

Minimising Soil Movement by Vehicles Off Farm

BACKGROUND MATERIAL



AGRI
LINK





Andrew Barber & Henry Stenning from **Agrilink NZ** prepared the background material for this document for the **Vegetable Research & Innovation Board**.

This background document supports the *Minimising Soil Movement by Vehicles Off Farm Code of Practice*. It covers the existing literature on a range of mitigation measures designed to minimise soil transport between farms or onto the road.

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The Toolkit

There is an array of mitigation options that growers can use to minimise the movement of soil on vehicles between properties or onto the road.

The accompanying guidelines to this document include a risk assessment and should be used to determine the practices that a grower should implement.

ELIMINATE	ISOLATE	MINIMISE	REMOVE
Avoid using farm machinery on roads	Trans-shipping of produce between harvesting and transport machinery	Install wheel cleaning devices on tractors and trailed equipment	Use road sweeping devices
Construct loading pads/parking bays to prevent vehicle exposure to soil		Install metallised farm tracks	Construct on-site washdown pads or use a water blaster
		Stabilise and raise all accessways	Construct a full washdown pad in a central depot

Washdown pad

LITERATURE REVIEW

A washdown pad is simply an area on a farm or packhouse depot that is set aside for washing down agricultural machinery such as tractors to remove mud and other solids such as seeds and organic matter.

They are typically located near the entry and exit points of a paddock. The two main benefits to removing mud and organic debris are reducing the risk of spreading soil borne pests and diseases, and the reduction of mud that is brought onto roads. Additional benefits include improved maintenance of equipment, with the removal of mud helping to prevent rust and paint removal.

There are many examples in the New Zealand horticulture industry of invasive pests and diseases that have spread rapidly – causing damage to entire industries. These include Psa in the kiwifruit industry, kauri dieback, and Chilean needlegrass. The spread of many of these pests and diseases could have been significantly slowed with better biosecurity precautions, with washdown pads being a significant tool in reducing soilborne disease and pest transfer.

In 2019 the New Zealand horticulture industry prepared the Farm Machinery Washdown Code of Practice. This drew on previous work by other NZ organisations including: The National Pest Control Agencies “*Keep it Clean*” guideline on machinery washdown¹ and New Zealand Winegrowers factsheet for washdown procedures to minimise the spread of Leafroll Virus².

In Australia, both Western Australia³ and Victoria⁴ have published advice on the proper set up and use of washdown pads.

The mechanism of soil removal on a washdown pad can include physical removal of soil and organic matter, pressure washing with air or water, and vacuum cleaning. The simplest and most prevalent measure is pressure washing with water, sometimes with the aid of a disinfectant. Washing down with water can be accomplished with low volume/high pressure (LVHP) systems and high volume/low pressure (HVLP) systems, and an ideal washdown system would have a combination of both⁵. Steam cleaning at >100°C can also be used alongside regular washdowns to decontaminate machinery surfaces without the use of chemicals. An example of a non-water-based sediment removal system are cattle-grate style shaker ramps installed at site entrances and exits⁶.

Most existing literature specifies that washdown pads need to be constructed of impervious, smooth, and easily cleanable material such as concrete⁴. Multiple configurations of washdown pads are discussed in the literature, with some advanced systems being similar to service station car washes used for personal vehicles. This would be impractical in most horticultural situations, however, there still needs to be consideration of factors such as access to the underside of the vehicle and vehicle direction paths through the pad to prevent recontamination.

A washdown pad should be sized around the largest machine that will be using it, a 2m working area around the perimeter of the largest vehicle has been detailed in these guidelines^{4/7}. Some guidelines⁵, specify bunded walls around this area, however this is unlikely to be necessary on a farm as the washdown water is only likely to contain soil and organic matter, with any other chemicals or hydrocarbons only being present in very small quantities. To increase the effectiveness of washdown activities, the

entranceways to the site should be stabilised to reduce further sediment movement at these high traffic zones⁶. Stabilised parking and turn around areas⁶ can also prevent transport vehicles like cars and trucks being exposed to the soil in the first place, reducing the magnitude of the problem.

The water resulting from washing down machinery does pose a threat to freshwater and can contain high levels of sediment and nutrients, and to a much lesser extent bacteria, oil, fuel and solvents amongst others. All of these pose a threat to New Zealand's freshwater quality.

