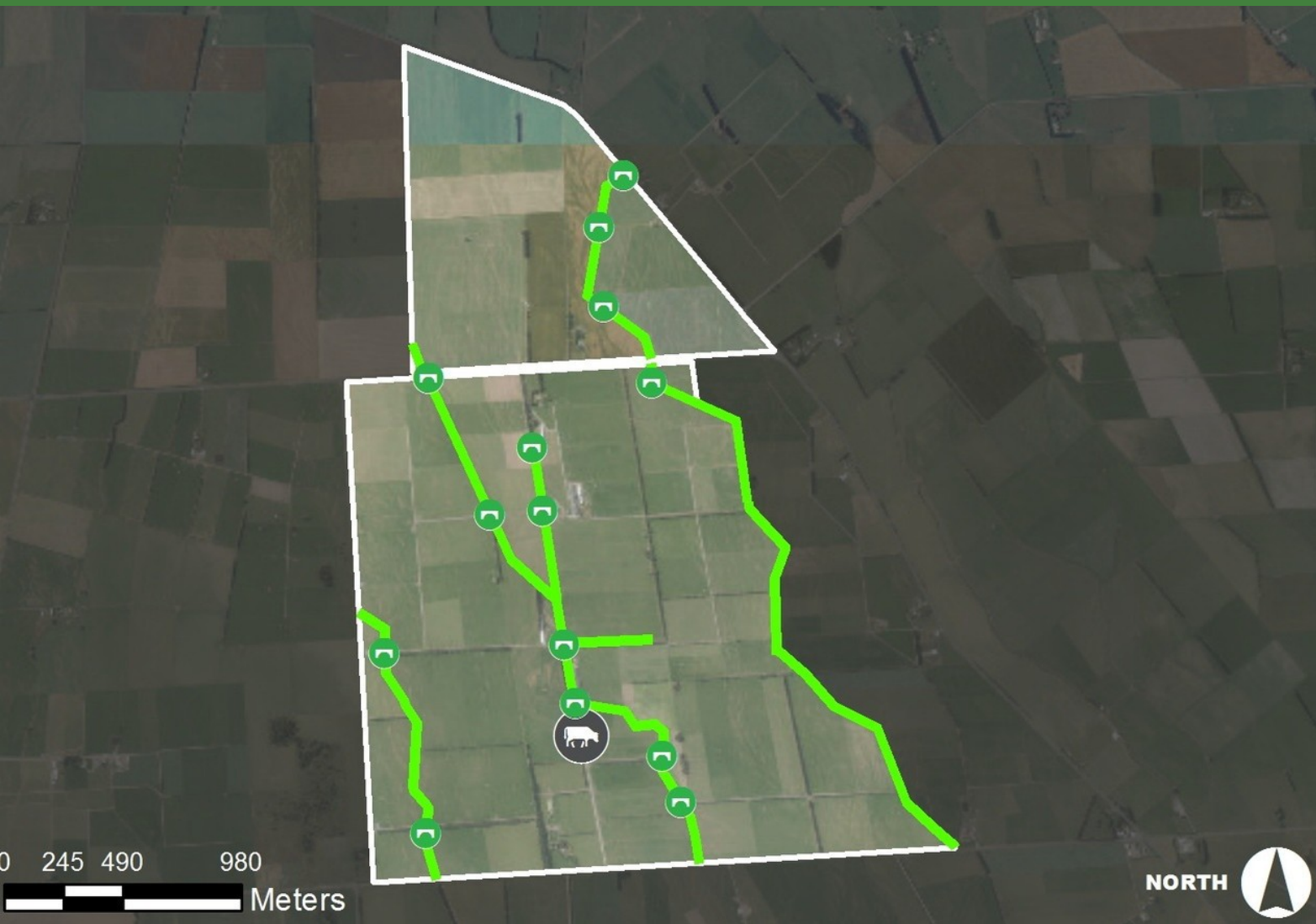
PLAN LAST EDITED DATE






31 July 2019






POINTS OF NOTE

FARM OVERVIEW MAP

The map below presents the land on which the farming operations covered in this document occur and identifies some key points of interest. More detailed maps looking at specific environmental management topics are contained throughout the document.


















-  Accord Defined Stock Excluded Waterway
-  Accord Defined Stock Not Excluded Waterway
-  Non-Accord Defined Stock Excluded Waterway
-  Non-Accord Defined Stock Not Excluded Waterway
-  Farm Boundary

-  Compliant Crossing
-  Non-Compliant Crossing
-  Non-Compliant Non-Regular Crossing
-  Dispensation Crossing
-  Dairy Shed



