

PANAMA DISEASE TROPICAL RACE 4



Wash-down designs to combat Panama disease tropical race 4



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Wash-down designs to combat Panama disease tropical race 4

These wash-down designs have been published by Biosecurity Queensland's Panama TR4 Program to help banana farmers in the region further protect themselves from the threat of Panama disease tropical race 4. Cleaning, washing and decontaminating vehicles, machinery and equipment is important for controlling the spread of the disease.



Wash-down facilities should be tailored to meet operational and maintenance requirements of the property based on farm practises, zoning, level of contamination and hygiene. These designs are specifically aimed at the control of Panama disease tropical race 4 and can be directly applied to farms affected by the disease, as well as to the wider banana industry and agricultural sector in general. Biosecurity Queensland recommends using the design specifications as a guide and to implement some, or all, of the options consistent with your estimated level of risk and your individual situation.

Biosecurity Queensland's Panama TR4 Program engaged FSA Consulting to research current practices and scientific evidence and to consult with industry, government and stakeholders to develop the most effective and practical designs for banana farming operations in a tropical climate.

The designs were based on the following:

- safety – for users of the wash-down facility
- cost effective – for construction, operation and maintenance
- effectiveness – for minimising the risk of disease spread from affected land, or preventing the introduction of the disease to other properties
- ease of implementation – for the facility to be implemented into current farming practices without the need for specialist construction, operation or maintenance services
- risk – for consideration of the different levels of disease contamination risk of a farm with Panama disease tropical race 4 (separation or clean entry/exit point and farming activity zone or dirty exit point)
- practicality – for robust and realistic construction, operation and maintenance
- flexibility – for design options that accommodate different site conditions and operational requirements
- environmental considerations – for climate, high rainfall and evaporation rates and water quality protection
- compliance – for Queensland legislation to minimise the risk of spread of Panama disease tropical race 4 from affected land.

If implemented, these designs should meet the standard required for properties that are confirmed as infested with Panama disease.

While wash-down facilities are optional for all other growers, they play a critical role in protecting properties from the introduction of the disease, and therefore should be considered as part of an integrated on-farm biosecurity action plan.



EXCLUSION ZONE

for the exclusion of all non essential vehicles such as visitor and staff car parking, typically located near the farm entrance.

SEPARATION OR 'CLEAN' ZONE

roadway for essential vehicles that need to come on-farm. This could include fruit pick-up trucks, or fertiliser/fuel delivery or waste pick up.

FARMING ACTIVITY OR 'DIRTY' ZONE

where farm vehicles, machinery and equipment operate. Vehicles, machinery, equipment or tools should not enter or exit this area without appropriate decontamination.

FARM ZONING

By dividing a farm into separate areas or zones, growers can manage the movement of vehicles, machinery and equipment both between zones and within zones. For effective on farm biosecurity, three zones are used. These are the exclusion zone,

separation or 'clean' zone and the farming activity or 'dirty' zone. Demarcation of different zones can be made with physical barriers such as fences, signs and road surfaces. An example of farm zoning can be found on page 16.

Design options

These two concept designs service the different on-farm biosecurity zones: the separation zone which is a ‘clean’ area where there is a lower risk of vehicle and equipment contamination by soil and plant matter (e.g. packing sheds and supply receiving areas) and the farming activity zone which is a ‘dirty’ area where there is a high-risk of vehicle and equipment contamination by soil and plant matter.



OPTION ONE

Farming activity zone or dirty exit point where high-risk vehicles, machinery and equipment exit the farming activity zone of the property to access public roads and/or move to other zones of the farm.

High-risk vehicles that are exiting the farming activity zone, or dirty exit point, must undergo a three step washing/scrubbing, rinsing and disinfection process. A final rinse can be added if there are concerns about long term repeated exposure of disinfectants on vehicles, machinery and equipment.

Automated systems were compared with manual wash-down facilities.

A manual wash-down facility was selected as the preferred option for the farming activity zone or dirty exit point as it allowed for cleaning of both lightly and heavily soiled vehicles, machinery and equipment. Heavily soiled vehicles, machinery and equipment may need additional manual cleaning, which limits the practicality of the automated wash-down facility.

Recommendations for a manual wash-down facility at the farming activity zone or dirty exit point:

- all vehicles, machinery and equipment are required to be washed, rinsed and disinfected with appropriate detergents and disinfectants. Clean water must be used for each cycle (i.e. no recycling).
- a graded, bunded concrete pad that falls to a grated pit with a sediment trap
- a roof and wall to contain overspray and shield against periods of high rainfall
- a high pressure, low volume hose to reduce the volume of water used per vehicle and to mitigate the risk of overspray
- disinfection is performed manually with a small hand operated garden style pressure pack sprayer, garden sprinkler or other manual spray device
- a wastewater disposal system that incorporates a septic type structure, which allows for the captured wastewater to be returned to the land.

The manual wash-down is designed to be used by vehicles and farm machinery and equipment, e.g. tractors and mobile plant.





OPTION ONE

Design, operation and maintenance considerations and modification options for the farming activity zone or dirty exit point wash-down facility concept design.

DESIGN, OPERATION AND MAINTENANCE CONSIDERATIONS	COMMENTARY	MODIFICATION OPTIONS
<p>Wastewater and rainwater need to be segregated.</p> <p>A roof is recommended.</p>	<ul style="list-style-type: none"> • This to prevent contamination of stormwater and reduce the volume of wastewater requiring management. • Diversion drains are required to direct up gradient stormwater flows around the wash-down bay. • 150 – 200mm high concrete bunds are required on all sides of the slab. Rollover bunds should be used on entry and exit points. • A roof is recommended to divert stormwater and encourage use during inclement weather. • Walls should be included to reduce windblown rainfall and contain overspray (if high-pressure water is used). • The roof over the wash-down bay may be classified as a Class 10a structure and a town planning or building permit may be required. 	<ul style="list-style-type: none"> • <i>A roof could be omitted but alternate stormwater controls will be required.</i> • <i>There are several options to manage incidental rainfall. Examples include manually operated diversion valve (low cost but high-risk of user error), automated diversion valve (may need to modify for remote applications without mains power or water (about \$6,000)) or roof (minimal maintenance but high capital outlay). A roof would make the site easier to use by personnel in wet or hot weather.</i> • <i>If walls are not provided a horizontal roof overhang of 25% of the roof height on each side will be necessary to reduce windblown rainfall.</i>
<p>A concrete slab is included in the concept design.</p>	<ul style="list-style-type: none"> • This is for ease of cleaning after use to prevent cross contamination. • A concrete slab should also require no maintenance. 	<ul style="list-style-type: none"> • <i>Ballast rock could be used in place of concrete. It may be more difficult to clean after use and require ongoing maintenance. It would also be difficult to manage wastewater drainage.</i>
<p>Slab size needs to be suitable for the largest equipment and splash containment.</p>	<ul style="list-style-type: none"> • The slab should extend at least 2m in each direction from the largest vehicle/equipment to enable users to move around freely. • Largest vehicles accessing the facility will be heavy farm machinery and the wash-bay shall be sized to allow for at least half a wheel rotation. • 150 – 200mm high concrete bunds are required on all sides of the slab. Rollover bunds should be used on entry and exit points. • Walls should be installed to manage wastewater splash and overspray if a high- pressure washer is used. • An operational works approval could be required from the local Council if earthworks exceed prescribed thresholds. 	<ul style="list-style-type: none"> • <i>Walls could be omitted if a low-pressure washer is used.</i>



DESIGN, OPERATION AND MAINTENANCE CONSIDERATIONS

This is a manual hand-wash type facility and uses the three-step wash-down procedures identified by Biosecurity Queensland as:

1. Wash with biodegradable detergent and clean water
2. Rinse with clean water
3. Sterilise with biodegradable disinfection agent.