Therefore, wash pads need to be correctly designed and maintained to not only be effective and prevent the transfer of soil onto roads and the transfer of diseases, but also so that the resulting washdown water does not pose environmental risks. Carefully siting washdown pads so that washdown water does not immediately enter the freshwater environment is essential. Ways of doing this include sediment retention ponds or directing the washdown water to enter long stabilised on-farm drains with baffles. If the washdown water had been treated with a disinfectant or was contaminated with fuel or oil from the machinery, then further treatment may be required – passing through an oil/water separator for instance. Generally, a washdown pad should be constructed at a moderate slope designed to divert washdown water into the destination drain or trap. This slope should be approximately 3 - 4% as slopes under 3% do not drain well when a large volume of solids are on the pad⁸.

Health and safety of workers and the public must be an integral part of all activities, including when designing a washdown pad and selecting its location. Agricultural machinery should be prevented from moving on the washdown pad, with raised implements lowered and free moving parts secured to prevent injury to operators when washing the machine down. The pad should also be in a highly visible location and offset slightly from the entry/ exit point in order to prevent potential injuries from vehicle traffic.

Council rules in New Zealand generally allow vehicle washdown as a permitted activity, provided a set of minimum conditions are met. These conditions generally relate to ensuring water quality in any receiving waterbody is not adversely impacted by vehicle washdown runoff. For a full list of conditions for councils in the main growing regions (Auckland, Waikato, Hawke's Bay and Canterbury), refer to the supporting document *Council Rules for Discharge of Water from Farm Machinery Washdown Pads* (Version 1.2). For other regions please contact the relevant council directly.

¹ National Pest Control Agencies. Keep It Clean. June 2013. <https://www.bionet.nz/assets/Uploads/Publications/A16-KeepItClean-2015-HR.pdf>

² New Zealand Winegrowers. Vineyard Hygiene and Leafroll Virus. August 2013.

³ Department of Water, Government of Western Australia. Water quality protection note 68: Mechanical equipment wash down. September 2013.

⁴ Agriculture Victoria. Cleaning farm machinery. May 2012.

⁵ Meat & Livestock Australia. Beef cattle feedlots: design and construction, Chapter 42. Vehicle washdown. August 2016.

⁶ Auckland Council. Guideline Document 05: Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region. June 2016.

⁷ City of Swan. Guidelines for the design and operation of wash down bays.

⁸ Meat & Livestock Australia. Beef cattle feedlots: design and construction, Chapter 42. Vehicle washdown. August 2016.