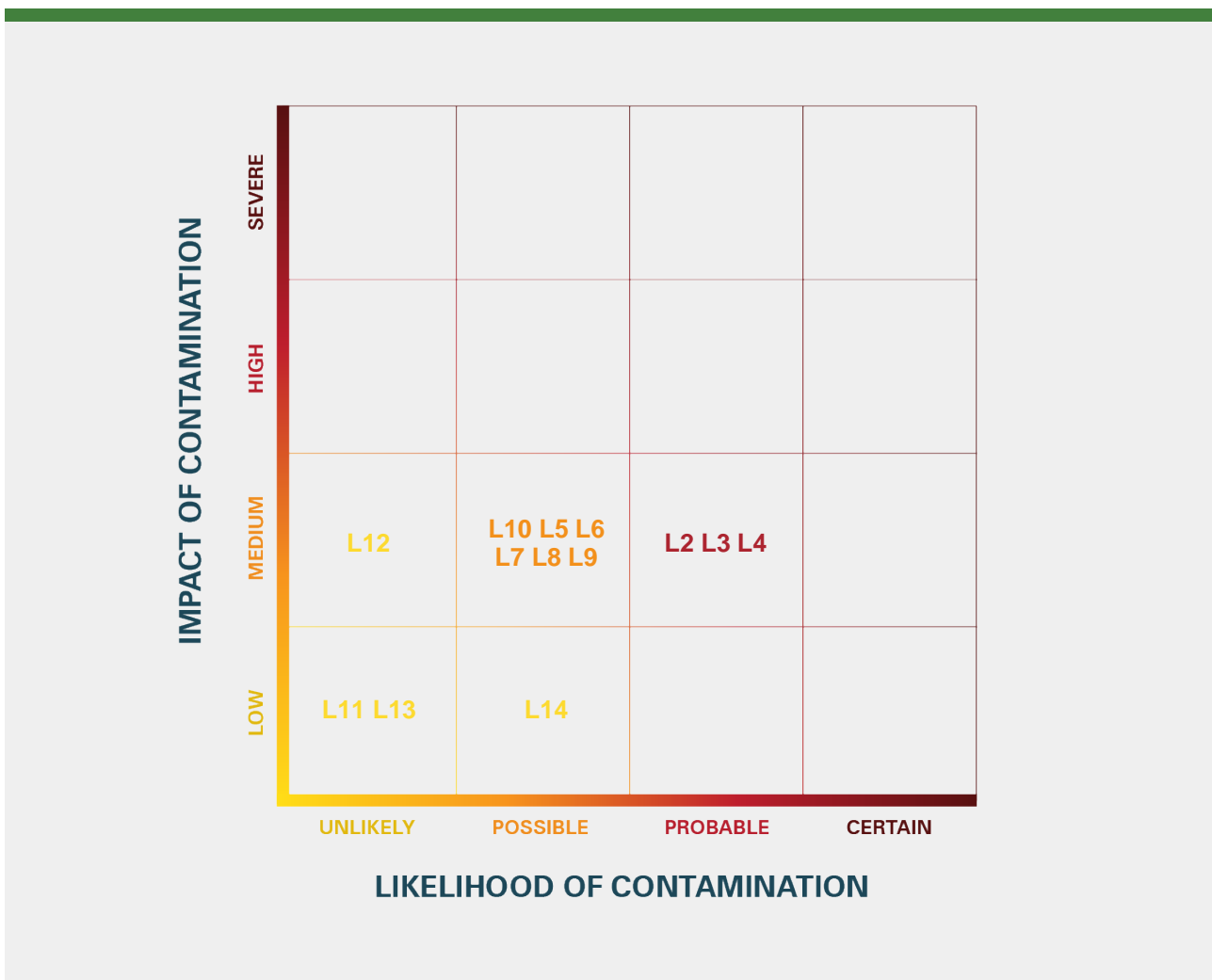
SUMMARY OF OPEN ACTIONS

This table includes all open or ongoing actions that have been agreed as part of this Farm Environment Plan. They are organized by their target due date. Where an action has been identified as especially important an additional (Flag) icon may have been added.

CATEGORY	FEATURE TYPE & NAME	ACTION REQUIRED	TARGET DATE
 L2	Race Maintenance & Management - Lane Adjacent Waterway (West of Wintering Barn)	Establish Vegetated Riparian Margin (Beside Barn)	1 st August 2020
 L3	Critical Source Area - Critical Source Area (Paddocks 14-15)	Increase riparian buffer (triangle paddock)	1 st August 2020
 L3	Critical Source Area - Critical Source Area (Paddocks 14-15)	Enlarge Culvert (Paddocks 14-15)	1 st August 2020
 L4	Race Maintenance & Management - Central Lane (between WOL and WTL)	Reduction in Use of Central Dairy Lane	New Consent
 L4	Race Maintenance & Management - Central Lane (between WOL and WTL)	Slope Lane and Extend Riparian Buffer-Central Lane	1 st August 2020
 L5	Race Maintenance & Management - Lane Beside Waterway (Paddocks 18 & 19)	Extend Riparian Margin & Slope Lane	1 st February 2021
 L6	Culvert Management	Build up sides of culvert (South of Paddock 34)	1 st February 2021
 L7	Critical Source Area - Main Culvert (South of Wintering Barn)	Install Kerb - Main Culvert South Wintering Barn	1 st February 2021
 L8	Overland Flow Path - Overland Flow Path (Paddock 15)	Move Temporary Lane (Paddock 15)	1 st February 2021
 L9	Overland Flow Path - Critical Source Area (Paddock Marcel #1)	Extend Riparian Margin (Marcel #1)	1 st February 2021
 L10	Race Maintenance & Management - Lane Adjacent Waterway (Paddock 34)	Modify Lane beside Creek (Paddock 34)	1 st February 2021
 L11	Overland Flow Path - Overland Flow Path (Paddock 34)	Extend Riparian Margin (Paddock 34)	1 st August 2021
 L12	Critical Source Area - Culvert - Woldwide Two Dairy Shed	Build up Culvert Sides (Beside WTL Dairy Shed)	1 st August 2021
 L13	Critical Source Area - Culvert (Paddock Marcel #9)	Raise sides of culvert (Marcel #9)	1 st August 2021
 L14	Overland Flow Path - Critical Source Area (Paddock 21)	Extend Riparian Buffer (Paddock 21)	1 st August 2021

UNDERSTANDING THE RISKS ON YOUR FARM

This section provides some context to help understand the relative impact and likelihood of environmental risks that have been identified on your farm. The chart on this page together with the map on the following page can be useful when thinking about what environmental risk areas on your farm need the most focus.



HOW ARE RISK RATINGS MEASURED?

