FEEDLOT DESIGN AND CONSTRUCTION

42. Vehicle washdown

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Introduction

Vehicle and machinery hygiene is important for biosecurity, maintaining operational efficiency, maintaining aesthetic appearance and facilitating mechanical servicing.

Cleandown facilities vary in design, layout, functionality and operation depending on the type of vehicles, mobile plant and machinery that may require cleaning. These may include front end loaders, skid steers or bobcats, excavators, feed trucks, manure cartage and spreader trucks, tractors and tillage equipment and livestock transport vehicles.

Design objectives

The design objectives of a vehicle or machinery cleandown facility are to

- provide the required level of cleaning of mobile equipment for biosecurity, prolonging working life, aesthetic and/or mechanical servicing
- accommodate a range of vehicle, mobile plant and equipment types and configurations
- ensure collection of solid and liquid wastes
- minimise the release of contaminants to the environment
- provide contingency disposal options in case of system failure
- provide a safe working environment for people
- reduce the risk of regional or farm level spread of biosecurity hazards.

Mandatory requirements

Mandatory requirements for the design of feedlot vehicle cleandown facilities relate to minimising the release of contaminants to the environment and the provision of a safe working environment.

The washdown facility must comply with

- National Guidelines for Beef Cattle Feedlots in Australia (MLA, 2012a)
- National Beef Cattle Feedlot Environmental Code of Practice (MLA, 2012b)
- Work Health and Safety Act 2011 (WHS Act).
- Commonwealth, state and local authority codes, regulations and relevant Australian standards as applicable to feedlot development.

The installation of electrical services must comply with the current standards and with the requirements of the Supply Authority Services Rules and all applicable regulations and by-laws of statutory authorities. Other electrical work shall comply with the latest edition of the appropriate publication from the Standards Association of Australia. In some jurisdictions, the building elements such as concrete footings, floor slabs and steel structures may need to achieve the structural provisions of the Building Code of Australia (BCA). See *Section 26 – Office and amenities* and *Section 40 – Machinery workshops* for further information on structural design criteria.

Technical data

All vehicle cleandown facilities should incorporate the following functional elements

- building structures
- cleandown area
- stormwater management system
- solid waste management system
- liquid waste management system
- utilities – mechanical, electrical, hydraulic supply and services
- cleandown systems e.g. water, air, vacuum.

Design should integrate these systems so that the performance objectives are met with the least interference between elements. The design may also incorporate and utilise elements of the site layout rather than be a discrete stand alone system.

Building structures – enclosures for pumping equipment, control systems, cleandown equipment.

Cleandown area – suitably sized impervious setdown area/s for cleaning vehicles

Stormwater management system – stormwater exclusion features

Solid waste system – sedimentation system and solid waste storage/ stockpile areas

Liquid waste system – drains, sedimentation system, holding ponds, oil/water separation if required

Utilities – required electrical, mechanical and hydraulic services

Cleandown system – provision of water, air or vacuum and associated pumps, pipelines and components. This may also include elevated platforms for personnel to safely access the top of vehicles to be cleaned.

A range of technical data is required before a layout can be proposed.

Design choices

When designing a vehicle and/or machinery cleandown facility, several design criteria will influence the overall layout.

Data requirements

Site plans– aerial photographs, topographic plans, site layout

Elevation data – site-specific elevation data – see *Section 7 – Site investigations*

Soils – site-specific geotechnical parameters for concrete footing, slab design and liquid waste management systems

Vehicle data – geometry (length, width, height) and weight of vehicles, mobile plant and machinery

Services – electrical power, water supply, water pressure and air pressure requirements

Accessibility – traffic flow, site layout – see *Section 2 – Feedlot site layout* and *Section 13 – Access and internal roads*.

Drive-through design with platform along full length of washdown pad. Wastewater drains to feedlot drainage system.

Concrete pad with suitable length and width for most feedlot vehicles, kerbed pad, adequate slope on pad and suitable wastewater collection system.

Concrete pad of suitable length and width for semi-trailers; 4% downslope provides excellent self-cleaning and drainage.

Design

Primary function

The primary function influences the overall design. For example, a facility which primarily cleans down livestock transport vehicles for biosecurity will have different design requirements to one for cleaning down only feedlot vehicles for vehicle maintenance.