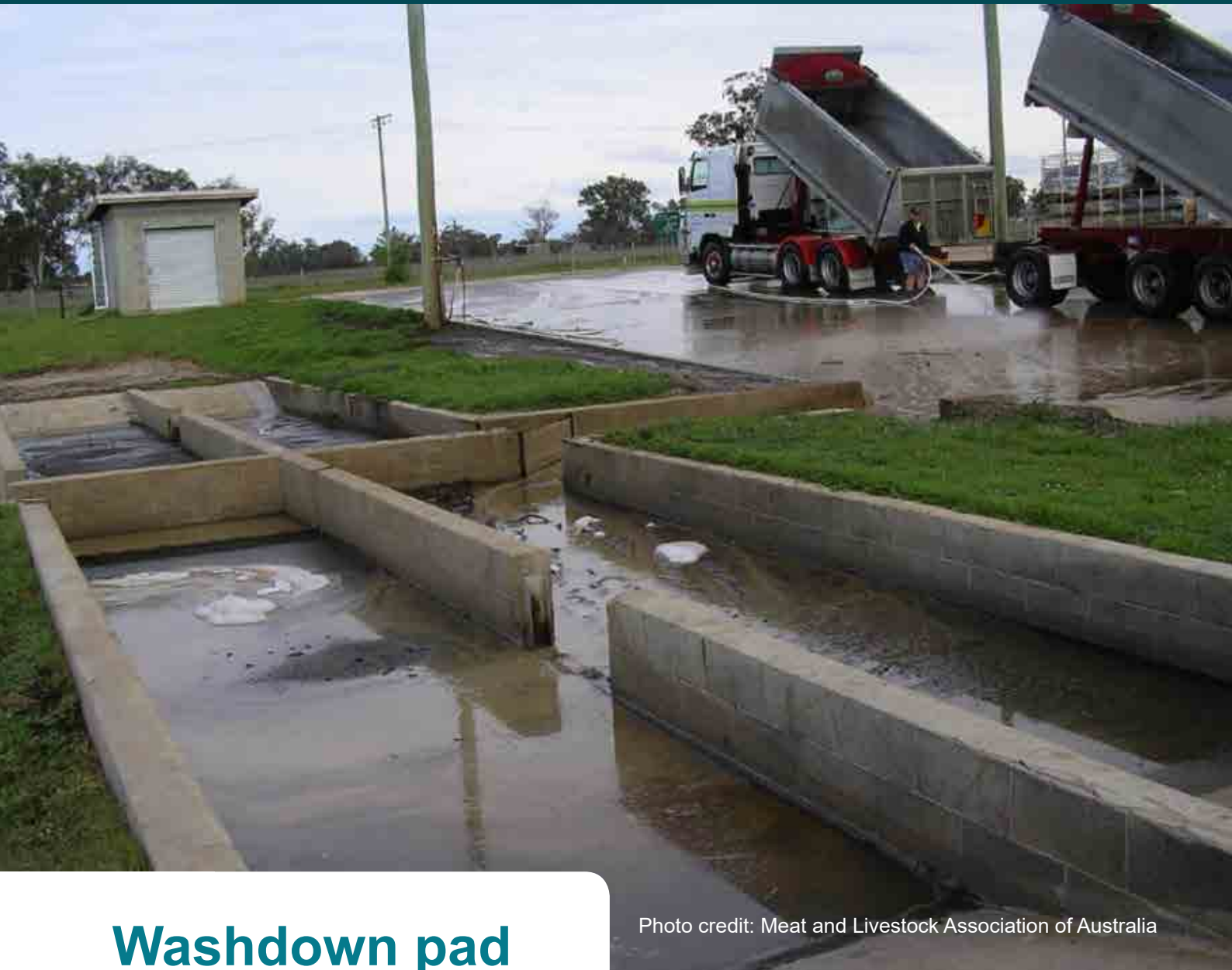


Photo credit: Meat and Livestock Association of Australia

Washdown pad

DESIGN CONSIDERATIONS

Overall, the existing literature on washdown pads generally specifies more comprehensive requirements than would be necessary in a horticultural context. However, several of the design considerations used in other industries will have applications to washdown pads used in the horticulture sector.

The factors that should be considered when designing a horticultural operation's washdown pad include:

