



Cattle Hill Wind Farm

Weed Management Plan (WMP)

*Developed to satisfy the requirements of Condition 22 of the Commonwealth EPBC
Approval 2009/4839 for the Cattle Hill Wind Farm*

Date	Revision	Prepared	Reviewed	Approved
12/08/2017	Draft 1	R Barnes and C McCoull	R Barnes	R Barnes
16/08/2017	Draft 1	R Barnes and C McCoull	S Marsh	S Marsh
12/10/2017	Draft 2	R Barnes and C McCoull	R Barnes	R Barnes
12/10/2017	Draft 2	R Barnes and C McCoull	S Marsh	S Marsh
02/12/2017	Draft 3	R Barnes and C McCoull	R Barnes	R Barnes
02/12/2017	Draft 3	R Barnes and C McCoull	S Marsh	S Marsh
04/12/2017	Final	R Barnes and C McCoull	R Barnes	R Barnes
04/12/2017	Final	R Barnes and C McCoull	S Marsh	S Marsh

Table of Contents

Definitions and Acronyms	5
1. Objectives of the Weed Management Plan	8
2. Introduction	9
2.1 The Project	9
2.2 The Proponent (Approval Holder).....	9
2.3 Relevant Permit Conditions and Pre-Existing Requirements.....	9
2.3.1 Commonwealth EPBC approval 2009/4839.....	9
2.3.2 Conservation Covenant and Operations Plan	10
2.4 Data Sources	13
2.4.1 Significant Flora Species.....	13
2.4.2 Conservation Covenant.....	14
2.4.3 Weed Records	14
2.5 Existing Environment	14
2.5.1 Topography	14
2.5.2 Geology and Soils	14
2.5.3 Climate	15
3. What is a weed?.....	18
3.1 Weed Prioritisation for Nature Conservation Values	18
3.2 Relevant Weeds and Classification	18
3.2.1 Weed of National Significance	18
3.2.2 Declared weeds.....	18
3.2.3 Sleeper weeds	19
3.2.4 Weed Groups	19
3.3 Weed Location Data.....	19
3.3.1 Existing Data.....	19
3.3.2 New Data records	20
4 Administrative Controls	29
4.1 Roles and Responsibilities.....	29
4.1.1 Proponent	29
4.1.2 Site Manager	29
4.1.3 Staff and General Contractors	29
4.1.4 Weed Spraying Contractors	29
4.1.5 Expert Consultants	30

4.2	Inductions and Training	30
4.2.1	General Training.....	30
4.2.2	Specialist Training	30
4.3	Machine Log Book.....	31
4.4	Construction Environment Management Plan	31
5	Preventative Management Actions	32
5.1	Education and Training	32
5.2	Pre-Construction Flagging	32
5.3	Construction Materials	32
5.4	Machinery and Equipment Floated to Site	33
5.5	Vehicles Travelling to Site on Public Roads.....	33
5.6	Machinery Washdown within Site	34
5.6.1	Designated Washdown Facility	34
5.6.2	In-field Washdown	34
5.7	Vegetation Sheet and Soil/Vegetation Mix Reuse	35
5.7.1	Native Species Dominated Vegetation Sheets.....	35
5.7.2	Exotic Species Dominated Vegetation Sheets	36
6	Responsive Management Actions.....	37
6.1	Physical Removal and/or Burying Material.....	37
6.1.2	Physical Removal of Seed and Mature Flowerheads	37
6.1.2	Burying Material	37
6.2	Weed Spraying Program	38
6.3	New Weed Incursion.....	39
7	Performance Monitoring	40
7.1	Weed Surveys.....	40
7.2	Staff and Contractor Weed Records	40
8	Review of Plan and Procedures	41
8.1	Plan Review	41
8.2	Detection of listed species	41
9	Reporting	42
9.1	Training and Induction of staff and contractors	42
9.2	Machine Log Books	42
9.3	Inspection Sheets	42
9.4	Weed Incursions	42
9.5	Weed Management Plan Implementation Reporting	42
	Attachment 1. Significant Flora Species Information	43

Attachment 2a. Weed Recording Procedure	50
Attachment 2b. Weed Record Form	51
Attachment 3. Weed Spraying Program Work Plan – example spreadsheet	52
Attachment 4. Guideline for Safe and Effective Herbicide Use near Water	53
Attachment 5. Weed Information References.....	54
Attachment 6. Hygiene Protocols Movement of soil and gravel	57
Attachment 7. Hygiene Protocols Heavy Machinery and Vehicles.....	58
Attachment 8. Washdown Record Sheets	59

Tables

Table 1. Bronte Heights Monthly Averaged Climate Statistics (1910-2009).....	15
Table 2. Weed species and groups that are of relevance to weed management at the Cattle Hill Wind Farm site.....	21
Table 3. Weed species and groups of primary focus to the Plan.....	25

Figures

Figure 1. Location of Cattle Hill Wind Farm	16
Figure 2. Detailed Location of Cattle Hill Wind Farm.....	17
Figure 3. Significant areas for weed management at the Cattle Hill Wind Farm	27
Figure 4. Location of known weeds within and near to the Cattle Hill Wind Farm	28

Definitions and Acronyms

In this Weed Management Plan, the following definitions and acronyms apply:

annual (weeds)	weed species that germinate from seed each year and live for one growing season. Summer annuals germinate in the spring and die back in the autumn. Winter annuals germinate in late summer or early autumn and die the following spring or summer.
biennial (weeds)	weeds have a 2-year life cycle. They germinate, emerge, and usually form a rosette (radial cluster of leaves close to the ground, e.g. wild carrot) in the first year. The second year, the plant bolts (produces a flower stalk), flowers, sets seed, matures, then dies.
Clover Glycine	means the vulnerable listed species Clover Glycine (<i>Glycine latrobeana</i>).
construction area	means the land within The Land which will be temporarily or permanently disturbed, damaged and/or negatively affected, either directly or indirectly, by the construction and/or installation of wind farm infrastructure including hardstands, roads and tracks, laydown areas, compounds, site office, turning circles and cabling trenches.
CPR8065	means the reserve [conservation covenant] established under the Tasmanian <i>Nature Conservation Act 2002</i> which is identified by the Central Plan Register document 8065.
Crowded Leek Orchid	means the endangered listed species Crowded Leek Orchid (<i>Prasophyllum crebriflorum</i>).
Department	means the Department responsible for the implementation of the <i>Environment Protection and Biodiversity Conservation Act 1999</i> , currently called the Australian Government Department of Environment and Energy
DPEMP	Development Proposal and Environmental Management Plan
DPIPWE	Department of Primary Industries, Parks, Water and Environment (Tas)
EPBC Act	means <i>Environment Protection and Biodiversity Conservation Act 1999</i> and any statutory modification, substitution or re-enactment of that legislation or legislative provision
EPA	Environment Protection Authority (Tas)
Equipment	The set of tools needed to achieve a goal is "equipment". Equipment includes for example cranes, generators, ablutions block, site office, compressors etc.
Liawenee Greenhood	means the vulnerable listed species Liawenee Greenhood (<i>Pterostylis pratensis</i>).