Configuration

Design considerations include

- drive in-reverse out versus drive-through
- washdown system – manual or fixed overbody/underbody sprays, or both
- vehicle flow paths at the site
- bunding
- wastewater/sediment system
- underbody access – ramps etc or overbody access platforms.

Washdown area – material

Constructed to accommodate the weight and dimensions of the vehicles and/or machinery to be cleaned. The washdown area surface needs to be impervious, smooth, durable and easily cleaned. Concrete is the most common material used.

Typically, a minimum thickness of 150 mm slab on grade and edge thickening will be required.

Washdown area – size

Length and width of the washdown area is based on the dimensions of the largest vehicle and/or machinery to be cleaned. Adequate clearance around the vehicle and/or machinery for operator and plant access and containment of overspray should be considered. This is important if cleaning at height is required.

The washdown area should be large enough so that the largest vehicle is located on an impervious bunded area. This ensures that all wastewater is contained and operators are not required to reposition the vehicle.

As a guide, a working area of 2 m around the full perimeter of the extent of the largest vehicle should be sufficient to allow for clearance and manoeuvrability of mobile plant such as forklifts and containment of overspray.

A kerb nib wall at the perimeter of concrete slabs may be provided to minimise discharge from the slabs. The nib wall along the edges of concrete that are intended to be trafficable should be a raised rolled edge that drains inwards towards the washdown area. Elsewhere, the edge of the washdown area may have a 200 mm (H) × 200 mm(W) nib wall so that vehicles cannot easily mount the kerb.

Washdown area - slope

The design should allow gravity drainage of solids and wastewater to the sediment trap. Down slopes of about 3–4% and a cross slope of 2–3% are desirable. Slopes under 3% do not drain well when there is a buildup of mud/manure.

The slope chosen depends on site topography. For flat sites where earthworks are required to artificially create slope, lower slopes (<3%) are often chosen. For steeper slopes, the natural topography usually determines the slope.

Cleaning services

Primary cleaning requires water at both low volume/high pressure (LVHP) and high volume/low pressure (HVLP).

LVHP washers are adequate for general exterior and engine cleaning; HVLP water is preferred for removing large quantities of mud/manure and organic material buildup. Rigid or semi-rigid lances with nozzles with any combination of forward or 90° angle jets will facilitate cleaning in areas that are hard to access.

Compressed air is useful in removing dry material and cleaning seed and organic material out of radiators, air filters and inaccessible places. Air compressors can be single phase or three phase electric, petrol or diesel, stationary or portable. A retractable enclosed air hose reel suitable for outside exposure and air blow gun with a long nozzle for directional access are recommended.

Vacuum equipment is useful for cleaning cabins and dry material build up (seed and straw). Vacuum equipment removes this material rather than blowing it into less accessible areas on the machine or vehicle.

Hot water or steam may be required to disinfect vehicle/plant or equipment in areas which may have a local biosecurity requirement.

Effective sterilisation requires steam above 100°C as indicated by a jet of clear invisible steam between steam outlet and the visible condensate cloud.

Water supply

Water will normally be from the feedlot supply. Rainwater could be harvested from nearby buildings but recycled water may pose a biosecurity and health risk. A risk assessment should be conducted to determine the risks associated with using recycled effluent for vehicle cleandown.

Flow rates will depend on the demand of the facility and the water delivery equipment provided but pumping will usually be required, as flow rate and pressure supplied by gravity would be too low.

The supply should be supplemented with a suitably sized holding tank, which serves as a storage reservoir to equalise the fluctuations in demand. A suitable system or device should be installed that will shut off the water supply if the holding tank becomes filled to capacity, or due to a leak into the system or lack of maintenance pumping of the system.

Traffic movement/ accessibility

Entry and exit areas should be well gravelled to cope with anticipated vehicle movements – see *Section 17 – Pen and road surfaces* for further discussion on structural thickness and suitable materials for road construction.

The siting and layout of the facility should ensure good traffic management and flow.

This small concrete pad has limited downslope with no wastewater containment.

This concrete pad has suitable length and width and equipment storage, but it is flat with no wastewater containment.

This concrete pad is of suitable length, but too narrow. Water is supplied, but the pad is flat and there is no controlled wastewater drainage system.