The issues plotted on the chart above have been done so based upon two measures that are assigned to a specific area of your farm where an environmental risk has been identified. 1. Impact of contamination (on the vertical axis, or the first dial) is a measure of the potential scale or significance of contaminants that may be lost from this area of your farm. It's about quantifying how bad could the outcome for the environment be; 2. Likelihood of contamination (on the horizontal axis, or the second dial) is about the chance of the contamination actually occurring from that area of your farm. It takes into account things like how far the area might be from waterways as well as the slope or aspect of the area; When combined together the two measures also give an overall 'risk rating'. The measures and the combined rating are presented for each risk area along with other descriptive information about the risk area on the subsequent pages of this document.

Example:



RISK RATING

The map below shows the location of the risk areas identified on your farm. The Risk Rating presented here is a combined measure of the impact and likelihood of contamination occurring from each risk area.

● LOW
 ● MEDIUM
 ● HIGH
 ● SEVERE



L2 Race Maintenance & Management - Lane Adjacent Waterway (West of Wintering Barn)

L3 Critical Source Area - Critical Source Area (Paddocks 14-15)

L4 Race Maintenance & Management - Central Lane (between WOL and WTL)

L5 Race Maintenance & Management - Lane beside Waterway (Paddocks 18 & 19)

L6 Culvert Management

L7 Critical Source Area - Main Culvert (South of Wintering Barn)

L8 Overland Flow Path - Overland Flow Path (Paddock 15)

L9 Overland Flow Path - Critical Source Area (Paddock Marcel #1)

- L10 Race Maintenance & Management - Lane Adjacent Waterway (Paddock 34)
- L11 Overland Flow Path - Overland Flow Path (Paddock 34)
- L12 Critical Source Area - Culvert - Woldwide Two Dairy Shed

- L13 Critical Source Area - Culvert (Paddock Marcel#9)
- L14 Overland Flow Path - Critical Source Area (Paddock 21)

L1 Phosphorus Loss Overview

DESCRIPTION:

The overall property comprised of Woldwide One and Woldwide Two (as proposed) has three waterways passing through it and two tributaries to these waterways. The topography of the farm is flat, resulting in very few critical source areas that would facilitate the overland flow of contaminants into adjacent waterways. The main areas likely to be responsible for phosphorus losses are laneways that run adjacent to waterways and waterway crossing points (culverts).

Overseer is not spatially explicit and is unable to take into account landscape features. It assumes a hydrological connection exists to second order streams and that there is a transport mechanism to get phosphorus to those streams. The model will over estimate phosphorus loss if a significant portion of the block is hydrologically isolated from a second order stream (Gray, 2016).

The initiation and transport of phosphorus from the landscape requires conditions conducive to either overland or subsurface flow. In many situations, P loss to the stream is dominated by overland flow since soil will sorb most phosphorus from subsurface flow, unless, as with mole-pipe drainage, there is a direct conduit to the stream (McDowell et al. 2001). In general, more P is lost from soils with increasing slope, largely as particulate phosphorus.

Critical source areas are included in the model in general terms as the model was calibrated against catchment studies where losses from critical source areas would have occurred (Gray, 2016). On this basis, protecting critical source areas is a mitigation that needs to be applied outside of Overseer and will reduce phosphorus losses further from those modelled.

The estimated reductions in phosphorus referenced in this report are derived from the following calculations and research:

Phosphorus Loss – Culverts

There will be a reduction in phosphorus loss from mitigations applied around culverts but there is no robust research information to base an estimate on. On this basis estimated reductions in phosphorus have been referenced as >0 Kg/P.

Phosphorus Loss – Lanes

Overseer automatically estimates that there will be phosphorus loss from lanes to waterways. It assumes that all excreted phosphorus ends up as dung and that 30% of the phosphorus deposited on lanes is lost to water with the remaining 70% expected to remain on the lane or return to the adjacent paddock. This is a significant assumption and a major component of modelled phosphorus loss, reported as part of “other sources” in the Overseer phosphorus report.

Table 1.4 The fate of minerals ingested by a lactating dairy cow (ingesting 15.5 kg DM/day) (adapted from During 1984).

Element	Consumption Kg /week	Percentage in			
		Faeces	Urine	Milk	Retained
N	5.1	26	53	17	4
P	0.4	66	-	26	8
K	2.9	11	81	5	3
Mg	0.2	80	12	3	5
Ca	0.4	77	3	11	9
Na	0.4	30	56	8	6

(Fertiliser and Lime Research Centre, 2014)

From Table 1.4 above, a cow eating 15.5 kg/DM/day will consume approximately 0.4kg of phosphorus per week, of which 66% is excreted in dung. For a cow with a 290 day lactation (assume not walking on lanes outside of the milking season) this equates to 10.9 kg/P/cow/yr. Cows are conservatively walking on the farm lanes for 1 hour per day as they move to and from the dairy shed. This means 4% (1 hour is 4% of a day) of phosphorus excreted is deposited on a lane. Overseer assumes 30% of this phosphorus is then lost to water via run-off.

$((10.9 \times 1500 \text{ cows}) \times 0.04) \times 0.3 = \underline{196 \text{ kg/P/yr lost to water from dairy lanes.}}$

In total there are 10.8km of lanes on the farm of which 1.5km are adjacent to waterways and present a risk of contaminant runoff. This represents 14% of the lanes on the farm and proportionally 28kg of the total phosphorus losses from lanes. In reality this figure is likely to be higher as many of the other lanes on the property have no hydraulic connection to waterways. On this basis, lanes beside waterways are likely to make up a much larger proportion of the total phosphorus losses from the dairy lanes on the farm.