Log Book	the book located within each machine/equipment that is to be used to record, as a minimum, (i) the date of entry for the machine/equipment to the wind farm site, from where it has been floated and whom authorised the entry to the wind farm site and (ii) where and when machinery/equipment was washed down once within the wind farm site, and of where the machine was taken for use after it had been washed down.
Machinery	a collection or group of machines.
Machines	an apparatus using mechanical power and having several parts, each with a definite function and together performing a task. Machines include bulldozers, diggers, trenchers, heavy-trucks (with or without trailers), excavators and other earth-moving motorised apparatus.
MCP	minimum convex polygon (the area formed by the joining of the outer most points of interest)
NVA	means the Natural Values Atlas, managed by DPIPWE
Operations Plan	the management document approved by the State Minister for CPR8065.
Owner	applied in the context of conservation covenant CPR8065.
perennial (weeds)	live 3 years or more. Some reproduce by seed, and some reproduce by creeping stems that can be either above-ground (stolons) or below-ground (rhizomes).
The Land	Situated immediately to the east of Lake Echo and off Bashan Rd, approximately 3km southwest of Waddamana in central Tasmania with folio identifiers 135246/1, 29897/1, 29897/3, 29897/5, 248810/1, 135247/1, 135247/2, 29888/4, 29897/6
Proponent	the proponent of the Wild Cattle Hill Pty Ltd (ACN 610 777 369)
reserve	means the reserve [conservation covenant] established under the Tasmanian <i>Nature Conservation Act 2002</i> which is identified by the Central Plan Register document 8065.
Significant flora species	Liawenee greenhood (<i>Pterostylis pratensis</i>), Crowded leek orchid (<i>Prasophyllum crebriflorum</i>) and Clover glycine (<i>Glycine latrobeana</i>)
Sod	A section of grass-covered surface soil held together by matted roots
suitably qualified ecologist	means an ecologist or biologist that (i) has appropriate educational qualifications and/or (ii) has gained experience working as an ecologist or biologist for a minimum of 5 years in an area related to Tasmanian highland native vegetation and species and weed identification and management.
significant weed(s)	A weed or weed group identified as having a High or Moderate rating for 'Threat Level to habitat of significant flora species' in Table 2.

VDC	Van Diemen Consulting Pty Ltd
Vehicle	a motorised thing used for transporting people or goods. This includes 4WD vehicles, light trucks and passenger vans and cars.
Weed	any plant that requires some form of action to reduce its effect on the economy, the environment, human health and amenity. This is further refined to be a plant species that does or has the capacity to invade the habitat of <i>significant flora species</i> such that these species are displaced.
Weed Record Form	The form entitled <i>Weed Record Form</i> (see Attachment 2b).
Weed Record Procedure	The procedure entitled <i>Weed Record Procedure</i> (see Attachment 2a).
wind farm site	means the site of the Cattle Hill Wind Farm as delineated and within the yellow boundary shown in Figure 1.
WMS	Weed Management Plan
WoNS	Weed of National Significance

1. Objectives of the Weed Management Plan

The objectives of this Weed Management Plan (WMP, the 'Plan') are to:

- Provide a mechanism to record, map and monitor the occurrence of weeds, as defined in this Plan, in the *construction area* for the Cattle Hill Wind Farm;
- Flag areas of existing significant weeds in the *construction area* for the Cattle Hill Wind Farm prior to construction works and implement appropriate management regimes at these locations;
- Provide training through site inductions and educational resources to staff and contractors in weed identification, management and recording;
- Identify, document and implement both preventative and responsive management measures within the construction area of the Cattle Hill Wind Farm site to –
 - minimise the risk of spreading propagules within the construction area;
 - minimise the risk of importation of weed propagules of species to the construction area that are not already present;
 - control and/or eradicate weeds in the construction area that is in and near habitat for the Liawenee Greenhood, Crowded Leek Orchid *and* Clover Glycine; and
 - ensure that construction area rehabilitation works in and near habitat for the Liawenee Greenhood, Crowded Leek Orchid *and* Clover Glycine are not compromised by the occurrence and/or growth of weeds.
- Prioritise weed management monitoring and on-ground actions where the construction area includes and is near habitat for the Liawenee Greenhood, Crowded Leek Orchid *and* Clover Glycine;
- Establish and implement a process to monitor the results of on-ground control/actions to manage weeds and a mechanism to review these actions; and
- Establish and implement a process of review for the Plan, including its objectives and implementation.

The Plan is consistent with the measures described within the -

- Threatened Tasmanian Orchids Flora Recovery Plan where relevant to Liawenee Greenhood, Crowded Leek Orchid; and the
- National Recovery Plan for Clover Glycine, *Glycine latrobeana*.

2. Introduction

2.1 The Project

The Cattle Hill Wind Farm occupies privately-owned land situated east of Lake Echo in Tasmania's Central Highlands, approximately 93 kilometres to the north-west of Hobart (Figures 1 and 2). The wind farm site is bounded by Lake Echo to the west and grazing and forestry land to the north, east and south. The nearest settlement of Waddamana is located to the north east. The site is currently used for grazing, small forestry operations and hunting.

The project was approved by Tasmanian State Regulators in April 2012 and by the (now) Commonwealth Department of Environment and Energy in December 2014.

2.2 The Proponent (Approval Holder)

The proponent is Wild Cattle Hill Pty Ltd (ACN 610 777 369).

2.3 Relevant Permit Conditions and Pre-Existing Requirements

2.3.1 Commonwealth EPBC approval 2009/4839

A Weed Management Plan (WMP) is required pursuant to Condition 22 of the Commonwealth EPBC approval 2009/4839 for the Cattle Hill Wind Farm.

This Condition states:

*Three months prior to the **commencement of construction**, submit a weed management Plan to the **Minister** for approval. The Plan must include but not be limited to:*

- a. details on how construction activities will be managed to minimise and prevent the establishment of new or spread of existing weed species, specifically where construction is to occur within or near habitat for the Liawenee Greenhood, Crowded Leek Orchid and Clover Glycine;*
- b. weed management activities to be undertaken with reference to weed species that are known from and likely to occur at the wind farm site;*
- c. vehicle and machine wash down protocols for all vehicles entering the site;*
- d. weed identification programs and staff inductions; and*
- e. measures to monitor, control and eradicate weed outbreaks that may occur on site.*

The approved weed management Plan must be implemented.

Reporting is required pursuant to Condition 27 of the Commonwealth EPBC approval 2009/4839 for the Cattle Hill Wind Farm.

This Condition states:

Within 90 days of each anniversary of the commencement of the action, the person taking the action must publish a report on its website addressing compliance with each of the conditions of this approval, including implementation of any management plans

as specified in the conditions. Documentary evidence providing proof of the date of publication and non-compliance with any of the conditions of this approval must be provided to the Department at the same time as the compliance report is published.

2.3.2 Conservation Covenant and Operations Plan

The Cattle Hill Wind Farm site includes a 'reserve' (conservation covenant - CPR8065) established under the Tasmanian *Nature Conservation Act 2002*.