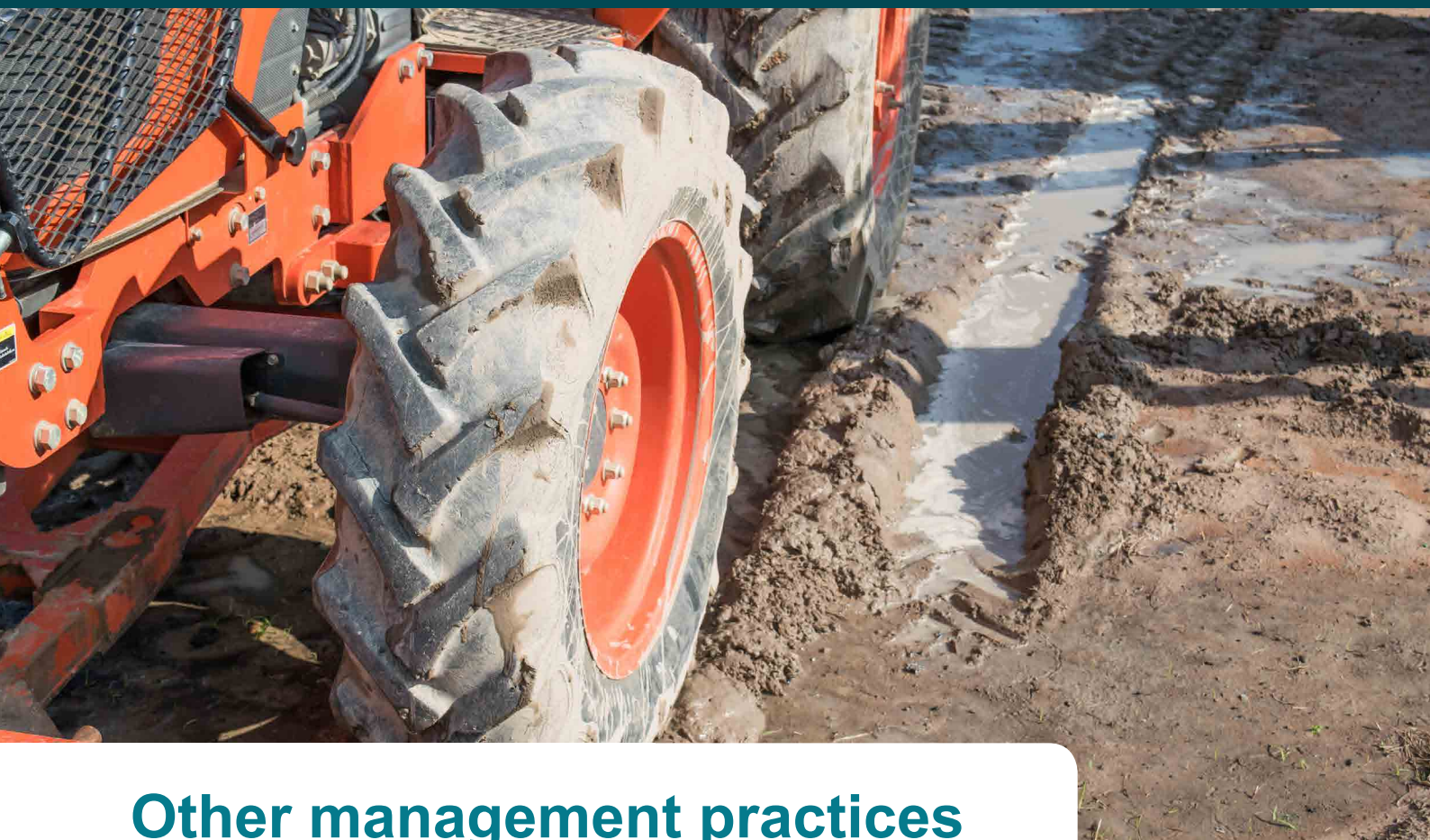
- **Surface material of the washdown pad:** most guidelines specify concrete or a similar impervious material, although metal or other compacted aggregate can be used.

- **Petrol/oil separators:** Some guidelines specify the necessity of fuel interceptors or separators, and these should be considered if washdown water is identified as containing a noticeable quantity of any vehicle fuel or oil. These separators can be of several types including vertical gravity separators (VGS) and coalescing plate separators (CPS). Information about the design of these can be found in multiple sources online⁹. The separators are designed to reduce the maximum hydrocarbon level of washdown water to 30ppm (30mg/L)¹⁰ and can also be used to remove suspended solids such as sediment. In most horticultural situations the level of hydrocarbons in the discharged washwater will be below this benchmark anyway. Generally, oil water separators need incoming water to spend time in a retention tank or settling pond to be effective.
- **Sediment traps:** Washing soil from vehicles by its primary purpose carries with it a great deal of sediment in the discharge water. If washdown activities are frequent and the volume of sediment laden washdown water is large, then a sediment trap should be installed in the drainage system leading from the washdown pad. The volume and flow rate of water entering the drainage system and the concentration of sediment should be used as guidance when determining the size of the trap. The trap itself can be as simple as a mesh filter to separate large solids, but preferably should consist of one or a series of multiple holding ponds to allow for settling of suspended sediment.
- **Detergents:** Detergents are unlikely to be necessary in a horticultural context, which is mostly focussed on removing soil. However, if they are used, for instance to remove oil, they should preferably be quick break detergents which allow the oil molecules to separate before entering the oil water separators.
- **Roofing:** If oil/fuel and sediment separation is deemed necessary for the washdown pad then roofing may be required to prevent clean rainwater entering the system and compromising the effectiveness of separation measures.
- **Washdown pad slope:** Washdown pads should slope towards the outlet/drainage channel. As discussed previously, slopes of 3 - 4% should be considered to allow for proper movement of dislodged soil into the outlet.
- **Washdown pad size:** Washdown pads should be sized for the largest vehicle expected to use it with a margin of a few metres either side. For example, to wash a 5m long and 2m wide tractor, the total hard surfaced pad area should be around 9m x 6m.
- **Exterior bunding:** If there is a risk of washdown pad water missing the drainage system then a bund around the perimeter should be installed to direct flow towards the drain. These should be at least 75mm high and 100mm wide¹⁰.