Assuming the conservative figure of 28 kg/yr of phosphorus loss from lanes adjacent waterways and the actions contained in this plan are carried out (improved vegetative buffer strips and lane management) then phosphorus losses from these areas are estimated to reduce by 40% (conservatively based on the lower end of the range of 38-59% of the data summarised in Figure 2 below). The exception to this is at site L12 where the use of the main cow lane is to be reduced significantly (by at least 50%) due to the reconfiguration of the farms if consent is granted. This is in addition to the management and vegetation buffer improvements. At this site a 60% reduction phosphorus reduction factor has been used.

Overall phosphorus loss from lanes is estimated to reduce by 13.1kg/P/yr as outlined in the Table 1 below:

Site and Lane Length (m)	% of Total Lanes	P Loss (kg)	Mitigations (% Reduction)	Reduction in P Loss (kg)
L5 – 207	1.9	3.7	40	1.5
L2 – 241	2.2	4.3	40	1.7
L10 – 356	3.3	6.5	40	2.6
L4 – 553	5	9.8	60	5.9
L8 - 190	1.8	3.5	40	1.4
				13.1

Table 1 – Phosphorus Loss – Lanes

Phosphorus Loss – Critical Source Areas

Overseer predicts 101kg of phosphorus will be lost to water from paddocks (effective area of 478.9ha). Assuming phosphorus loss occurs evenly over the effective area of the farm, then critical source areas and their associated catchments would account for 2.5% of the phosphorus loss from blocks on the property. This equated to 2.5kg of phosphorus.

Assuming a 50% reduction in phosphorus loss occurs through the implementation of wider, vegetated riparian buffers (at locations where critical source areas enter waterways) and better management of critical source areas then a further reduction of 1.2kg of phosphorus is estimated to occur beyond that modelled in Overseer. See Table 2 below.

Site and Catchment Area	% of Total Catchment	P Loss (kg)	Mitigations (% Reduction)	Reduction in P Loss (kg)
L11 – 0.6ha	0.13	0.13	50	0.06
L3 – 0.7ha	0.15	0.14	50	0.07
L14 – 2.7ha	0.56	0.57	50	0.29
L9 – 7.5ha	1.57	1.9	50	0.79
				1.2

Table 2 – Phosphorus Loss – Critical Source Areas

The 50% reduction is based on research that shows management of critical source areas and vegetated buffers can reduce phosphorus loss by 38-59% (Figure 1). A midpoint reduction figure of 50% has been used to account for the likelihood of more phosphorus loss occurring in critical source areas than the rest of the farm and as such, more potential for phosphorus loss reductions.

It is acknowledged by McDowell et al, 2005 in the original design of the Overseer sub-model that, in some areas, 90% of phosphorus loss may come from only 10% of the catchment area (Sharpley et al, 1999). McDowell states that defining and isolating critical source areas, combined with adaptive management over the farm is the best approach to decreasing phosphorus loss.