The Covenant details in Clause 4.1 and 4.2 those activities that are absolutely prohibited in the reserve and in Clause 4.3 those activities which may be undertaken with the written approval of the State Minister.

The Operations Plan functions as written authorisation from the Minister, for the purposes of Clause 4.3 of the Covenant, and describes the extent to which certain activities will be permitted within the reserve. The management of the reserve is stipulated by an Operations Plan which provides objectives and limitations of the management and activities that can and cannot occur within the reserve.

All decisions, approvals, consents, recommendations, monitoring and other responsibilities of the State Minister specified in this Operations Plan may be made, given or carried out by the State Minister or a duly appointed delegate (or authorised person) of the State Minister.

While the reserve was established under Tasmanian legislation, clause 17 of the instrument which creates the conservation covenant provides the Commonwealth the ability to authorise or otherwise any amendments to the instrument.

A management objective for the reserve is –

‘To eradicate or control weeds and feral animals and prevent any further introduction(s) of exotic species;’

The Operations Plan has **pre-existing requirements** of the Owner (who is also the Proponent of the wind farm) and State Minister in relation to the management, control and eradication of weeds in the reserve. These requirements are not diminished, eroded or replaced by this WMS.

The weed-related management requirements of the reserve described in the Operations Plan are provided below. They are relevant insofar that there are constraints on how weeds are to be managed in the reserve (eg Herbicides, other chemicals and fertilisers - No chemicals or herbicides are to be applied (directly or aerially) within the Land unless it is part of a weed or pest eradication program approved by the Minister [State]) –

‘General Grazing Conditions for all Conservation Covenant Areas (ie the reserve):

- The enhancement of productivity or other grazing values (e.g. the application of fertilisers) is not permitted.
- Exotic plant species (e.g. pasture species) must not be sown or otherwise deliberately introduced.
- Wherever possible, the Owner must ensure that the movement of stock into the Land is managed in such a way that the introduction of weeds and diseases is minimised.
- The movement of stock into the Land from an area with a high incidence of noxious weed species (e.g. serrated tussock) or an area infected with root rot fungus (*Phytophthora cinnamomi*) must be avoided.

- The use of fodder (e.g. hay and grains) must be restricted within the Land to prevent the introduction of weed seeds. Fodder can be used in designated areas that must be agreed to by the Owner and the Minister [Tasmanian]. However, these areas will not be within forest or woodland areas of the Land, and will be located in areas where the grassland is in poorer natural condition.

Weed Control

- Conservation Covenant Area 11, is subject to the greatest weed threat, due to weed invasion from water-borne weed seed from adjacent land, accessibility of this area to the public and maintenance of powerlines within this section of the Land. There are currently willow (*Salix* sp.), tree lucerne (*Chaemaecytisus palmensis*) and horehound (*Marrubium vulgare*) infestations in this part of the Land.
- The willow infestation represents the most serious threat to the Land, as this species has the potential to invade large sections of the riverflat adjacent to the Ouse River. The current infestation can be divided into three zones representing threat to the reserve and hence priority for control (see East Reserve Management Map, page xxxiv).
- The priority one and two zones occur away from the riverbank, these areas are less susceptible to reinfestation and at the same time represent the greatest threat of further encroachment into the Land. The priority three zone is the riverbank proper. Willow control here, whilst being very helpful to populations of the endangered riverbank plant *Barbarea australis*, are the most susceptible to reinfestation. Long term eradication from zone three will only be possible as part of concerted efforts involving neighbouring land managers.
- The willow infestation in the priority one and two zones can be managed with the aim of killing established trees and minimising the further spread of willows into non-weedy areas (see Appendix 4).
- The tree lucerne infestation consists of two main plants within the priority 2 willow control zone.
- The Minister agrees to undertake the initial control works in these two zones for both willow and tree lucerne. This will begin with stem injection of mature trees and 'cut-and-paint' or hand pulling of smaller plants (see Appendix 4) in zones one and two over a one - two-day period. The Minister [Tasmanian] also agrees to undertake one follow-up day of weed control works (two years after the initial control efforts) to repeat the above works on any surviving plants and any newly established plants.
- The Owner agrees to participate or provide in-kind assistance when the Minister undertakes these works to control the willow (e.g. planning, monitoring, and supervision of works or direct participation in the on-ground control works).
- After completion of the above works the Owner will continue to monitor the willow control priority one and two zones at least annually, if not more regularly (e.g. during the course of normal farm management activities such as mustering, or routine weed control work). The Owner will attempt to destroy willows and other weeds when they are found to occur as isolated re-infestations of a few plants that can be dealt with either by hand-pulling, the 'cut-and-paste' method or stem-injection of larger plants and trees (see Appendix 4).
- The Owner will inform the Minister [Tasmanian] if a willow or tree lucerne reinfestation occurs beyond this extent and more substantial on-ground works need to be undertaken.

- Funding assistance is provided under the Management Agreement to assist the Owner in purchasing herbicides and herbicide application equipment for weed control activities within the Land.
- The horehound (*Marrubium vulgare*) infestation occurs on steep slopes and rock outcrops within the southern half of Conservation Covenant Area 11 (up-slope from weed priority zone one). The population covers about 1 hectare. At this time the infestation appears to be static. However, the infestation should be monitored and controlled for example by release of a biological control (horehound plume moth *Wheeleria spilodactylus*), or spraying regenerating seedlings following fire.
- The introduced pasture grasses: sweet vernal grass (*Anthoxanthum odoratum*) and browntop bent (*Agrostis capillaris*) are widespread in the native grassland of the Land. The cover of these weeds in the Land may be decreased by managing stock grazing so that bare ground is minimised and by restricting the use of fodder (see section General Grazing Conditions). However, the best management at this site is not currently known and requires further investigation.
- Excepting the above there are no other known weed infestations of concern in the Land.
- The Owner will make annual inspections of other areas of the Land and must control and (if possible) eradicate infestation (s) of environmental weeds.
- The Owner will inform the Minister of any weed infestations that do not respond to standard control methods.
- Only herbicides that are recommended by the Minister [Tasmanian] for the control of target species are to be applied. The Owner will apply and dispose of herbicides in accordance with the manufacturer's recommendations
- Drift of herbicides spray onto native species must be minimised.

Herbicides, other chemicals and fertilisers

- No fertilisers are to be applied within the Land.
- No chemicals or herbicides are to be applied (directly or aurally) within the Land unless it is part of a weed or pest eradication program approved by the Minister [Tasmanian] (see sections on Weed Control and Feral Animal Control).
- Wherever possible, the Owner must also ensure that the use of fertilisers, chemicals or herbicides on land adjacent to the Land will not impact on the Land.

Introduction of non-native flora or fauna

- No exotic species are to be deliberately introduced into the Land unless approved by the Minister (e.g. grazing management or a weed control program using a biological control).
- Dogs and horses may be used to assist with mustering stock in the Land. Horse riding is also permitted as a recreational activity within the Land (see section Recreational Use).