A final rinse can be added if there are concerns about long term repeated exposure of disinfectants on vehicles, machinery and equipment.

The slab should grade to a central drainage pit.

The wash-down bay must be cleaned of all soil, mud and plant material after each use.

Wastewater can be disposed to land in a controlled manner.

COMMENTARY

- A high-pressure low-volume water sprayer is recommended for washing and rinsing.
- Clean water is bore water, rain water collected directly into a tank, town water or chlorinated river water.
- The detergent solution needs to contain a suitable biodegradable detergent agent mixed with clean water in accordance with the product label. Farmcleanse® is a commonly used detergent.
- A disinfectant solution should be prepared with clean water in accordance with the product label. Research has shown that disinfectant products with a minimum of 12% didecylidimethyl-ammonium chloride (DDAC) as the active ingredient to be effective when mixed at 1% as per the product label.

- The drain pit should include a heavy-duty steel grate and a sediment trap to contain mud/silt/organic matter.

- This is to prevent stormwater contamination and contamination of other equipment in the wash-down bay.
- The silt trap should be emptied, washed and sterilised after each use.

- Wastewater could be released to the ground surface in a wastewater disposal area to be contained on-farm.
- The area should be level, vegetated and stable.
- Wastewater should be distributed uniformly across the disposal area.
- Vegetated earthen bund walls are required to contain the solution and divert overland flow around the disposal area.
- Bund walls must be of a sufficient height to contain the volume of the spent solution and with a 500mm freeboard.
- Fencing or signage of the disposal area to prevent uncontrolled access.
- Wastewater should not be directed into growing areas.
- ¹ Recommended separation distances from waters: 1.2m to groundwater and 30m to streams/creeks, gutters and stormwater drains.
- A buffer zone should be provided between the wash-down bay and wastewater disposal areas and adjoining crop land.

MODIFICATION OPTIONS

- Petrol or electric high pressure sprayers are available.

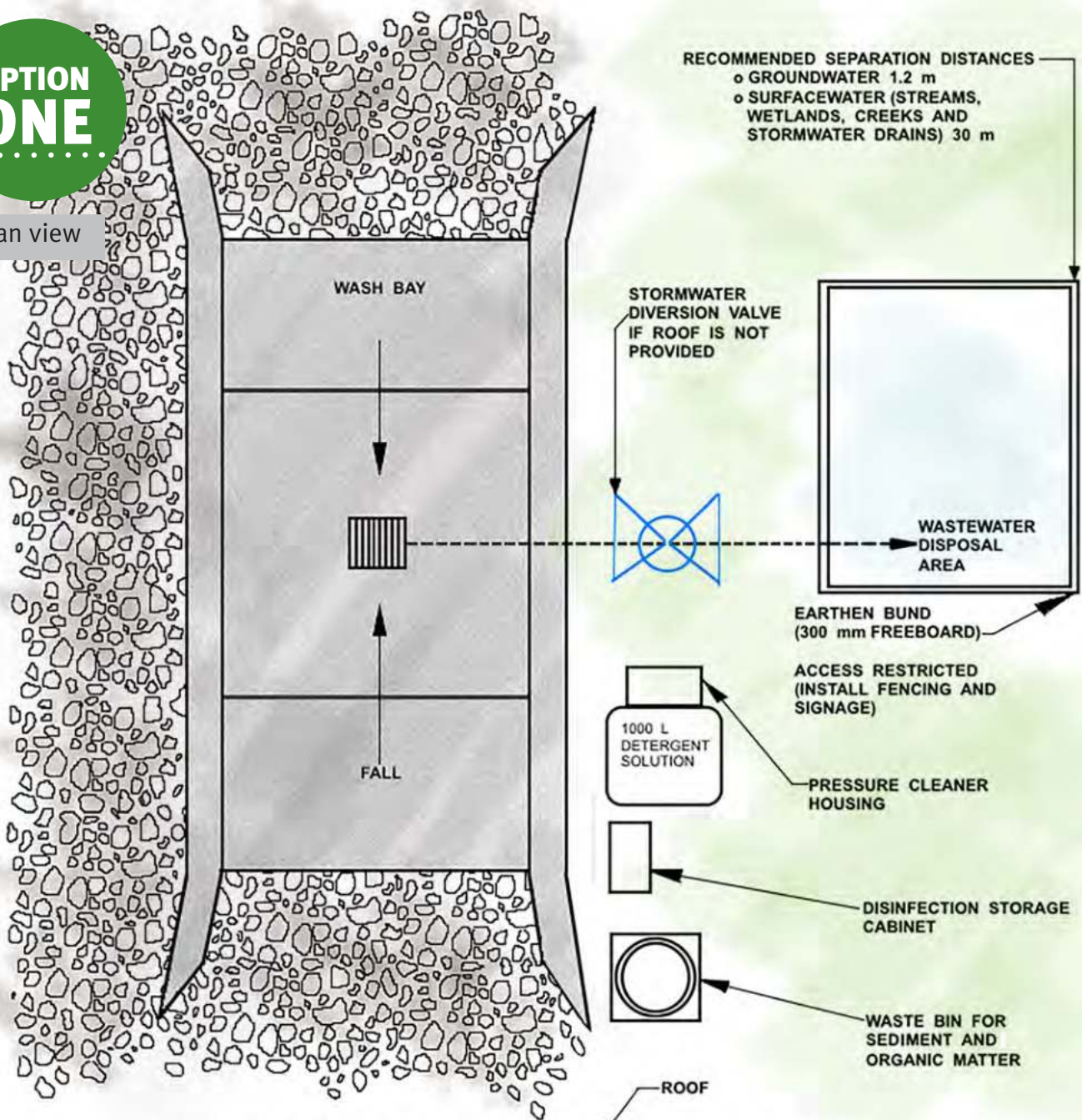
- Nil identified

- Nil identified

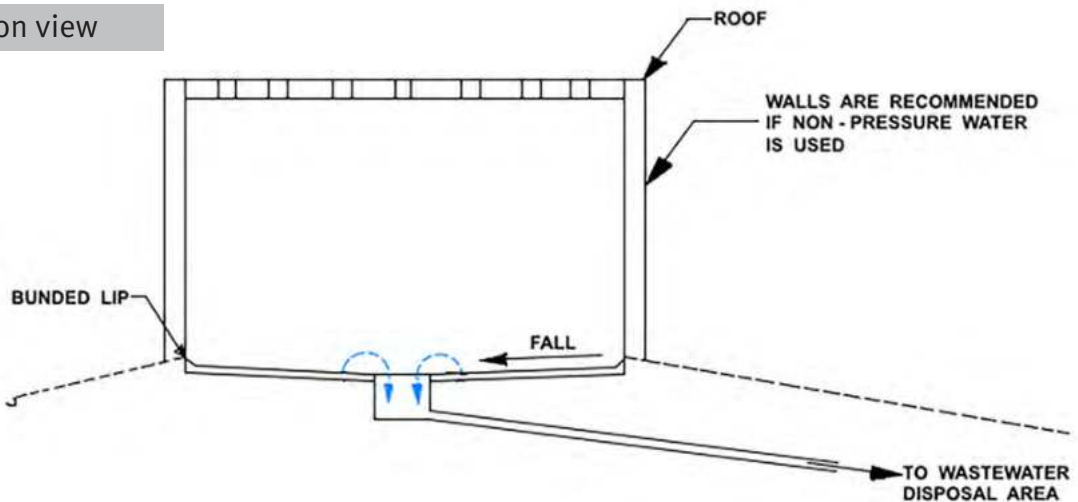
- Remove spent solution with a vac truck for offsite disposal at a licensed waste disposal facility.
- Release spent solution to a subsurface infiltration system (i.e. septic tank soakage system) as per guidance provided by AS/NZS 1547:2000 On-site domestic wastewater management.