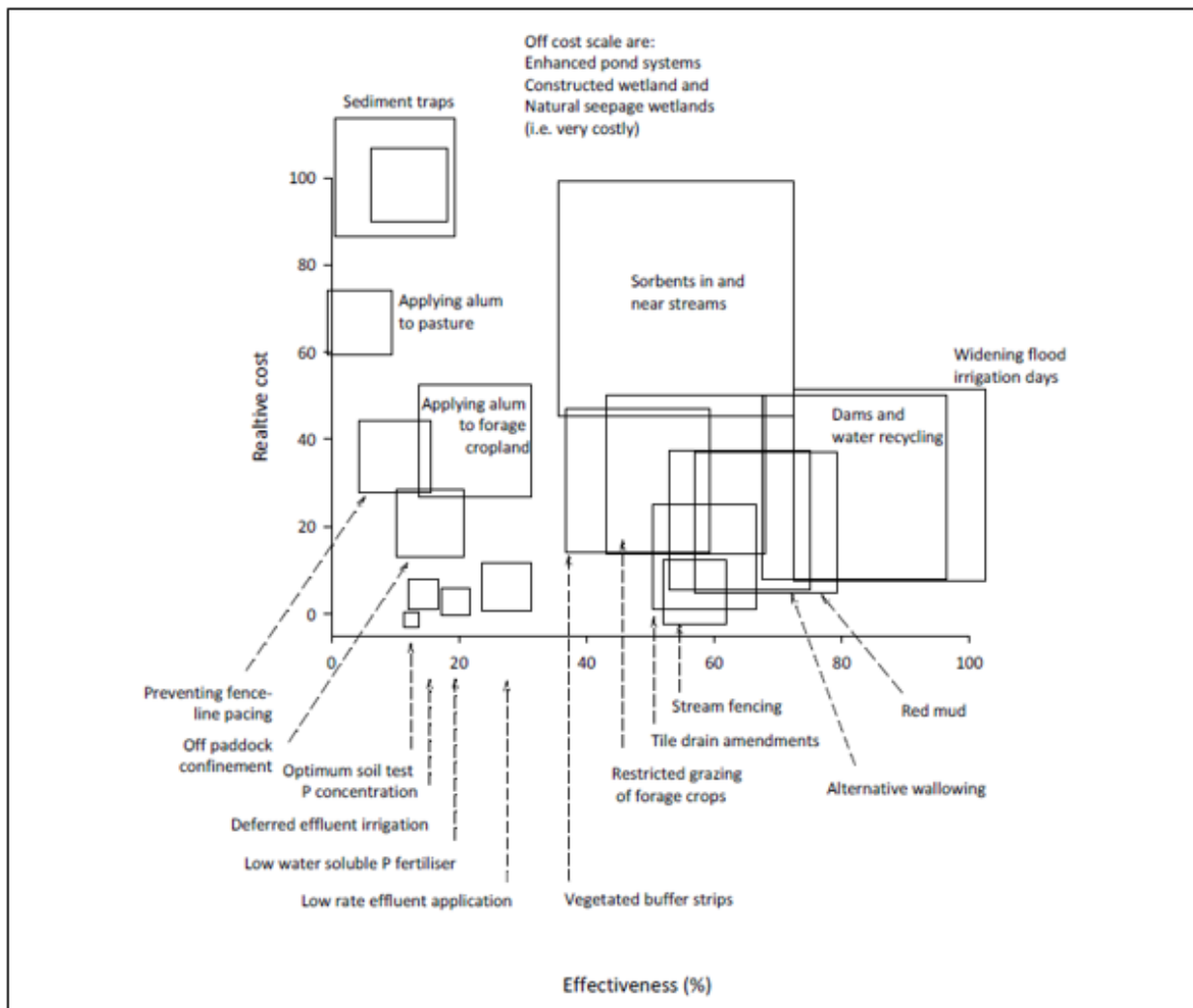


Figure 1 - Cost and effectiveness of strategies to mitigate phosphorus losses (McDowell et al, 2013)

Based on the topography of the property, it is likely that significantly more phosphorus will be lost through a small number of critical source areas rather than evenly over the property. On this basis, the estimated phosphorus loss from critical source areas is likely to be underestimated and thus the overall reductions achieved from implementing riparian buffers and better management of critical source areas.

References:

- Fertiliser and Lime Research Centre. (2014). *Sustainable Nutrient Management Introductory Notes and Mastery Test*. Massey University.
- Gray, C.W., Wheeler, D.M. and McDowell, R. (2016). *Review of the phosphorus loss submodel in OVERSEER®*. Report prepared for OVERSEER® owners under AgResearch core funding contract A21231(A). AgResearch. Report RE500/2015/050.
- McDowell, R; Monaghan, R and Wheeler, D. (2005). *Modelling phosphorus losses from pastoral farming systems in New Zealand*, New Zealand Journal of Agricultural Research, 48:1, 131-141.
- McDowell, RW; Sharpley, AN; Beegle, D and Weld J. (2001). *Comparing phosphorus management strategies at the watershed scale*. Journal of Soil and Water Conservation 56: 306-315.
- McDowell, R; Wilcock, B and Hamilton, D. (2013). *Assessment of Strategies to Mitigate the Impact or Loss of Contaminants from Agricultural Land to Fresh Waters*. Report prepared for MfE. AgResearch. Report RE500/2013/066.
- Sharpley, AN; Gburek, WJ; Folmar G and Pionke, HB. (1999). *Sources of phosphorus exported from an agricultural watershed in Pennsylvania*. Agricultural Water Management 41: 77-89.

 LAND MANAGEMENT

L2

Race Maintenance & Management

Lane Adjacent Waterway (West of Wintering Barn)

**IMPACT OF
CONTAMINATION**


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**LIKELIHOOD OF
CONTAMINATION**

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HIGH RISK RATING
DESCRIPTION:

Main lane to the west of the Woldwide One wintering barn running adjacent to a waterway. There is 1-2m riparian buffer, which is wider to the north. Due to the location of farm infrastructure there is minimal opportunity to extend the riparian margin wider. There is minimal vegetation cover in the riparian margin to filter any run-off.

It is recommended this area be planted in low native grasses such as red tussock and carex secta (1m intervals) to filter any run-off and utilise the associated nutrients. As a minimum, the riparian buffer should be maintained in a healthy sward of rank grass. In addition to this, any areas of the lane that slope towards the waterway should be modified to slope in the opposite direction.

Estimated Reduction in Phosphorus: 1.7 Kg/P

IMAGES:


OPEN ACTIONS:**Establish Vegetated Riparian Margin (Beside Barn)**

The riparian margin between the main dairy lane and the waterway to the west of the Woldwide One wintering barn should be maintained in a healthy vegetative cover. It is recommended native carex secta and red tussock are planted (1m spacing's) in the riparian margin to filter run-off and utilise any associated nutrients. As a minimum the riparian margin should be maintained in a healthy sward of rank grass.

TARGET DATE: 1st August 2020



Critical Source Area

Critical Source Area (Paddocks 14-15)

IMPACT OF
CONTAMINATION



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LIKELIHOOD OF
CONTAMINATION

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HIGH RISK RATING

DESCRIPTION:

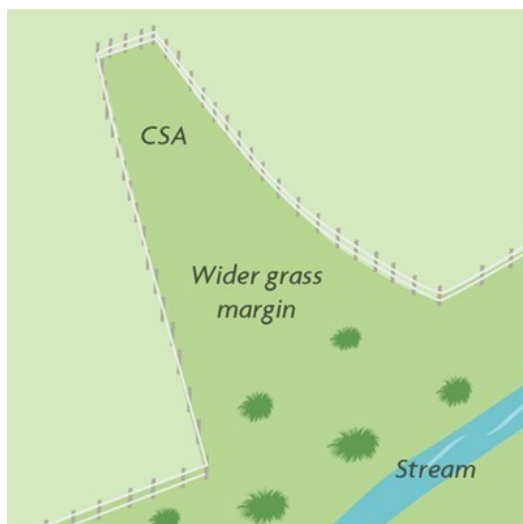
Low lying area at the eastern end of paddocks 14 and 15 on either side of the dairy lane. At times water flows out of the adjacent waterway into this area, which results in flooding of the dairy lane and water subsequently re-entering the creek further downstream. The area is partly fenced off but is still grazed. The flooding appears to be caused by a blocked or undersized culvert. Downstream of the culvert the creek is flows normally.

Being one of the few critical source areas on the farm and the fact water flows over the dairy lane means this area is likely to have a disproportionately high loss of sediment and phosphorus compared to other areas of the farm.

It is recommended the culvert size be enlarged to prevent blockages/backing up of water and the resulting flooding. In addition to this, the riparian margin where the gully enters the adjacent waterway should be extended and maintained in rank grass (or planted in native grasses such as carex secta or red tussock) to filter any overland flow that may occur under normal rainfall conditions.