Introduction of native flora and fauna

- No native flora and / or fauna species are to be deliberately introduced into the Land unless approved by the Minister [Tasmanian] (e.g. as part of a rehabilitation, restoration or translocation Plan).

Vehicle Access

- If practicable, vehicles must be washed prior to entering the Land if they have come from areas infested by weeds (especially those in seed) or disease (especially areas known to be affected by root rot fungus).

5. Works to be performed by the Owner

The following Works are to be performed by the Owner:

Weed Control:

- The Owner agrees to undertake weed control works as necessary within the Land. This includes the control of willow along the Ouse River floodplain, with the aim of preventing further spread into non-infested areas, and will occur after the initial weed control efforts undertaken by the Minister as described in the section 'Weed Control' (see page xxi). In particular, the Owner agrees to monitor this area at least annually, if not more regularly during the course of normal farm management activities (such as mustering or routine weed control work). The Owner will attempt to destroy willows when they are found to occur as isolated re-infestations of a few plants that can be dealt with, either by hand-pulling, the 'cut-and-paste' method or stem-injection of larger plants and trees.
- The Owner will inform the Minister if a willow reinfestation occurs beyond this extent and more substantial on-ground works need to be undertaken.
- Funding assistance is provided under the Management Agreement to assist the Owner in purchasing herbicides and herbicide application equipment for weed control activities within the Land.'

2.4 Data Sources

2.4.1 Significant Flora Species

In 2017 VDC was commissioned by the Proponent to –

1. compile existing data for significant flora species in the Cattle Hill Wind Farm site – Liawenee greenhood (*Pterostylis pratensis*), Crowded leek orchid (*Prasophyllum crebriflorum*) and Clover glycine (*Glycine latrobeana*) (Attachment 1); and to
 2. conduct additional surveys for significant flora species in the Cattle Hill Wind Farm site
- to address aspects of permit conditions associated with the development.

Location data for significant flora species have accumulated from the flora surveys conducted for the development since 2008. Surveys conducted within the peak flowering periods of significant flora species include 2008, 2010-11, 2012-13, 2014-15 and 2016-17. These data are contained within, and can be accessed from, the NVA.

Liawenee greenhood and Crowded leek orchid

The minimum convex polygon (MCP) generated from known occurrences (combined datasets) of Liawenee Greenhood and Crowded Leek Orchid for the wind farm site is shown in Figure 3. A small outlier for Liawenee Greenhood occurs on a basalt ledge near the entrance to the wind farm site at Macclesfield Road. The area of suitable habitat for the species is identified (light green shading) within the MCP in Figure 3.

Clover Glycine

The point locations for the species in the wind farm site are shown in Figure 3.

2.4.2 Conservation Covenant

The location of the reserve (conservation covenant - CPR8065) established under the *Tasmanian Nature Conservation Act 2002* is shown in Figure 3.

2.4.3 Weed Records

Existing data held within the Natural Values Atlas and weed location data collected during flora surveys conducted for significant flora species of the wind farm site were used to prepare Table 2 and Figure 4.

2.5 Existing Environment

2.5.1 Topography

The wind farm site is characterised by a north-south trending plateau which includes several low and high points including Wild Cattle Hill (905 m) located in the central northern portion of the site. Bashan Ledge (860 m) extends from the plateau towards the south east in the eastern portion of the wind farm site. The plateau drops to a low-lying region of approximately 550 m adjacent to the Ouse River near the eastern boundary of the site. Towards the west the ridgeline drops to a flatter area adjacent to Lake Echo. The southern portion of the site is generally flatter and lower lying.

2.5.2 Geology and Soils

The region which includes the wind farm site is underlain by basement rocks of early sedimentary origin (over 400 million years) which are rarely exposed. Later sedimentary rocks were deposited throughout the region during the Triassic, Permian and Carboniferous periods (250 – 350 million years ago). These were then intruded and overlain by Jurassic dolerite (185 million years ago). A narrow unit of Permian mudstone is located along the east of the wind farm site, near Waddamana, and another narrow unit of altered sandstone occurs to the south-west of the site parallel to the shore of Lake Echo. A thin ridge of dolerite occurs in contact with the sandstone.

Two periods of faulting in the Tertiary period (65 million years ago) created the Derwent River basin in the south of the region. It resulted in basalt flows in some areas within the wind farm site, including to the east of Lake Echo. The basalt cap is the dominant bedrock apparent over much of the wind farm site.

The soil profile reflects the basement geology. Basalt derived soils appear to be 0.5 – 2.5 metres thick and interspersed with unweathered basalt remnants and boulders which can also occur at surface and within the profile. The soil is a dark brown loamy soil with high clay content, increasing with depth which is typical of a basalt derived soil. Most of the soil appears to be a residual soil which has developed in situ with little transported deposited material. Soils formed on a sandstone and mudstone are a sandy loam with little clay content. Holocene deposits of alluvium (rich in clay) have formed in drainage basins.

2.5.3 Climate

Tasmania is characterised by a temperate maritime climate with this influence decreasing with distance from the coastline and with increasing altitude. Climatic conditions, especially temperature regimes and rainfall gradients/levels, play a critical role in determining plant growth in any given environment.

The wind farm site is located at altitudes between 550 m and 900 m AHD.

Monthly averaged climate data were obtained for the period 1910 to 2009, from the Bronte Heights meteorological station (Australian Bureau of Meteorology (BOM)). Bronte Heights is located approximately 16 km to the west of the wind farm site and represents a climate typical for the region around Lake Echo. The climate data results are presented in Table 1 and are summarised below.