OPTION ONE

Plan view



Elevation view



MANUAL WASH-DOWN FACILITY

Cost estimates (current at May 2016)

	Unit	Quantity	Rate	AIQS BCI 2015 BRISBANE RATE	Total
GROUNDWORKS					
Earthworks	m3	29		26.48	\$767.92
100mm rock ballast	m2	115		5.82	\$669.30
Fence changes (allowance)	item	1	1000		\$1,000.00
Subtotal					\$2,437.22
WASH BAY (assume 4 x 8 m slab)					
Concrete slab (labour and concrete) - all concrete N32	m3	10		223.46	\$2,234.60
Concrete slab reinforcement (labour and F81 reo)	m2	32		30.18	\$965.76
Concrete bunds formwork (labour and materials)	m2	5		95.31	\$476.55
Subtotal					\$3,676.91
ROOF STRUCTURE & WALLS					
Estimated dimensions 4 m x 8 x 4 m (based on estimate for larger shed provided by Transportable Shade Sheds on 10/03/2017)	item	1	18000		\$18,000.00
Subtotal					\$18,000.00
ANCILLARY ITEMS					
1000L detergent solution storage (shuttle pod)	ea	1	250		\$250.00
Detergent in solution (allow Farmcleanse®) 1,000L total sol @ 10% (quote from Lowes Petroleum)					
(excludes future refills)	L	100	7.15		\$715.00
Disinfectant solution (allow Steri-max®) (excludes future replenishment costs)	L	20	19.24		\$384.80
High pressure washer	ea	1	2000		\$2,000.00
Rain water storage tank (10,000L)	ea	1	2000		\$2,000.00
Clean water storage (1000L shuttle pod)	ea	1	250		\$250.00
Disinfectant storage cabinet (allowance)	item	1	800		\$800.00
10L hand pump dispensers	ea	3	100		\$300.00
Subtotal					\$6,699.80
TOTAL					\$30,813.93

Cost estimate (plus or minus 25%) = \$31,000.

Cost estimates are provided for the key elements or components of the wash-down facility and are current as at May 2016. Farm-specific factors must be considered when estimating costs and growers must make an individual assessment of their requirements to determine the cost of implementation.

Estimate does not include mains power supply, water supply, staff time to operate and maintain, freight and transport, wastewater disposal systems and breakdown replacements costs.

This wash-down facility is designed for vehicles that are routinely moved on and off the property. Extremely high-risk, heavily soiled vehicles, machinery and equipment such as oversized earth moving equipment, are not catered for in the dirty exit wash-down facility design as it was decided that this equipment is infrequently used, and therefore, alternate decontamination facilities should be sought.

OPTION TWO

Separation zone or clean entry/exit point for low-risk vehicles that access areas such as packing sheds and supply receiving areas.

Vehicles using the separation zone or clean entry/exit point should arrive at the zone visually free of mud/soil and/or organic material and undergo disinfection only. If a vehicle arrives at this point dirty, they should be refused entry. No wash-down capability is required as it is assumed that vehicles and machinery entering and leaving this zone use only clean asphalt/concrete or gravel sealed roads that prevent vehicles driving on dirt or mud. This zone is for low-risk vehicles that access areas such as packing sheds and supply receiving areas. Vehicles do not enter the farming activity zone.

A separation zone clean entry/exit point or access road on affected land must be:

- built using clean construction machinery
- built and maintained in a manner to ensure the surface remains free from soil, mud or plant material
- either sealed or built from heavy grade gravel
- designed to include sufficient turning and parking areas for incoming vehicles accessing residences and packing sheds and fully fenced and signposted, which includes any demarcation lines within packing sheds where clean zones and dirty zones abut
- accompanied with fencing and signage that restricts movement of persons between the clean access road and surrounding dirty zones
- equipped with suitable wash-down and decontamination facilities at the exit point where machinery, personnel and equipment exit dirty zones.

Automated wash-down systems were compared with manual and drive through dip style wash-down facilities.

The dip style wash-down facility, where vehicle tyres are disinfected by driving through a shallow pool that contains a disinfectant solution, was not considered to be a cost-effective design for disinfecting vehicles that use the separation zone or clean entry/exit point due to the significant annual cost of chemicals required to maintain an effective disinfecting solution.



An automated system was identified as better than a manual system due to issues with practicality and compliance. Manual disinfection limits the ability to apply disinfectant to the underbody of vehicles, machinery and equipment, and relies on drivers/operators to stop, exit the cab and apply the appropriate amount of disinfectant.

The recommendation for a clean entry/exit point was for an automated drive through disinfection spray system that includes:

- a wash grid, spray grid or spray shuttle system, for example a Gridrite® system or similar
- a wastewater disposal area to prevent further spread of the disease
- ballast rock with vegetated earthen bund walls
- a roof to minimise evaporation of disinfectant solution and dilution by rainfall
- a rainwater storage tank to collect rainfall runoff from the roof to provide a clean water source.



VIEW

CS:
m
WS,
m

LEGEND	
	ROCK BALLAST ON RAMP

NOTES:

1. DESIGN NOT BASED ON SURVEY DATA.

Application

- The concept design is provided for use at high contamination risk entry/exit points in the Farming Zone.
- It is suitable for use by lightly and heavily soiled vehicles and machinery.