⁹ <https://cleanawater.com.au/information-centre/guide-to-vertical-gravity-separators-vgs>

<https://cleanawater.com.au/oil-water-separators/coalescing-plate-separators>

¹⁰ City of Swan. Guidelines for the design and operation of wash down bays.



Other management practices

FOR REDUCING SOIL MOVEMENT ON MACHINERY

Whilst beside paddock washdown pads are a good solution to preventing the spread of soil onto roads and other properties, they can often be prohibitively expensive and are often too large and impractical for many sites. Therefore, while a central washdown facility is one solution, other management practices can be used on and around the farm to reduce the magnitude of soil trafficking.

Avoid using the road

The best method to reduce soil trafficking is to eliminate the problem entirely. Avoiding the use of roads by using interconnected farm tracks can reduce the frequency of vehicles moving from exposed soil to the road. Stabilising farm tracks and loading pads through compaction or surfacing with metal or other aggregate, can reduce the frequency that vehicles are exposed to the cultivated soil.

Wheel scrapers

If eliminating or isolating the issue is not possible, such as for tractors moving between multiple separate sites, then minimising the quantity of soil trafficked is the next best option. There are several methods to minimise soil build-up on vehicles, with wheel cleaning devices such as scrapers being a cheap and effective option. These are usually attached to the outside of the wheel to scrape off soil that attaches itself to the surface of the tyres. Whilst they don't detach all of the soil that gets trapped in tyre treads, they do minimise the overall volume of soil carried by vehicle wheels.

Trans-shipping

If it isn't possible to eliminate the issue, then try to isolate the machinery that is exposed to the soil. For instance, trans-shipping between harvesting machinery and a transport vehicle. The transport vehicle should be located on a hard surface loading pad for further road transport. This can be done by palletising harvested produce and helps to prevent the movement of 'dirty' vehicles into 'clean' areas such as roads or separate farms if there is a contamination issue.

Raised accessways

Raising farm accessways helps minimise soil movement onto the road from rainfall induced erosion and from vehicle trafficking. Technical details for raised stabilised accessways can be found in the Auckland Council's Guideline Document 05¹¹.

Metalled or compacted farm tracks

Another minimisation technique is to use metalled farm tracks to get up to as close to road speed as is safely possible, in order to detach soil stuck in on vehicle wheels. This typically requires at least 50 - 100m of metalled farm track located before the exit point. Whilst a safe speed is paramount and is dictated by local conditions, at least 50 km/hr would be necessary to detach a significant volume of trapped soil. To safely reach this speed, the farm track should be well constructed and level, well stabilised and as straight as possible to ensure there is no loss of vehicle control.

Portable water blasters

When these methods are insufficient to reduce the issue of soil trafficking to acceptable levels, for instance in cases of pest and disease or in medium to large multi-site operations on sticky clay soils, then well-constructed washdown pads may be required. In cases where this is not practical for economic or site-specific reasons then portable water blasters can be used on vehicles while sitting on metalled and stabilised pads.

Road sweepers

Another mitigating measure that can be used if mud has made its way onto roads are road sweeping devices attached to agricultural vehicles. These can be used to brush aside and collect soil that has left the vehicle when on the road and can also sweep aside previously deposited soil. However, these devices should only be used when road and traffic conditions permit.



Figure 1. An example of road cleaning equipment attached to a tractor. Mud on the road poses a safety hazard making the road slippery.

¹¹ Auckland Council. Guideline Document 05: Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region. June 2016.



Warning Signs

Some regions have a large amount of horticultural land concentrated in a small geographic area, such as around Pukekohe. In these areas there will always be some soil trafficked onto roads. Whilst this is not ideal, it is often the reality, and so for the safety of both horticultural workers and the general public warning signs may be necessary on roads that commonly have issues with trafficked mud.

Establishing signs on roadsides is dependent on local council rules and safety conditions. Before installing a roadside sign, permission from the local council or the New Zealand Transport Agency (NZTA) may be required. Some councils or NZTA may require you to establish temporary traffic management whilst erecting the sign if the installation would interfere with the normal operation of the road and any footpaths. Similarly, vehicle movement onto some roads may require a traffic management plan. This is a highly regulated process that requires permission, training and a large degree of planning¹².

If erecting a sign, it should be large enough to be easily visible, should not impede the view of motorists, and should be at least 200m from an official sign or traffic signal. It should be placed at right angles to the road to avoid headlight reflection and should have lettering of sufficient size to be easily read by passing motorists (minimum letter height of 160mm), as well as a maximum of 6 words with 40 characters¹³. For instance, a warning sign could state, "Caution: Mud on Roads."