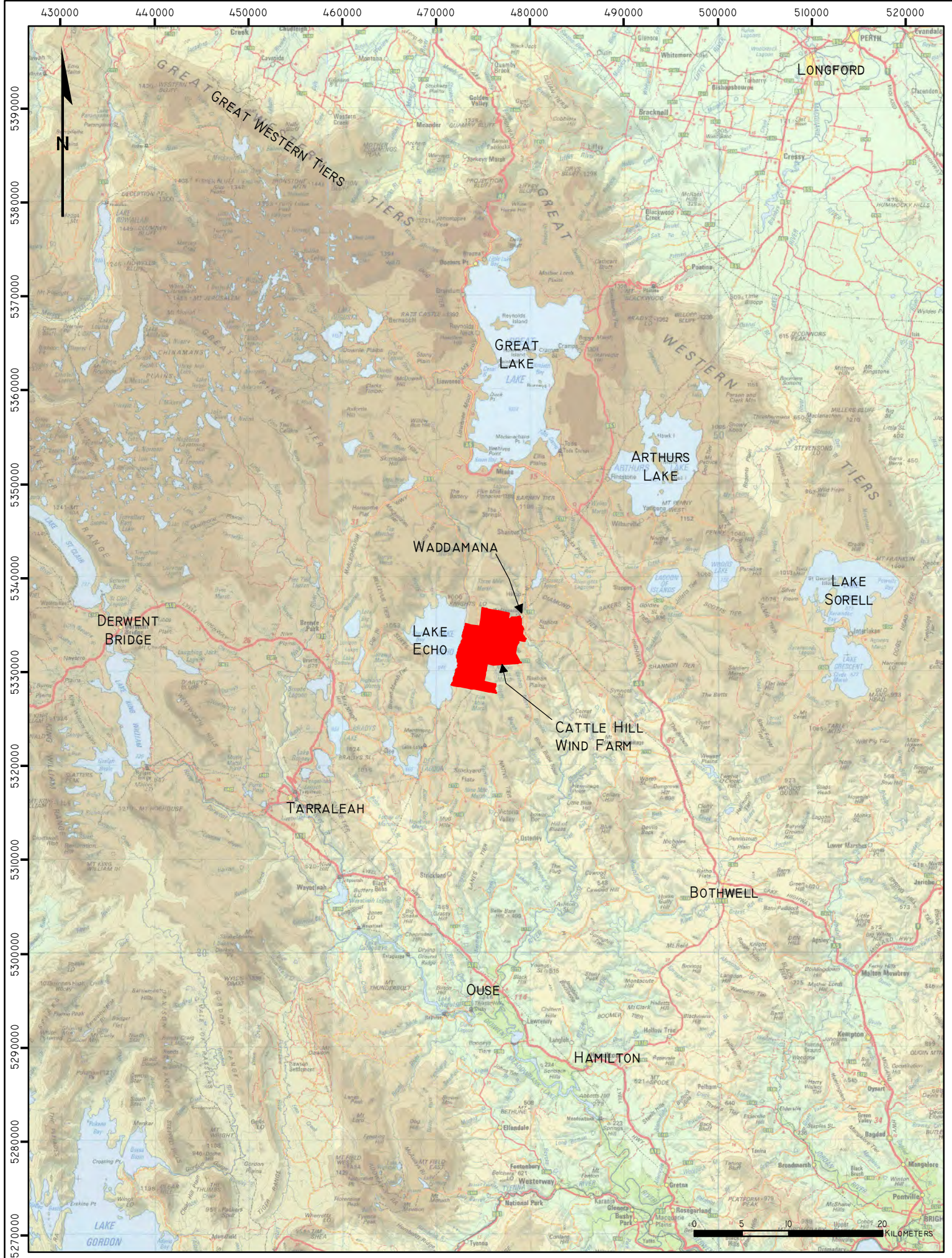
The climate in the local area is cool temperate with mild to warm summers and cold winters. Average temperatures range between 5.7 °C (night time) and 20.4 °C (day time) in summer months and 0.0 °C (night time) and 8.7 °C (day time) in winter months. Snow and frost can occur at any time of the year, including the summer months.

Average annual rainfall is 937.7 mm, with rainfall occurring on an average number of 132.4 days per year. Average monthly rainfall ranges between 53.2 mm in February to 97.4 mm in August.

Table 1. Bronte Heights Monthly Averaged Climate Statistics (1910-2009)

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
<i>Temperature</i>													
Mean Maximum Temperature (°C)	20.4	20.4	18.1	14.2	10.7	8.7	7.8	8.7	11.3	13.7	15.2	17.7	13.9
Mean Minimum Temperature (°C)	6.9	7.1	5.4	3.9	2.1	0.6	0.0	0.3	1.5	3.0	4.1	5.7	3.4
<i>Rainfall</i>													
Mean Rainfall (mm)	55.6	53.2	58.0	80.2	81.6	83.8	88.9	97.4	96.7	90.7	78.2	73.3	937.7
Mean Number of Days of rain ≥ 1mm	7.8	6.7	8.6	10.8	11.9	12.1	13.7	14.4	13.5	12.3	10.9	9.7	132.4

Note – peak growing season conditions occur in the months highlighted in green



CATTLE HILL WIND FARM - WEED MANAGEMENT PLAN

FIGURE I: LOCATION OF CATTLE HILL WIND FARM



PO Box 1 New Town TAS 7008

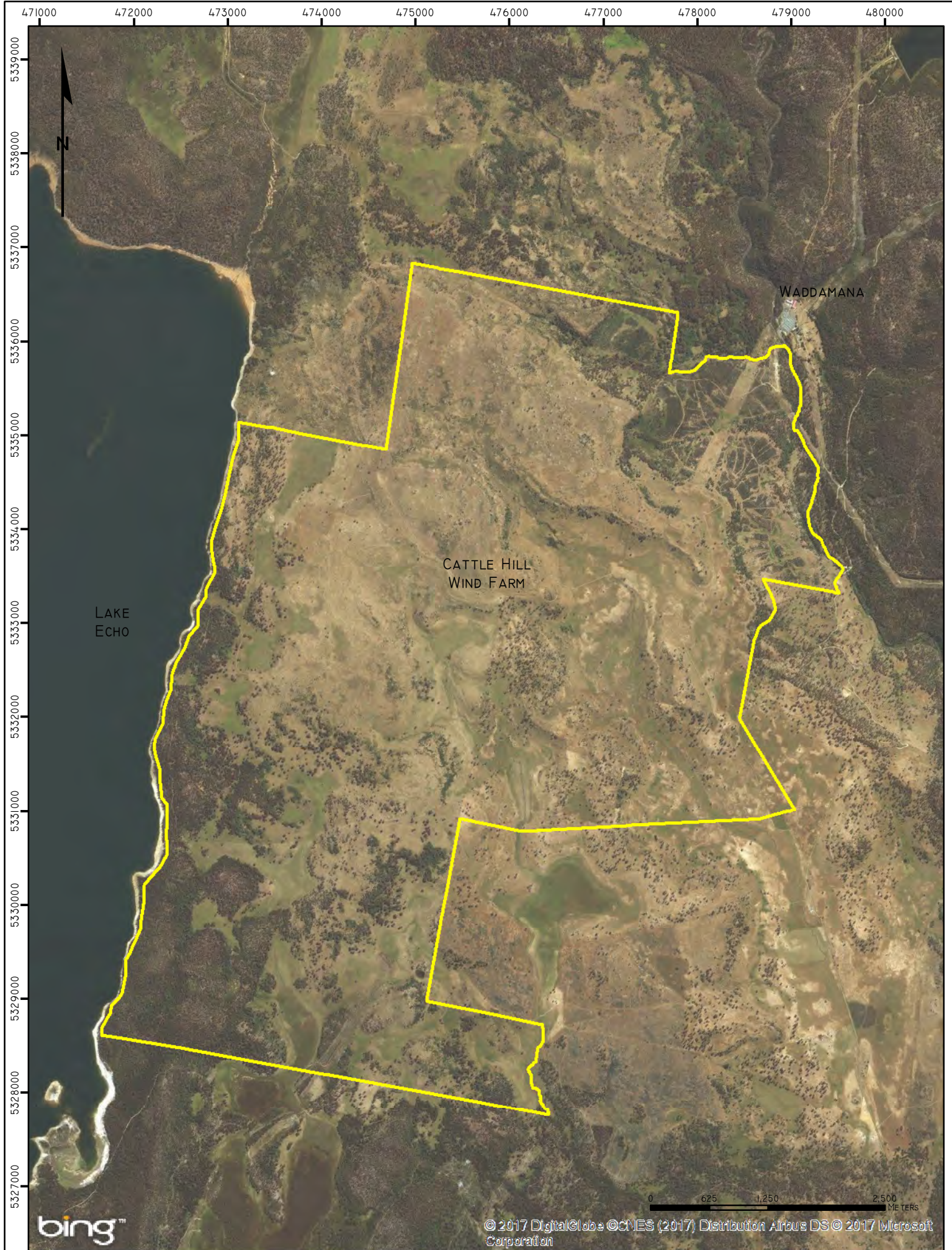
BASE DATA BY TASMAR © STATE OF TASMANIA
BASE IMAGE BY TASMAR © STATE OF TASMANIA