Design, Operation and Maintenance Considerations

- Wastewater and rainwater need to be segregated.
- A roof is recommended. If a roof is omitted alternate stormwater management measures will be required. Alternate options to manage rainfall include a manually operated diversion valve (low cost but high risk of user error) and automated diversion valve (may need to modify for remote applications without mains power or water).
- Walls should be included to reduce windblown rainfall and contain overspray (if high-pressure water is used).
- If walls are not provided a horizontal roof overhang of 25% of the roof height on each side will be necessary to reduce windblown rainfall.
- If walls are not provided a low-pressure washer should be used to reduce overspray.
- Up-gradient flows need to be diverted around the wash-down bay and wastewater disposal area.
- The concrete slab shall be graded to fall to a grated pit with a sediment trap at the centre of the slab.
- Concrete bunds are required on all sides of the slab (minimum 150 mm high). Rollover bunds should be used on entry and exit points of the slab.
- Slab size needs to be suitable for the largest equipment and splash containment.
- The wash-bay shall be sufficiently sized to allow for at least half a wheel rotation.
- The slab should extend at least 2 m in each direction from the largest vehicle/equipment.
- This is a manual hand-wash type facility and uses the three-step wash-down procedures identified by DAF as:
 1. Wash with biodegradable detergent and clean water;
 2. Rinse with clean water; and
 3. Sterilise with biodegradable disinfection agent.
- A high pressure – low volume water sprayer is recommended for washing and rinsing. Walls should be installed to control overspray if a high-pressure sprayer is used.
- Clean water is bore water, rain water collected directly into a tank, town water or chlorinated river water.
- The detergent solution needs to contain a suitable biodegradable detergent agent mixed with clean water in accordance with the product label. Farmcleanse® is a commonly used detergent.
- The disinfectant solution should contain a suitable biodegradable disinfection agent. Research has shown that disinfectant products with a minimum of 12% Al DDAC to be effective when mixed at 1% as per the product label.
- The wash-down bay must be cleaned of all soil, mud and plant material after each use.
- The silt trap should be emptied, washed and sterilised after each use.
- Spent solution could be released to ground in a wastewater disposal area.
- The wastewater disposal area should be level, vegetated and stable.
- Wastewater should be distributed uniformly across the disposal area.
- Vegetated earthen bund walls are required to contain the solution and divert overland flow around the disposal area.
- Bund walls must be of a sufficient height to contain the volume of the spent solution and with a 500mm freeboard.
- Solid materials removed from the wash-down bay shall be deep buried on the property in accordance with DAF guidance for this management practice.
- A buffer should be provided between the wash-down/bay/wastewater disposal area and cropping land.
- The roof over the wash-down bay may be classified as a Class 10a structure and a Town Planning or Building Permit may be required.
- An Operational Works approval could be required from the local Council if earthworks exceed prescribed thresholds.

WASTEWATER DISPOSAL AREA

WHEN BUND (FREEBOARD)

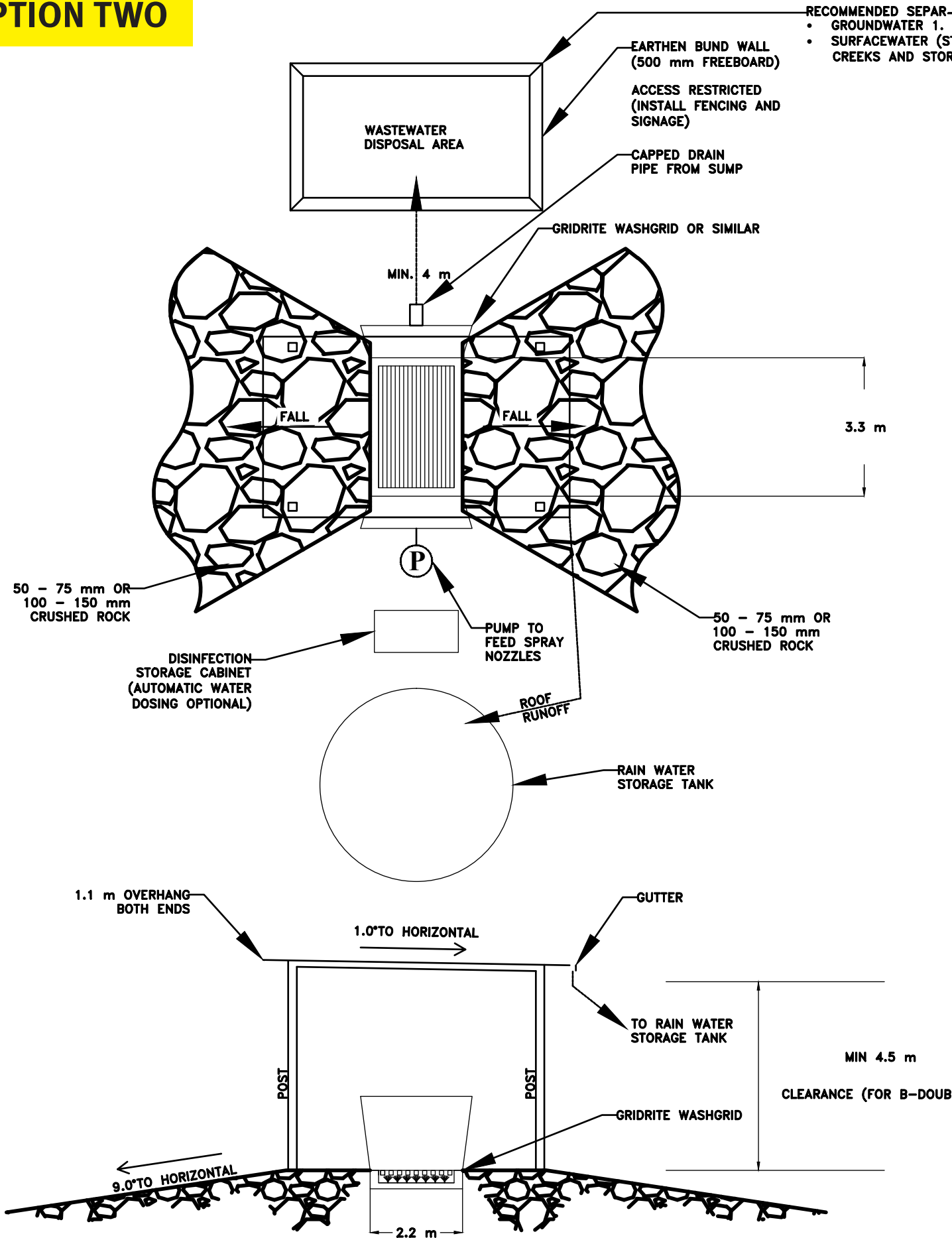
RESTRICTED ZONING AND SIGNAGE)

VIEW

SCALE: NTS (A3)
DRAWN: TCG
CHECKED: LT
DATE: 09/02/17

NOT TO SCALE

OPTION TWO



FSA Consulting

DATE

REVISION

DRAWN

PROJECT:

PANA

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TELEPHONE (07) 4632 8230
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06.06.16

(A) UPDATE NOTES

TJS

DRAWING TITLE

SEPARATION



ATION DISTANCES:
 m
 STREAMS, WETLANDS,
 (MFWATER DRAINS) 30 m

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LEGEND

 ROCK BALLAST ON RAMP

PLAN VIEW

NOTES:

1. DESIGN NOT BASED ON SURVEY DATA.

Application

- The concept design is provided for use at low contamination risk entry/exit points in the Separation Zone.
- It is only suitable for use by vehicles that are free of soil, mud and organic matter.
- Vehicles entering the farm must be visually inspected prior to accessing the wash-down bay for any obvious signs of soil/mud/plant matter. Should a "dirty" vehicle be encountered, it should not be allowed to access the wash-down facility or the property. It should be directed to either return to its place of origin for cleaning or attend a wash-down facility a Farming Zone at the property at the property owner's discretion.