Estimated Reduction in Phosphorus: 0.07 Kg/P

IMAGES:







OPEN ACTIONS:

Increase riparian buffer(triangle paddock)

The riparian margin where the gully (Critical Source Area) enters the waterway should be extended and maintained in rank grass (or planted in native grasses such as carex secta or red tussock) to filter any overland flow that may occur under normal rainfall conditions. See photo above.

TARGET DATE: 1st August 2020

Enlarge Culvert (Paddocks 14-15)

The culvert on the main dairy lane running between paddocks 14 and 15 should be enlarged to prevent blockages and flooding of the waterway into the adjacent paddock and lane. See Dairy NZ Waterway Technical Manual (2016) for culvert sizing details.

TARGET DATE: 1st August 2020

L4

Race Maintenance & Management

Central Lane (between WOL and WTL)

IMPACT OF
CONTAMINATION



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LIKELIHOOD OF
CONTAMINATION

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HIGH RISK RATING

DESCRIPTION:

Main dairy lane running between Woldwide One and Woldwide Two. Currently this is used frequently by stock from Woldwide Two to access paddocks to the south, south east and south west of the dairy shed. The reconfiguration of the farm will result in a number of these paddocks being assigned to the Woldwide One Dairy Platform and being accessed by different lanes. This will significantly reduce the frequency of stock movements along this section of the central lane (minimum of 50% reduction in stock movements) and the corresponding amount of dung (and associated phosphorus) deposited on the lane. In addition to the reduction in lane usage the lane should be sloped away from the adjoining waterway and the riparian buffer extended by 1m and maintained in rank grass (or planted in native grasses such as carex secta or red tussock).

Estimated Reduction in Phosphorus: 9.8 Kg/P

IMAGES:





OPEN ACTIONS:

Reduction in Use of Central Dairy Lane

The reconfiguration of the central dairy lane between Woldwide One and Woldwide Two will result in a significant reduction in stock movements along this section of laneway and a subsequent reduction in dung (phosphorus) deposited on the lane.

TARGET DATE: New Consent Issued

Slope Lane and Extend Riparian Buffer-Central Lane

The lane should be sloped away from the adjoining waterway and the riparian buffer extended by 1m and maintained in rank grass (or planted in native grasses such as carex secta or red tussock).

TARGET DATE: 1st August 2020

L5

Race Maintenance & Management

Lane beside Waterway (Paddocks 18 & 19)

IMPACT OF
CONTAMINATION



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LIKELIHOOD OF
CONTAMINATION

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MEDIUM RISK RATING

DESCRIPTION:

Main dairy lane running adjacent to a waterway. There is a small riparian buffer but this is not well vegetated and provides minimal opportunity for filtering contaminants off the lane. The lane is relatively wide in this area and as such it is recommended the fence be moved out 1m and a rank grass (or native plants such as carex secta and red tussock) be established to assist in filtering any run-off.

In a number of places the lane does slope away from the adjacent waterway but during upcoming lane maintenance the entire lane should be sloped away from the creek.

Estimated Reduction in Phosphorus: 1.5 Kg/P

IMAGES:



**OPEN ACTIONS:****Extend Riparian Margin & Slope Lane**

Extend the riparian margin by a minimum of 1m and establish a good sward of rank grass (or plant native grass such as carex secta and/or red tussock) to assist with filtering run-off from the lane. In addition to this slope the lane away from the waterway.

TARGET DATE: 1st February 2021

L6 Culvert Management

IMPACT OF
CONTAMINATION



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LIKELIHOOD OF
CONTAMINATION

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MEDIUM RISK RATING

DESCRIPTION:

Culvert crossing the waterway to the south of paddock 34. The culvert has no raised sides which allows any runoff to flow off the side into the underlying water. Building up the sides of the culvert and directing run-off back into the paddock or at a minimum into a grass riparian area will assist with filtering sediment and associated phosphorus.

Estimated Reduction in Phosphorus: >0 Kg

IMAGES:





OPEN ACTIONS:

Build up sides of culvert (South of Paddock 34)

Build up the sides of the culvert crossing the waterway to the south of paddock 34. This will prevent the direct deposition of sediment and associated phosphorus into the underlying waterway and allow for filtering via a grass buffer.

TARGET DATE: 1st February 2021



Critical Source Area

Main Culvert (South of Wintering Barn)

IMPACT OF
CONTAMINATION



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LIKELIHOOD OF
CONTAMINATION

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MEDIUM RISK RATING

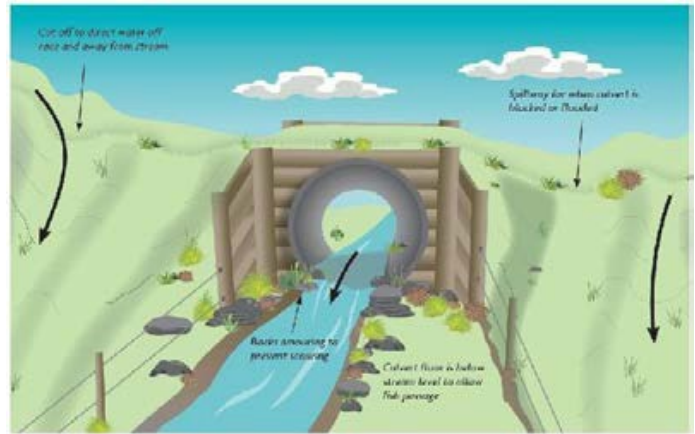
DESCRIPTION:

The main lane culvert to the south of the wintering barn on Woldwide One. A kerb should be installed on the sides of the concrete lane going over the culvert to prevent direct run-off into the underlying waterway. The kerb should direct run-off back into the adjacent paddocks. On the western side of the culvert a triangle could be fenced off and left in rank grass.