DATUM: GDA94
GRID: MGA ZONE 55

TASMAR: WADDAMANA 4633
ECHO 4632
CLIENT: BARTEL CONSULTING

DATE: 1ST AUGUST 2017



CATTLE HILL WIND FARM - WEED MANAGEMENT PLAN

FIGURE 2: DETAILED LOCATION OF THE
CATTLE HILL WIND FARM



PO Box 1 New Town TAS 7008

BASE DATA BY TASMAR © STATE OF TASMANIA
BASE IMAGE © MICROSOFT CORPORATION



DATUM: GDA94
GRID: MGA ZONE 55

TASMAR: WADDAMANA 4633
ECHO 4632
CLIENT: BARTEL CONSULTING

DATE: 1ST AUGUST 2017

3. What is a weed?

For the purposes of this Plan, a *weed* is any plant that requires some form of action to reduce its effect on the economy, the environment, human health and amenity.

Weeds can be invasive plants if they displace or reduce the coverage of native species in vegetation communities. Some weeds have been listed for priority management or in legislation. Weeds typically produce large numbers of seeds, assisting their spread. They are often capable of surviving and reproducing in disturbed environments and are commonly the first species to colonise and dominate in these conditions.

3.1 Weed Prioritisation for Nature Conservation Values

The Lake Echo climate is harsh. Nevertheless, the soils, climate and topography of the wind farm site conspire to make it susceptible to the colonisation of some weeds, whether they be existing there or brought in by the construction of the wind farm.

There is a very short plant growing season at the wind farm site. Consequently, *annual* and *biennial* weeds are the most likely to occur at and/or spread within the site. *Perennial* weeds that are not winter deciduous (eg briar rose), including woody weeds like gorse and brooms, are rare in the region.

The wind farm site has areas of improved pasture and semi-native vegetation which contain a high number of exotic grass and herb species. Pasture grasses, herbs and thistles pose the biggest threat to the habitat of Liawenee Greenhood, Crowded Leek orchid and Clover Glycine. Large areas of disturbed soil can become colonised by thistles, pasture grasses and/or herbs which tend to produce considerably higher numbers of seed than native species.

On this basis, it is of paramount importance in and near habitat for Liawenee Greenhood, Crowded Leek orchid and Clover Glycine to –

1. retain as much vegetative cover comprised of native species as possible; and
2. minimise soil disturbance during construction; and
3. minimise the amount of bare soil created and left unrehabilitated post-construction.

3.2 Relevant Weeds and Classification

For the purposes of this Plan, weeds can be classified into several categories.

3.2.1 Weed of National Significance

Thirty-Two Weeds of National Significance (WoNS) have been agreed by Australian governments based on an assessment process that prioritised these weeds based on their invasiveness, potential for spread and environmental, social and economic impacts. Consideration was also given to their ability to be successfully managed.

3.2.2 Declared weeds

The Tasmanian *Weed Management Act 1999* is the principal legislation concerned with the management of declared weeds in Tasmania. Under the Act, the State Government may:

1. Prohibit the introduction of declared weeds into Tasmania.
2. Undertake the eradication of declared weed species.
3. Take action aimed at preventing the spread of declared weeds within Tasmania.
4. Require that action be taken against declared weed species where this is necessary to alleviate or prevent a particular problem.

The *Weed Management Regulations 2000* are the statutory rules that help underpin the Act. They detail requirements and measures referred to in the Act.

Once declared the legislation requires a Weed Management Plan (WMP) be prepared for the weed. A WMP must include the name of the target weed, area of the State covered by the plan, distribution and extent of the weed, the reasons for declaring the weed and include restrictions and measures required to control, eradicate or restrict the spread of a weed. Restrictions on import, distribution and sale are also included.

3.2.3 Sleeper weeds

‘Sleeper weed’ is a concept developed by the Australian Government to complement the Weeds of National Significance list, which includes weeds that are already widespread. They are plant species that appear benign for many years, but which may suddenly spread rapidly following certain natural events such as flood, fire, drought, climate change, or change in land or water management. Sleeper weeds are not always recognised as a significant problem, even though the potential threat they pose to industry, people or the environment may be extreme. In 2003 the Bureau of Rural Sciences (BRS), through consultation with the Australian Weeds Committee, short-listed 17 potential agricultural sleeper weeds. BRS prioritised 10 species for which eradication was thought to be both desirable and feasible.

3.2.4 Weed Groups

Weeds in a ‘broad’ sense can be a *group* of plant (not necessarily related) species.

For the wind farm site, exotic species of greatest threat to the habitat of Liawenee Greenhood, Crowded Leek orchid and Clover Glycine are those of agricultural value and origin. For example, exotic species can include pasture grasses (eg. bent grasses, Yorkshire fog, cocksfoot, sweet vernal, annual grass) and herbs, such as clovers and broad-leaf pasture species (eg. Medicago, clover, lucerne, dandelion, sheep sorrel, hawkbit, cat’s ear, common cotula, storksbill’s, lesser swinecress, wild radish, wild mustard, charlick, chickweed). Individually these species are unlikely to pose a threat to the habitat of *significant flora species* but collectively they can dominate localised areas, especially when bare soil is created. They can potentially proliferate and set seed, adding to the seed load already generated in the wind farm site.

3.3 Weed Location Data

3.3.1 Existing Data

Natural Values Atlas (DPIPWE) sourced data collected during the flora surveys conducted for significant flora species were used to prepare the list of weeds displayed in Table 2.

3.3.2 New Data records

Weeds recorded within the construction area and wind farm site will be included into the database of natural values to be established for the wind farm.

Recorded locations of weeds will be added to the Natural Values Atlas if requested to do so by the DPIPWE.