Design, Operation and Maintenance Considerations

- The length required to allow one full rotation of a truck tyre is 3.3 m. However, this may be modified if the spray jets can treat a tyre without the need for full rotation.
- A minimum width of approximately 3.5 m is recommended for facilities used by trucks.
- Roof is recommended to minimise evaporation of solution and dilution by rainfall.
- A roof height of at least 4.5 m is recommended for facilities used by B-double trucks.
- Horizontal roof overhang of 25% of the roof height on each side to reduce windblown rainfall (unless walls are installed).
- The disinfectant solution should contain a suitable biodegradable disinfection agent. Research has shown that disinfectant products with a minimum of 12% AI DDAC to be effective when mixed at 1% as per the product label.
- The wash-down bay solution should be removed and replaced every 3 weeks (or sooner if required).
- Spent solution could be released to ground in a wastewater disposal area.
- The wastewater disposal area should be level, vegetated and stable.
- Wastewater should be distributed uniformly across the disposal area.
- Vegetated earthen bund walls are required to contain the solution and divert overland flow around the disposal area.
- Bund walls must be of a sufficient height to contain the volume of the spent solution and with a 500mm freeboard.
- Solid materials removed from the wash-down bay shall be deep buried on the property in accordance with DAF guidance for this management practice.
- A buffer should be provided between the wash-down/bay/wastewater disposal area and cropping land.
- The roof over the wash-down bay may be classified as a Class 10a structure and a Town Planning or Building Permit may be required.
- An Operational Works approval could be required from the local Council if earthworks exceed prescribed thresholds.

SECTION VIEW

IA DISEASE TROPICAL RACE 4 WASH-DOWN BAY PROJECT

LE:
 ATION ZONE WASH-DOWN BAY CONCEPT DESIGN

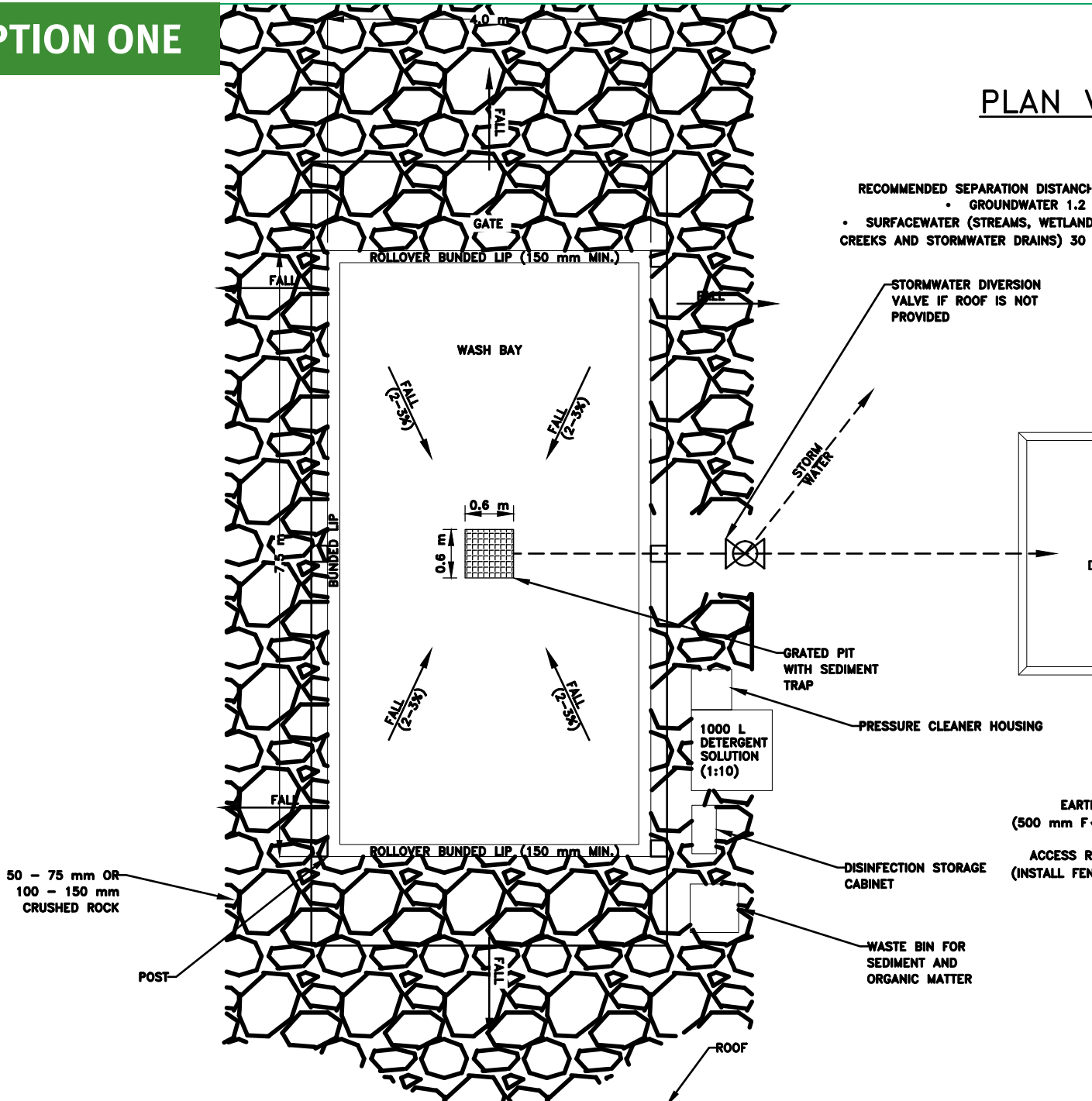
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DATE:	09/02/17

NOT TO SCALE	
DRAWING NUMBER: 8463 MASTERPLAN: CLEAN	Fig. 1

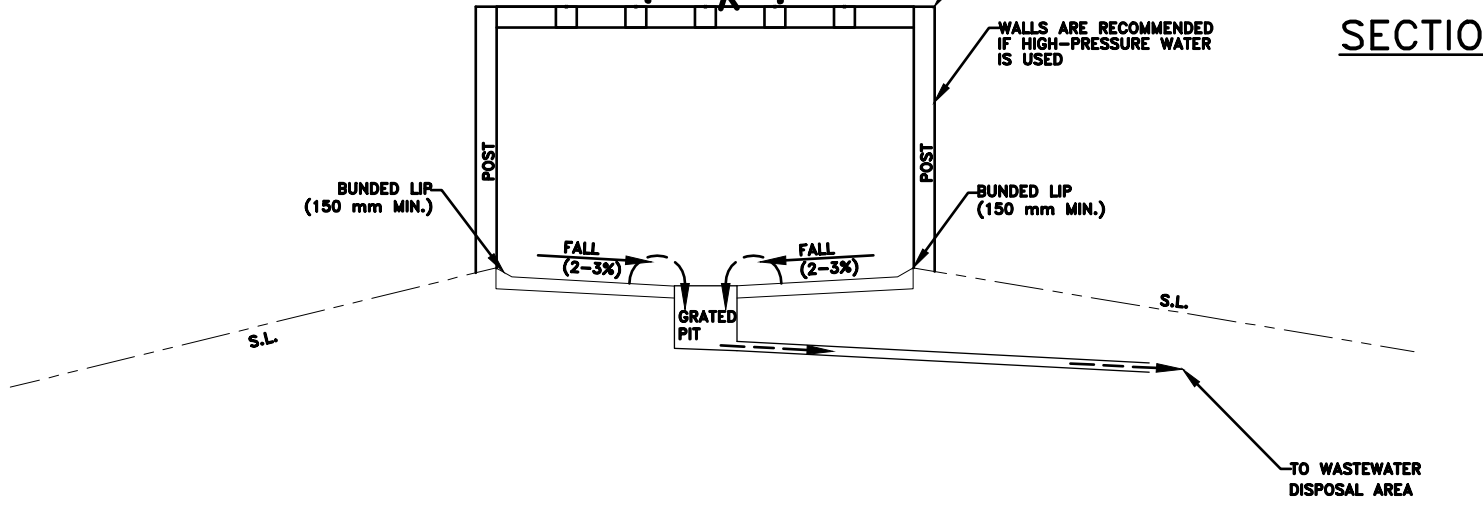
OPTION ONE

PLAN VIEW

- RECOMMENDED SEPARATION DISTANCE:
 - GROUNDWATER 1.2
 - SURFACEWATER (STREAMS, WETLANDS, CREEKS AND STORMWATER DRAINS) 30