Estimated Reduction in Phosphorus: >0 Kg/P

IMAGES:





OPEN ACTIONS:

Install Kerb - Main Culvert South Wintering Barn

Install a kerb on the concrete lane at the point it goes over the main culvert. This should direct run-off into the adjacent paddock.

TARGET DATE: 1st February 2021

L8

Overland Flow Path

Overland Flow Path (Paddock 15)

IMPACT OF
CONTAMINATION



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LIKELIHOOD OF
CONTAMINATION

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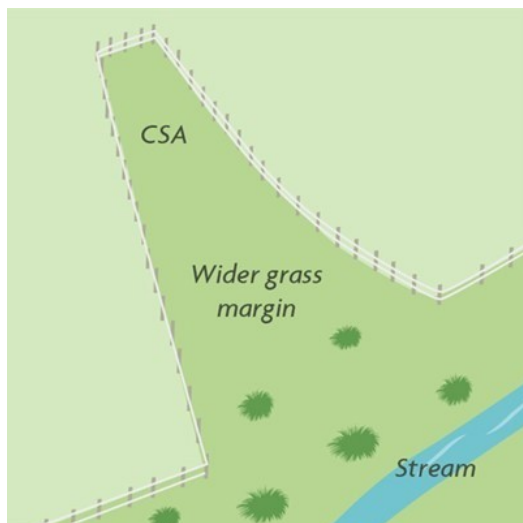
MEDIUM RISK RATING

DESCRIPTION:

Fenced off strip at the southern end of paddock 15. Area used as an unformed lane to reach paddock 35. There is an overland flow path down to the south west corner of paddock 15 where run-off can exit into the adjacent waterway. The proximity of the unformed lane to the adjacent waterway also results in a high risk of run-off directly into the creek. The temporary lane should be moved 2-3m back from the waterway when in use and the resulting area left as rank grass to filter any run-off. The riparian buffer at the south west corner of paddock 15 should be extended and maintained in rank grass (or planted in native grasses such as carex secta, red tussock and toetoe).

Estimated Reduction in Phosphorus: 1.4 Kg/P

IMAGES:



**OPEN ACTIONS:****Move Temporary Lane (Paddock 15)**

The temporary lane should be moved 2-3m back from the waterway when in use and the resulting area left as rank grass to filter any run-off. The riparian buffer at the low point at the south west corner of paddock 15 should be extended and maintained in rank grass (or planted in native grasses such as carex secta, red tussock and toetoe).

TARGET DATE: 1st February 2021

L9

Overland Flow Path

Critical Source Area (Paddock Marcel #1)

IMPACT OF
CONTAMINATION



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LIKELIHOOD OF
CONTAMINATION

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MEDIUM RISK RATING

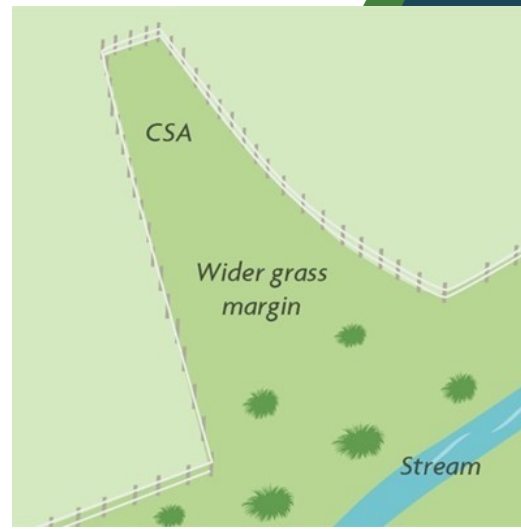
DESCRIPTION:

Swale/low area running through Marcel paddock 1. Overland flow will be concentrated in this area following heavy rain and make its way down into the adjacent waterway. The riparian margin should be increased where the swale enters the adjoining waterway and maintained in rank grass or planted in native grasses such as red tussock, carex secta or toetoe.

Estimated Reduction in Phosphorus: 0.79 Kg/P

IMAGES:





OPEN ACTIONS:

Extend Riparian Margin (Marcel #1)

Extend the riparian margin in Marcel Paddock 1 where the critical source area enters the adjoining waterway. This area should be left in rank grass or planted in native grasses such as carex secta, red tussock or toetoe.

TARGET DATE: 1st February 2021

L10

Race Maintenance & Management

Lane Adjacent Waterway (Paddock 34)

IMPACT OF
CONTAMINATION

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LIKELIHOOD OF
CONTAMINATION

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MEDIUM RISK RATING

DESCRIPTION:

Dairy lane on the boundary of Woldwide One and Woldwide Two, south of paddock 34. The lane is lined on the southern side with a row of tall gum trees, which will impact on the ability of the lane to dry out. There is a 1-1.5m riparian buffer between the lane and the creek, which is maintained in rank grass. Some re-contouring of the lane could occur to ensure it slopes away from the waterway along its full length. In addition to this the large gum trees could be removed and replaced with low growing native plantings such as flax, toetoe and red tussock. This will still provide stock shelter, aesthetic and biodiversity outcomes but not impact on the drying out of the lane.

Estimated Reduction in Phosphorus: 2.6 Kg/P

IMAGES:

**OPEN ACTIONS:****Modify Lane beside Creek (Paddock 34)**

Re-contour the dairy lane at the southern end of paddock 34 (between Woldwide One and Woldwide Two) so it slopes away from the dairy lane. In addition to this the gum trees could be removed to prevent shading of the lane, allowing it to dry out (reducing the likelihood of water ponding and running off). This area could be replanted in low natives such as flax, toetoe and red tussock to maintain biodiversity and aesthetic values.