Table 2. Weed species and groups that are of relevance to weed management at the Cattle Hill Wind Farm site

Common name <i>Scientific name</i>	Threat Level to habitat of significant flora species	On- site?	Distribution	Near site?	WoNS?	Declared Weed (Central Highlands objective)*?	Sleeper Weed?
Weed Species							
African boxthorn <i>Lycium ferocissimum</i>	Low	N	-	Y	Y	Y (B)	N
blackberry <i>Rubus fruticosus</i> aggregate	Low	Y	Very localised near entrance and paddocks	Y	Y	Y (B)	N
Boneseed <i>Chrysanthemoides monilifera</i> ssp. <i>monilifera</i>	Low	N	-	N	Y	Y (A - Early detection and prevention)	N
Californian thistle <i>Cirsium arvense</i>	High	Y	Near Martin Cash' Scrub	Y	N	Y (B)	N
Canadian pondweed <i>Elodea canadensis</i>	Low	N	Ouse River, near Waddamana	Y	N	Y (B)	N
Capeweed <i>Arctotheca calendula</i>	High	Y	Sporadic, mainly on light soils	Y	N	N	N
Chilean needle grass <i>Nassella neesiana</i>	High	N	-	N	Y	Y (A = Prevention and early detection)	N

Common name <i>Scientific name</i>	Threat Level to habitat of significant flora species	On- site?	Distribution	Near site?	WoNS?	Declared Weed (Central Highlands objective)*?	Sleeper Weed?
Gorse <i>Ulex europaeus</i>	Moderate	N	Not observed, but likely to be present in low numbers	Y	Y	Y (B)	N
Great mullein <i>Verbascum thapsus</i>	High	N	Not observed, but likely to be present in low numbers	N	N	N	N
Horehound <i>Marrubium vulgare</i>	High	Y	Near Ouse River above Waddamana Bridge	Y	N	Y (B)	N
Montpellier broom <i>Genista monspessulana</i>	Low	N	NA	N	Y	Y (B)	N
Nodding thistle <i>Carduus nutans</i>	Low	N	NA	Y	N	Y (B)	N
Orange hawkweed <i>Hieracium aurantiacum</i>	Very High	Y	One localised patch (observed 2017)	Y	N	Y	Y
Weld <i>Reseda luteola</i>	High	N	Not observed, but likely to be present in low numbers	N	N	N	N
Ragwort <i>Senecio jacobea</i>	High	N	NA	N	N	Y (B)	N

Common name <i>Scientific name</i>	Threat Level to habitat of significant flora species	On- site?	Distribution	Near site?	WoNS?	Declared Weed (Central Highlands objective)*?	Sleeper Weed?
Serrated tussock <i>Nassella trichotoma</i>	High	N	NA	N	Y	Y (B)	N
Slender thistles <i>Carduus tenuiflorus</i> and <i>C. pycnocephalus</i>	High	Y	Sporadic near cattle camps and wombat burrows	Y	N	Y (B)	N
Spanish broom <i>Cytisus scoparius</i>	Low	N	NA	Y	Y	Y (B)	N
Tree lucerne <i>Chaemaecytisus palmensis</i>	Low	Y	Ouse River	Y	N	N	N
Twiggy mullein <i>Verbascum virgatum</i>	High	N	Not observed, but likely to be present in low numbers	N	N	N	N
Weed Groups							
Pasture grasses (exotic) Sweet vernal, cocksfoot, brown-top bent, Yorkshire fog, annual, etc	High	Y	Abundant	N	N	N	N
Pasture herbs (exotic) Medicago, clover, lucerne, dandelion, sheep sorrel, hawkbit, cat's ear etc	High	Y	Abundant	N	N	N	N
Thistles (exotic) Spear, variegated	High	Y	Sporadic near cattle camps, wombat burrows	N	N	N	N

			and disturbed ground				
--	--	--	-------------------------	--	--	--	--

* Declared Weeds are those listed in the *Weed Management Act 1999* (the status under the statutory weed management plan is also provided. B = Containment within municipal boundaries, protection of specified areas within municipal boundaries, prevention of spread to Zone A municipalities. This applies to all Zone B municipalities).

Table 3 provides a list of weeds (individual species and/or Groups) from Table 2 which are the primary focus of the Plan. These have been identified as the priorities for management because they pose the greatest risk to the habitat [by invasion, establishment and/or displacement of native species] of the Liawenee Greenhood, Crowded Leek orchid and Clover Glycine.

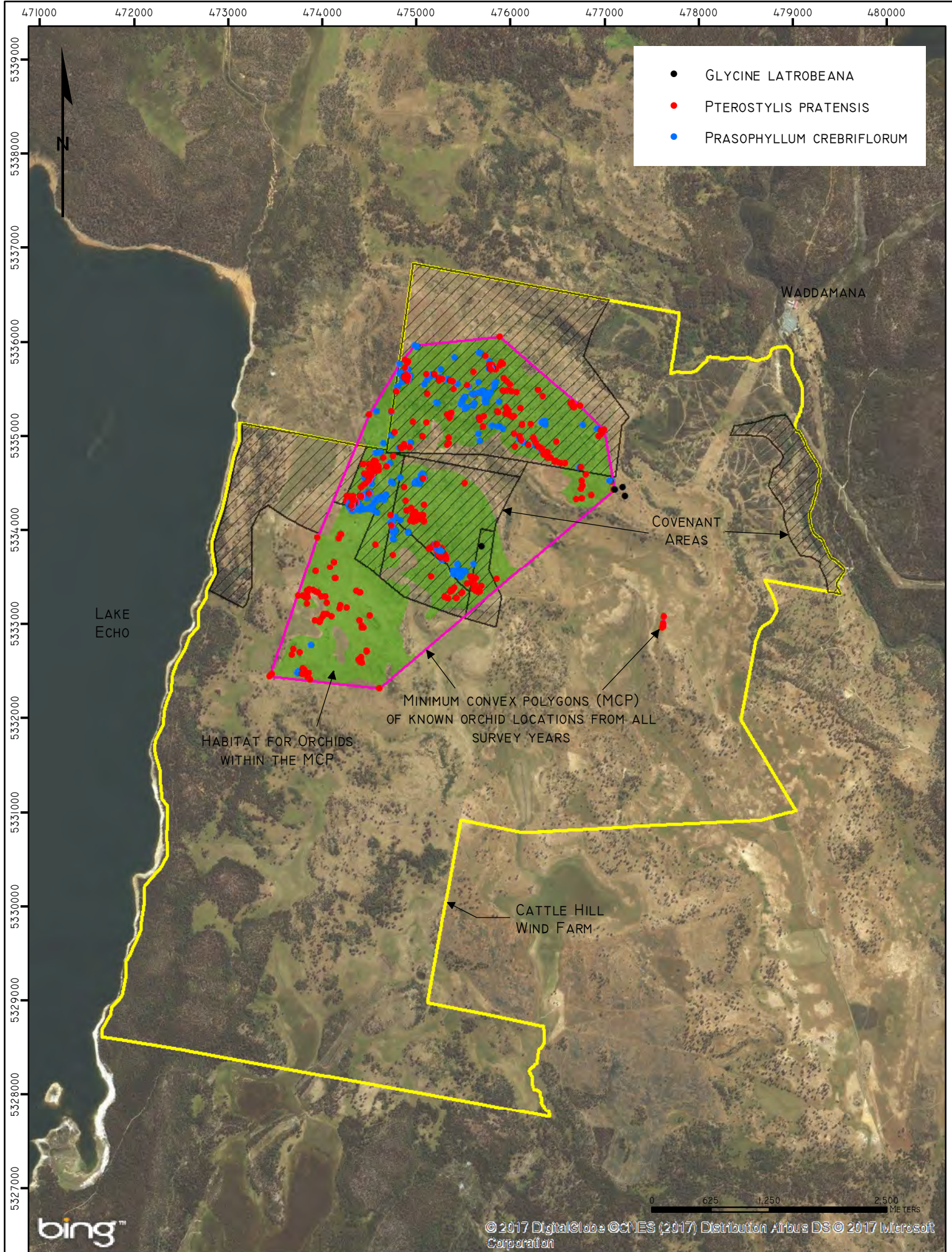
The main threats to these significant flora species are –

- shading of plants (especially from tall thistles);
- displacement of plants; and
- occupying areas of bare soil that could otherwise be colonised by desirable species.