SECTION



FSA Consulting



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DATE	REVISION	DRAWN	PROJECT: PAN-
06.06.16	(A) UPDATE NOTES	TJS	DRAWING FARM

“ AN AUTOMATED SYSTEM WAS IDENTIFIED AS BETTER THAN A MANUAL SYSTEM DUE TO ISSUES WITH PRACTICALITY AND COMPLIANCE. MANUAL DISINFECTION LIMITS THE ABILITY TO APPLY DISINFECTANT TO THE UNDERBODY OF VEHICLES, MACHINERY AND EQUIPMENT. ”





OPTION TWO

Design, operation and maintenance considerations and modification options for the separation zone or clean entry/exit point wash-down facility concept design

DESIGN, OPERATION AND MAINTENANCE CONSIDERATIONS	COMMENTARY	MODIFICATION OPTIONS
<p>A minimum width of approximately 3.5m is recommended for facilities used by B-double trucks.</p> <p>The length of the wash-down bay or spray jet arrangement needs to be able to accommodate the wheel circumference of the largest vehicle.</p>	<ul style="list-style-type: none"> • The length required to allow one full rotation of a truck tyre is 3.3m. However, this may be modified if the spray jets can treat a tyre without the need for full rotation. • A B-double is about 2.5m wide. A width of approximately 3.5m (same as highway lane) will provide about 0.5m either side of a B-double. • An operational works approval could be required from the local Council if earthworks exceed prescribed thresholds. 	<ul style="list-style-type: none"> • <i>Longer/shorter or wider/narrower wash-down bays could be considered based on vehicle types that use a particular entry/exit point.</i> • <i>The length needs to be sufficient to allow disinfection of the largest expected tyre.</i> • <i>The width needs to be sufficient to allow safe use by the largest expected vehicle.</i>
<p>A disinfectant solution should contain a suitable biodegradable disinfection agent.</p> <p>A disinfectant solution should be prepared with clean water in accordance with the product label.</p> <p>The wash-down facility solution should be removed and replaced as per the product label.</p>	<ul style="list-style-type: none"> • Research has shown that disinfectant products with a minimum of 12% DDAC to be effective when mixed at 1% as per the product label. • Disinfectant solutions have been shown to be active, stable and effective when used in accordance with the instructions on the product label. • Clean water is bore water, rain water collected directly into a tank, town water or chlorinated river water. 	<ul style="list-style-type: none"> • <i>An automatic dosing/injection system (Dosatron® or similar) for the incoming clean water supply could be considered to reduce the risk of human error of over or under dosing the water.</i> • <i>A tank could be connected to the roof to provide a water source.</i>
<p>The disinfectant solution volume and concentration needs to be monitored and maintained.</p> <p>The wash-down facility solution should be drained and replaced as per the product label.</p>	<ul style="list-style-type: none"> • This is to ensure the disinfectant is maintained at an effective concentration. • The volume of top ups between change-outs need to be measured and correctly dosed with disinfectant. 	<ul style="list-style-type: none"> • <i>Automated dip solution level monitoring and dosing could be considered.</i>
<p>A roof is recommended to minimise evaporation of solution and dilution by rainfall.</p> <p>A roof height of at least 4.5m is recommended for facilities used by B-double trucks.</p>	<ul style="list-style-type: none"> • Horizontal roof overhang of 25% of the roof height on each side to reduce windblown rainfall. • The roof over the wash-down bay may be classified as a Class 10a structure and a town planning or building permit may be required. 	<ul style="list-style-type: none"> • <i>Alternate roof materials (e.g. plastic sheeting) could be selected to reduce cost if deemed acceptable by engineer/building certifier.</i> • <i>Roof height can be adjusted to suit the largest expected vehicle.</i> • <i>Walls could be included to exclude rainfall.</i>