It is important to ensure that permission and advice from the relevant regional council and or the NZTA is sought before erecting any sign.

¹² <https://www.nzta.govt.nz/assets/resources/code-temp-traffic-management/docs/2018/sections-a-to-h-combined-copttm-4th-ed-nov2018.pdf>

¹³ <https://www.nzta.govt.nz/assets/resources/advertising-sign-alongside-sh/ad-signs-brochure.pdf>

Council*	Document	Activity Status	Details	Conditions
Auckland Council	Auckland Unitary Plan	Permitted	<p><u>Table E4.4.1 Activity A1:</u> Discharge of water and/or contaminants (including washwater into land and/or into water from any of the following activities: (d) washing vehicles, plant or machinery</p>	<p>E4.6.1:</p> <p>(1) The discharge must not, after reasonable mixing, give rise to any of the following:</p> <ol style="list-style-type: none"> the production of any conspicuous oil or grease film, scum or foam, or floatable or suspended materials; any conspicuous change in the colour or visual clarity; any emission of objectionable odour; the rendering of freshwater unsuitable for consumption by farm animals; a change to the natural temperature of the receiving water by more than 3 degrees celsius; a change in the natural pH of the water by more than 1pH unit; and any significant adverse effect on aquatic life. <p>(2) The discharge must not enter into any water supply catchment, or any areas identified in D8 Wetland Management Areas Overlay (excluding Wetland Management Area Number 450 Lake Pupuke), D5 Natural Lake Management Areas Overlay or D4 Natural Stream Management Areas Overlay except in the case of a discharge by a network utility operator carried out for maintenance, routine operations, or emergency works, provided there are no adverse effects on a Wetland Management Area, Natural Lake Management Area or Natural Stream Management Area.</p> <p>(3) The discharge must not cause erosion or scouring at the point of discharge or alter the natural course of the water body.</p> <p>(4) The discharge must not include washwater used for the external cleaning of a reticulated water supply system.</p> <p>(5) The discharge must be in accordance with best management practice to minimise the contaminants to the extent practicable</p>

Council Rules

FOR DISCHARGE OF WATER FROM FARM MACHINERY WASHDOWN PADS

**For councils not listed here please refer to that council's rules on their website or contact the council directly.*

Council*	Document	Activity Status	Details	Conditions
Hawke's Bay Regional Council	Hawke's Bay resource management plan	Permitted	6.6.7 Rule 49: The discharge of contaminants onto or into land, in circumstances which may result in those contaminants (or any other contaminant emanating as a result of natural processes from those contaminants) entering water, pursuant to section 15 (1) (b) RMA, except as expressly regulated by other rules in this Plan.	<ul style="list-style-type: none"> a. The rate of discharge shall be no greater than 50 m³/day. b. The discharge shall not result in a breach of any of the conditions set out in Rule 47. c. The discharge shall not result in a breach of any of the conditions set out in Rule 48. d. The point of discharge shall occur no less than 600 mm above the winter ground water table. e. There shall be no surface water ponding in the area of discharge, or runoff of any contaminant into a surface water body as a result of the discharge. f. The discharge shall not result in any airborne liquid contaminant being carried beyond the boundary of the subject property. g. There shall be no discharge within 20 m of any surface water body, or over the Heretaunga Plains or Ruataniwha Plains unconfined aquifers as shown in Schedule IV, except for material extracted from a surface water body associated with the maintenance of legally established structures. h. There shall be no surface ponding in the area used to store, mix or use the organic material, and no runoff of contaminants into any surface water body. i. There shall be no discharge within 30 m of any bore drawing groundwater from an unconfined aquifer into which any contaminant may enter as a result of the discharge. j. The discharge shall not cause any degradation of existing ground water quality in confined aquifers in the Heretaunga Plains and Ruataniwha Plains aquifer systems. k. For other aquifers, the discharge shall not cause or contribute to a breach of the following guidelines after reasonable mixing: <ul style="list-style-type: none"> i. The "Drinking Water Quality Standards for New Zealand" (Ministry of Health, 1995). ii. The guideline for irrigation contained in the "Australian Water Quality Guidelines for Fresh and Marine Waters" (Australian and New Zealand Environment and Conservation Council, 1998). i. Where the quality of ground water in any aquifer encompassed by condition (k) breaches the standards specified in that condition prior to the discharge occurring, the discharge shall not cause any further degradation of the quality of ground water in any such aquifer after reasonable mixing. <p>If these conditions cannot be met it becomes a Discretionary activity under section 6.6.8 Rule 52.</p>