Quadruple trafficable sedimentation basin side by side arrangement. Wastewater is diverted into one or more bays.

Dual trafficable sedimentation basins allow one to be taken offline to enable sediment to dry. Separate basins cost more than a side by side arrangement.

These basins are adequately sized for cleaning machinery but do drain to bed level.

Drive in-reverse out design with platform for elevated access to vehicles. Wastewater drains to feedlot drainage system.

Infrastructure

Typically, the washdown facility will require minimal building structures.

The pumping equipment, air compressor and associated control equipment should be inside some form of shed or under cover.

The need for electricity and/or other energy sources at the facility needs to be determined and may help determine the facility location.

Electricity will be required at the site to operate water pumping equipment (cleaning/recycling) and lighting and could be a three phase supply. Electrical supply lines should be kept well away from the cleandown area where they may be contacted by vehicles or washing equipment.

Lighting may need to be installed to allow the washdown to operate beyond daylight hours if required.

For facilities that are constrained by area and/or sited adjacent to other operational or storage areas, a side screen may be considered to prevent the drift of over-spray.

Side screens can interfere with cleandown operations and manoeuvrability of plant and add to the cost of the facility.

An elevated platform may be needed for personnel to safely access the top of vehicles to be cleaned.

Low volume/high pressure water systems

Industrial high pressure water systems with a minimum pressure of 20.6 MPa (3000 psi) and a minimum pump volume of 20 L/min would be sufficient.

Reels for high pressure hose mounted at the outlets provide convenience and safety for operators and reduce the potential for damage to the hoses.

Wastewater treatment train

Wastewater should be contained, segregated and treated, or disposed of in accordance with the environmental authority for the development.

Wastewater may be drained to a sediment trap and oil/water separator then directed to a holding pond/s to be evaporated or treated to an acceptable standard prior to discharge.

Preliminary treatment

Wastewater is temporarily held in a sediment basin where heavy solids (e.g. nuts and washers), gravel, manure and silt are trapped. This reduces the sediment load in the wastewater.

Sediment basin designs are discussed in *Section 11 – Sedimentation removal systems*.

Solid waste management

Accumulated sediment must be removed and disposal of properly. If accumulated sediment reduces the storage volume of the sedimentation basin below the design volume, the efficiency of the basin will be decreased and sediment may be washed out into the holding pond.

Inspection experience will determine the required cleaning frequency for the accumulated sediment in the sedimentation basin.

The accumulated sediment may contain some hydrocarbons e.g. benzene, toluene, ethylbenzene, xylenes (BTEX)) and/or weed seeds. Sediment containing hydrocarbons and/or weed seeds should be excluded from the manure stockpile.

Safety

Handrails preventing access to the sedimentation basin should be fabricated to Australian Standards AS1428 (Standards Australia 2009b). A suitable ladder and handrails need to be fitted to any overhead platform.

Operation

Supply units can be fitted with detergent systems if degreasing or chemical cleaning is required.

Biosecurity

Washdown of vehicles and machinery also prevents the spread of weeds and fungal disease.

In areas of infestation, seeds and vegetative material collect on many parts of a vehicle or agricultural machine, but especially on the vehicle radiator and tyres.

Quick tips

- The siting and layout of the facility should ensure good traffic management and flow.
- Size the washdown area on the largest vehicle to be cleaned down and allow a working area around the full perimeter for clearance and manoeuvrability of mobile plant such as forklifts and containment of overspray.
- A down slope of 3–4% will ensure good drainage.
- A trafficable sedimentation basin will facilitate removal of sediment. The width of the basin is set by the width of the cleaning equipment (e.g. bobcat, front end loader).
- Sedimentation basin access ramps should not be steeper than 1 in 10 – even for 4WD tractors.

A non-trafficable sedimentation basin grated to prevent access. The heavy grate must be removed to clean out sediment and debris. Not accessible to typical feedlot machinery.

Trafficable sedimentation basin with offset weeping wall/bar screen segment. Wastewater drains to bed level.

This single trafficable sedimentation basin is adequately sized for cleaning machinery, and has handrails for safety. Wastewater drains to bed level.

Further reading

Tyers, G., Grech, C. and Baldyga, N. (2004) Machinery Hygiene, Landcare Note, LC0425 ISSN 1329-833X, Department of Primary Industries, State of Victoria.

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