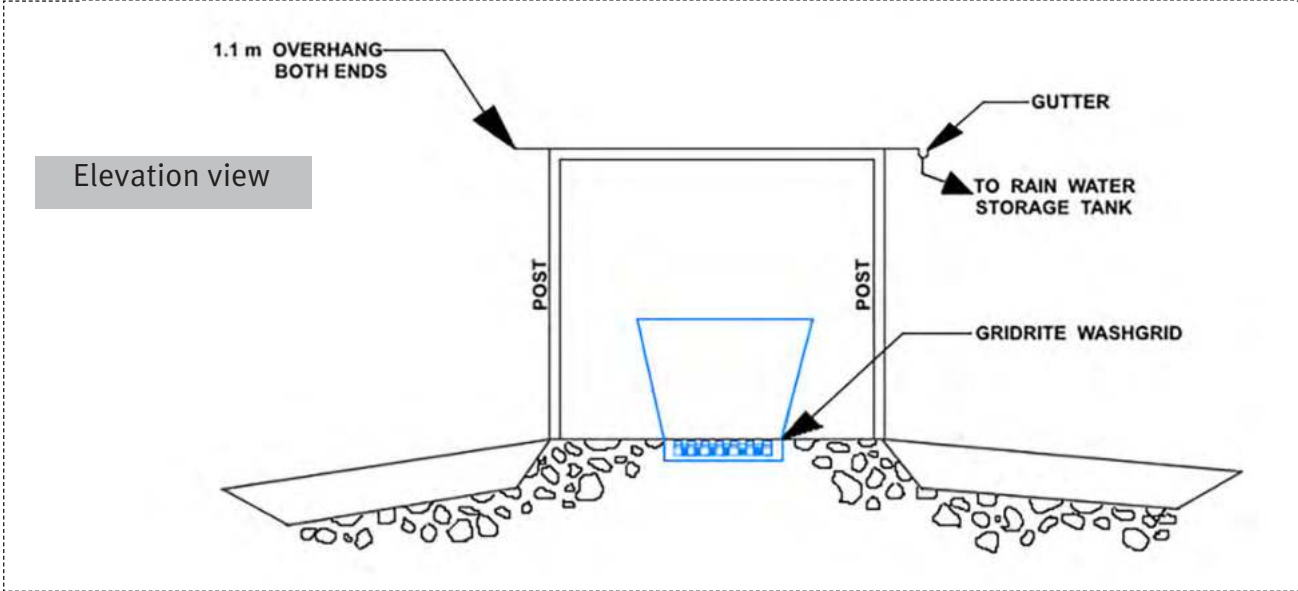
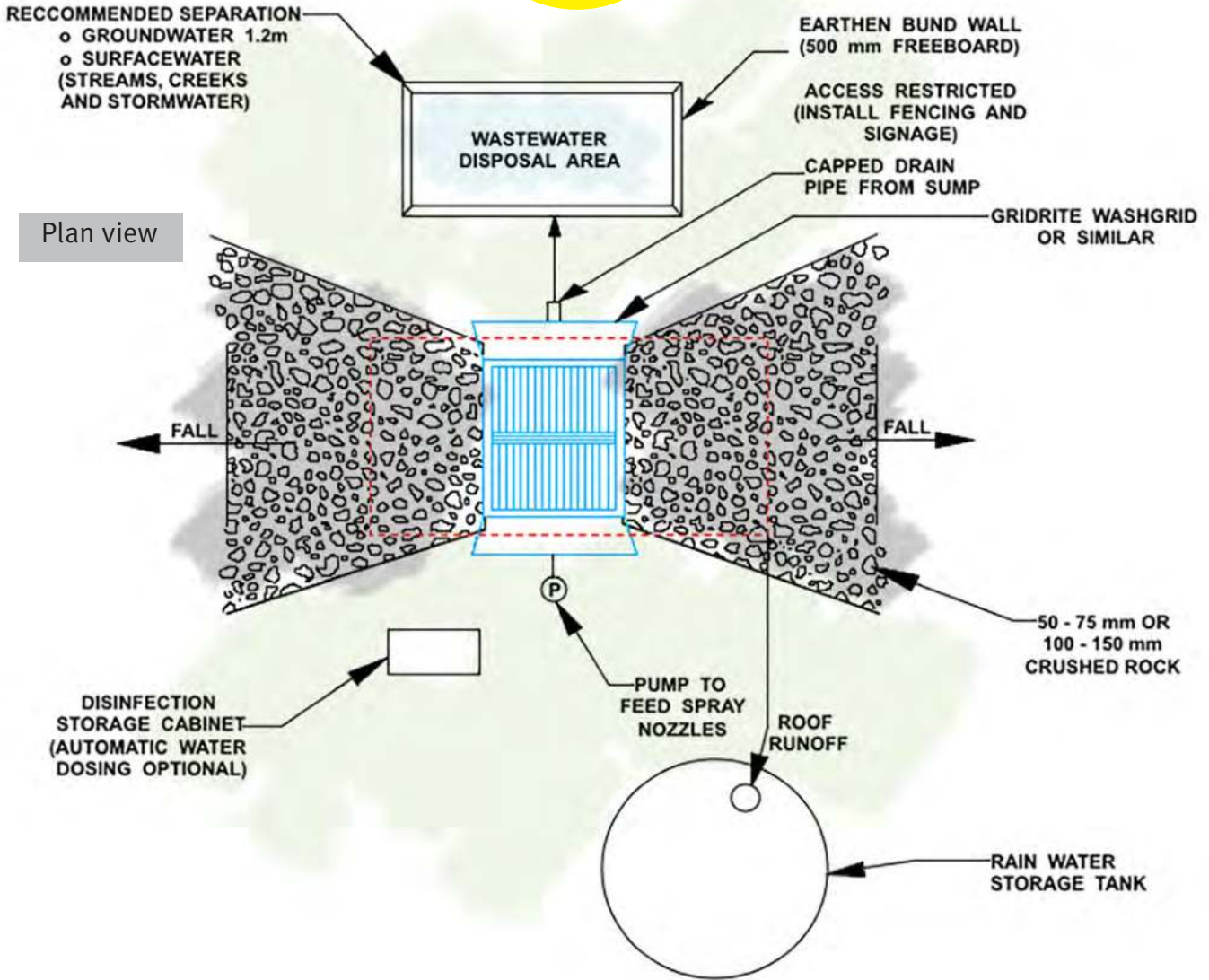


DESIGN, OPERATION AND MAINTENANCE CONSIDERATIONS	COMMENTARY	MODIFICATION OPTIONS
<p>Entry/exit ramps to the wash-down bay.</p>	<ul style="list-style-type: none"> • Stable entry and exit to the wash-down bay is required. • The ramps should direct overland stormwater flow away from the wash-down bay. 	<ul style="list-style-type: none"> • <i>Ramps could be ballast rock or concrete.</i> • <i>Ballast rock may be cheaper to use than concrete initially but may require more ongoing maintenance.</i>
<p>Disposal of spent wash-down bay solution.</p>	<ul style="list-style-type: none"> • Spent solution could be released to the ground surface in a wastewater disposal area. • Wastewater should be distributed uniformly across the disposal area. • The area should be level, vegetated and stable. • Vegetated earthen bund walls are required to contain the solution and divert overland flow around the disposal area. • Bund walls must be of a sufficient height to contain the volume of the spent solution and with a 500mm freeboard. • Fencing or signage of the disposal area to prevent uncontrolled access. • Wastewater should not be directed into growing areas. • ¹ Recommended separation distances from waters: 1.2m to groundwater and 30m to streams/creeks and stormwater drains. • A buffer zone should be provided between the wash-down bay and wastewater disposal areas and adjoining crop land. 	<ul style="list-style-type: none"> • <i>Remove spent solution with a vac truck for offsite disposal at a licensed waste disposal facility.</i> • <i>Release spent solution to a subsurface infiltration system (i.e. septic tank soakage system) as per guidance provided by AS/NZS 1547:2000 On-site domestic wastewater management.</i>
<p>Silt/sediment/sludge and organic matter shall be removed every 3 weeks from the wash-down or as required.</p>	<ul style="list-style-type: none"> • Solid materials removed from the wash-down bay must be deep buried on the same property, away from cropping areas. 	<ul style="list-style-type: none"> • <i>Nil identified</i>

¹Separation distance to groundwater was adapted from AS/NZS 1547:2000 On-site domestic wastewatermanagement and Chapter 7 – Infiltration Measures of Water Sensitive Urban Design Guidelines for South East Queensland (Healthy Waterways, 2006). Separation distance to surface waters was adopted from the Queensland Wetland Buffer Guideline (DERM, 2011) for controlling water pollution. This separation distance was commonly cited in literature regarding wash-down facility design.



OPTION TWO



AUTOMATED DISINFECTION SPRAY FACILITY

Cost estimates (current at May 2016)

	Unit	Quantity	Rate	AIQS BCI 2015 BRISBANE RATE	Total
GROUNDWORKS					
Earthworks	m3	50		26.48	\$1,324.00
100mm rock ballast	m2	100		5.82	\$582.00
Fence changes (allowance)	item	1	1000		\$1,000.00
Subtotal					\$2,906.00
SPRAY BOOTH					
Gridrite® Wash Bay (single phase) estimate provided by Gridrite® on 06/05/2016)	item	1	15000		\$15,000.00
Subtotal					\$15,000.00
ROOF STRUCTURE & WALLS					
Estimated dimensions 6m x 6 x 5m (based on estimate for larger shed provided by Transportable Shade Sheds on 10/03/2017)	item	1	10000		\$10,000.00
Subtotal					\$10,000.00
ANCILLARY ITEMS					
Concrete slabs (labour and concrete) - all concrete N32	m3	8		223.46	\$1,787.68
Concrete slabs reinforcement (labour and F81 reo)	m2	50		30.18	\$1,509.00
Disinfectant storage cabinet (allowance)	item	1	800		\$800.00
Rain water storage tank and pump (10,000L)	ea	1	2500		\$2,500.00
Generator	item	1	1500		\$1,500.00
Rainwater recycle pipework (80mm pvc)	m	15		29.76	\$446.40
Disinfectant in solution (allow Steri-max®) 2,000L total sol @ 1% (Estimate from CRT Gordonvale \$192.35 for 10L) (17 changes per annum)	L	350	19.24		\$6,734.00
Subtotal					\$15,227.08
TOTAL					\$43,183.08

Construction cost estimate (plus or minus 25%) = \$43,000.