Council*	Document	Activity Status	Details	Conditions
Waikato Regional Council	Waikato Regional Plan	Permitted	5.2.3	<p>Policy 1: Low Risk Discharges Onto or Into Land</p> <p>Enable, through permitted activity rules and non-regulatory methods, the discharge of contaminants onto or into land where:</p> <ol style="list-style-type: none"> a. hazardous substances present in the discharge, or produced as a consequence of the breakdown of the contaminants from the discharge: <ol style="list-style-type: none"> a. are not environmentally persistent b. will not bioaccumulate to a level that has acute or chronic toxic (carcinogenic, teratogenic or mutagenic) effects on humans or other non-target species b. the discharge of these contaminants onto or into land will not result in pathogens accumulating in soil or pasture to levels that would render the soil unsafe for agricultural or domestic use c. the discharge is not inconsistent with policies in Section 5.1.3 d. the discharge will not result in any effect on water quality or aquatic ecosystems that is inconsistent with the purpose of the Water Management Classes as identified by the policies in Section 3.2.3 e. the discharge will not result in any effect on air quality that is inconsistent with policies in Section 6.1.3 f. the discharge will not damage archaeological sites, waahi tapu or other identified sites of importance to tangata whenua as Kaitiaki.

Council Rules

FOR DISCHARGE OF WATER FROM FARM MACHINERY WASHDOWN PADS

**For councils not listed here please refer to that council's rules on their website or contact the council directly.*

Council*	Document	Activity Status	Details	Conditions
ECan	Canterbury Land and Water Regional Plan	Permitted	<p>5.98 (application to land)</p> <p>Or</p> <p>5.99 (application to surface water)</p>	<p>5.98 Any discharge of water or contaminants onto or into land in circumstances where a contaminant may enter groundwater that is not classified by any of the above rules, is a permitted activity, provided the following conditions are met:</p> <ol style="list-style-type: none"> 1. The volume of the discharge does not exceed 10m³ per day and the application rate does not exceed 10mm per day; and 2. The discharge is not directly into groundwater; and 3. The discharge does not result in any overflow or runoff into any surface water body or onto neighbouring site; and 4. The discharge does not, in groundwater, render fresh water unsuitable or unpalatable for consumption by animals or humans; and 5. The discharge does not contain any hazardous substance, hazardous waste or added radioactive isotope; and 6. The discharge does not occur when the soil moisture exceeds field capacity; and 7. The discharge is not from or into contaminated or potentially contaminated land; and 8. The discharge is not within <ol style="list-style-type: none"> (a). 50m of a bore used for water abstraction; or (b). within a Community Drinking-water Protection Zone as set out in Schedule 1; and <p>5.99 Any discharge of water or contaminants into surface water or onto or into land in circumstances where it may enter surface water that is not classified by any of the above rules, is a permitted activity, provided the following conditions are met:</p> <ol style="list-style-type: none"> 1 The discharge is not from or into contaminated or potentially contaminated land; and 2 The discharge is not into a Natural State water body; and 3 The discharge meets the water quality standards in Schedule 5 after reasonable mixing with the receiving waters, in accordance with Schedule 5; and 4 The concentration of total suspended solids in the discharge shall not exceed: <ul style="list-style-type: none"> 50 g/m³, where the discharge is to any Spring-fed river, Banks Peninsula river, or to a lake; or 100 g/m³ where the discharge is to any other river or to an artificial watercourse; and The discharge does not result in more than a 20% change in the rate of flow of the receiving surface water body; and The discharge does not contain any hazardous substance, hazardous waste or added radioactive isotope.

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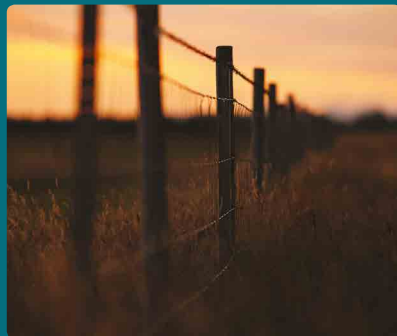
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