TARGET DATE: 1st February 2021

L11

Overland Flow Path

Overland Flow Path (Paddock 34)

IMPACT OF
CONTAMINATION



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LIKELIHOOD OF
CONTAMINATION

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LOW RISK RATING

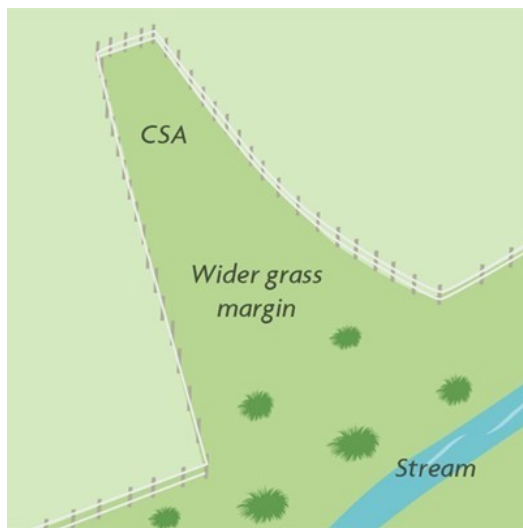
DESCRIPTION:

Small gully/swale running through paddock 34. In heavy rainfall events this will collect rainwater and associated contaminants from the surrounding land and direct them down to the waterway. Extending the riparian buffer and maintaining it in rank grass (or plant with native grasses such as Carex Secta or Red Tussock) in the location where the swale enters the creek will assist with filtering sediment and associated phosphorus.

Estimated Reduction in Phosphorus: 0.06 Kg/P

IMAGES:



**OPEN ACTIONS:****Extend Riparian Margin (Paddock 34)**

Extend the riparian margin where the small swale in paddock 34 enters the adjacent waterway. Maintain this area in rank grass or plant in native grass species such as red tussock or carex secta.

TARGET DATE: 1st August 2021

L12

Critical Source Area

Culvert - Woldwide Two Dairy Shed

IMPACT OF
CONTAMINATION



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LIKELIHOOD OF
CONTAMINATION

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LOW RISK RATING

DESCRIPTION:

Main culvert to the west of the dairy shed at Woldwide Two. The culvert could be improved to reduce the risk of contaminants off the lane flowing into the underlying waterway by building up the sides of the culvert and creating a wider buffer on the north side of the culvert where there is un-utilised space. Run-off should be directed off the culvert into adjacent paddocks (where possible) or as a minimum into a grassed riparian area.

Estimated Reduction in Phosphorus: >0 Kg/P

IMAGES:





OPEN ACTIONS:

Build up Culvert Sides (Beside Woldwide Two Dairy Shed)

Build up the sides of culvert and create a wider riparian buffer on the north side of the culvert where there is un-utilised space. Direct run-off into adjacent paddocks where possible or as a minimum into a vegetated riparian margin.

TARGET DATE: 1st August 2021

L13

Critical Source Area

Culvert (Paddock Marcel#9)

IMPACT OF CONTAMINATION



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LIKELIHOOD OF CONTAMINATION

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LOW RISK RATING

DESCRIPTION:

Lane culvert into Marcel Paddock #9. The culvert is in good condition along with the lane overlying it. The sides of the culvert should be raised to prevent contaminants off the lane running directly into the underlying waterway. Run-off should be directed out into the adjacent paddocks.

IMAGES:



OPEN ACTIONS:

Raise sides of culvert (Marcel #9)

Raise the sides of the culvert to prevent contaminants off the lane running directly into the underlying waterway. Run-off should be directed out into the adjacent paddocks.

TARGET DATE: 1st August 2021

L14

Overland Flow Path

Critical Source Area (Paddock 21)

IMPACT OF
CONTAMINATION



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LIKELIHOOD OF
CONTAMINATION

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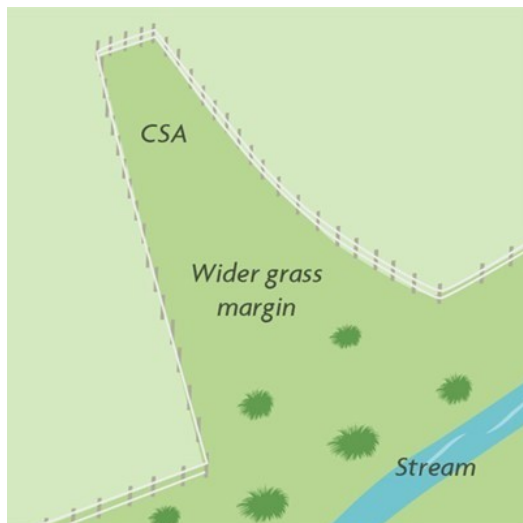
LOW RISK RATING

DESCRIPTION:

Shallow swale through paddock 21 that slopes down to the adjacent waterway. The swale will be a conduit for overland flow off the surrounding paddock during heavy rainfall events. Due to the flat topography of the farm and the small number of critical source areas, small swales as identified in paddock 21 are likely to carry a disproportionately high level of contaminants compared to the rest of the farm. On this basis having a wider riparian buffer where the swale enters the adjoining waterway and maintaining the buffer in rank grass or native grasses such as carex secta or red tussock will filter contaminants and reduce losses to surface waterways.

Estimated Reduction in Phosphorus: 0.29 Kg/P

IMAGES:





OPEN ACTIONS:

Extend Riparian Buffer (Paddock 21)

Extend the riparian margin in the location where the low area through paddock 21 enters the adjoining waterway. This should be maintained in rank grass or planted in native grasses such as Carex Secta, Red Tussock or Toetoe.

TARGET DATE: 1st August 2021