Cost estimates are provided for the key elements or components of the wash-down facility and are current as at May 2016. Farm-specific factors must be considered when estimating costs and growers must make an individual assessment of their requirements to determine the cost of implementation.

Estimates do not include mains power supply, water supply, staff time to operate and maintain, freight and transport, wastewater disposal systems and breakdown replacements costs.

This wash-down facility could be expanded to include a full wash-down and disinfectant process to eliminate any uncertainty about the cleanliness of the vehicle. The expanded system would need a wash, rinse and disinfect function, which would incur a substantially greater cost, build and operation and maintenance requirements.

The automated drive through disinfection spray system was found to be a suitable option for disinfecting vehicles that utilise the separation zone

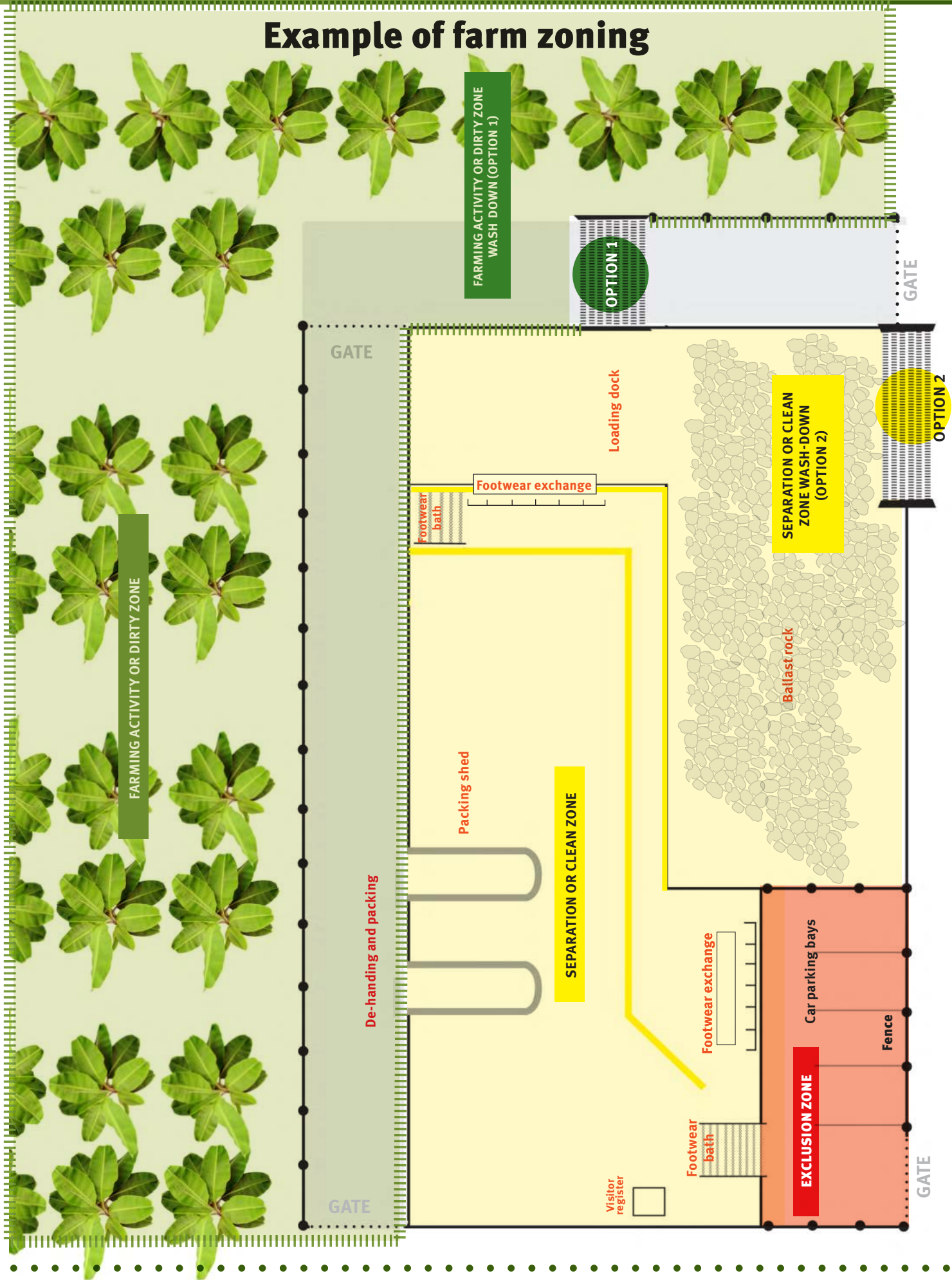
clean entry/exit point over a dip style wash-down facility as it had:

- lower water demand and wastewater output
- lower capital and operating cost (based on lower disinfectant consumption)
- smaller footprint and wastewater system required
- easy application of disinfectant solution to the underbody of high clearance vehicles.

Farmers in areas of lower rainfall may prefer to use a drive-through dip facility. For a dip style facility to be effective:

- all vehicles must be free of soil and plant material
- all vehicles are disinfected upon entry and exit
- the dip is used by vehicles up to the size of a B-double
- the wash-down facility is covered to limit rainfall ingress and evaporation.

Example of farm zoning





Additional points

- Both design specifications include a variety of options to allow growers to tailor the facility to their specific needs and budget.
- Products recommended for cleaning and disinfection are based on current research and on-farm practices already in place. It is advised that quaternary ammonium (QA) disinfectant products containing at least 12% didecyl-dimethyl-ammonium chloride (DDAC) active ingredient mixed at a minimum ratio of 1:100 with clean water should be used to disinfect vehicles, machinery and equipment, as per label directions for use.
- A detergent-based cleaner used as per label instructions will assist in the removal of dirt, followed by a rinse with clean water and then application of a quaternary ammonium disinfectant. If you're concerned about long term repeated exposure of QA compounds on vehicles, machinery and equipment, consider an additional, final rinse step.
- Dip style wash-down solution (QA) should be removed and replaced every three weeks or sooner if required, or as advised on the label instructions.
- For current research information about disinfectants, read the Panama disease tropical race 4 Research Update June 2016 'Disinfectant trials' at www.biosecurity.qld.gov.au.
- Wastewater and stormwater management in wash-down facility areas is critical to managing spread of the disease. Wastewater must be controlled and contained on-farm and away from waterways and growing areas.
- Banana growers are obligated under the *Environmental Protection Act 1994* to take all reasonable and practicable measures to prevent the release of wastewater, detergents and disinfectants and sediment from wash-down facilities to surface water, wetlands, groundwater and stormwater.
- Growers may need to contact their local Council to determine if town planning or building permits are required for construction of wash-down facilities. All wash-down facilities and associated structures must be constructed within property boundaries.
- The recommendations and concept designs must be referred to in conjunction with
 - the *Biosecurity Act 2014* and the *Biosecurity Regulation 2016*
 - the *Environmental Protection Act 1994*.



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