Table 3. Weed species and groups of primary focus to the Plan

Weed Name/Group	Main Dispersal Vector	Options For Management
Californian thistle <i>Cirsium arvense</i>	Rhizome (less so from seed)	Spraying
Capeweed <i>Arctotheca calendula</i>	Seed (prolific)	Spraying Physical removal
Chilean needle grass <i>Nassella neesiana</i>	Seed	Spraying
Great mullein <i>Verbascum thapsus</i>	Seed	Spraying Physical removal prior to seed set
Weed Name/Group	Main Dispersal Vector	Options For Management
Horehound <i>Marrubium vulgare</i>	Seed	Spraying Physical removal
Orange hawkweed <i>Hieracium aurantiacum</i>	Seed and rhizome	Spraying Physical removal
Narrow-leaved mignonette <i>Reseda luteola</i>	Seed (prolific)	Spraying Physical removal prior to seed set
Ragwort <i>Senecio jacobea</i>	Seed (prolific)	Spraying Physical removal prior to seed set
Serrated tussock <i>Nassella trichotoma</i>	Seed	Spraying
Twiggy mullein <i>Verbascum virgatum</i>	Seed	Spraying Physical removal prior to seed set

<p>Pasture grasses (exotic)</p> <p>Sweet vernal, cocksfoot, brown-top bent, Yorkshire fog, annual, etc</p>	Seed, runners and rhizomes	Spraying
<p>Pasture herbs (exotic)</p> <p>Medicago, clover, lucerne, dandelion, sheep sorrel, hawkbit, cat's ear, common cotula, storksbill's, lesser swinncress, wild radish, wild mustard, charlick, chickweed etc</p>	Seed and rootstocks	Various including spraying And physical removal prior to seed set
<p>Thistles (exotic)</p> <p>Spear, variegated, sow, prickly sow, groundsel,</p>	Seed	Spraying



CATTLE HILL WIND FARM - WEED MANAGEMENT PLAN

FIGURE 3: SIGNIFICANT AREAS FOR WEED MANAGEMENT
AT CATTLE HILL WIND FARM

an Diemen CONSULTING

PO Box 1 New Town TAS 7008

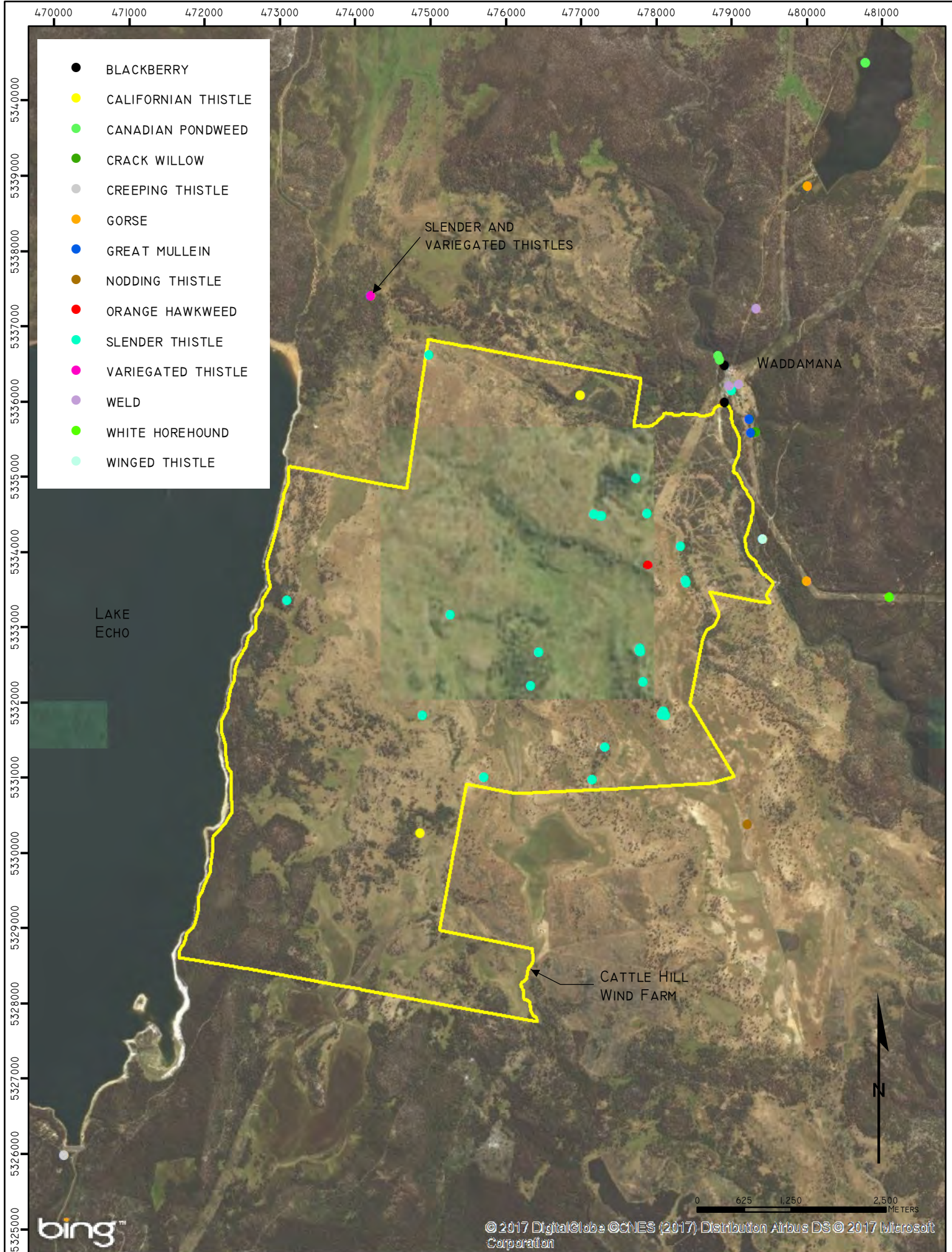
BASE DATA BY TASMAR © STATE OF TASMANIA
BASE IMAGE © MICROSOFT CORPORATION



DATUM: GDA94
GRID: MGA ZONE 55

TASMAR: WADDAMANA 4633
ECHO 4632
CLIENT: BARTEL CONSULTING

DATE: 1ST AUGUST 2017



CATTLE HILL WIND FARM - WEED MANAGEMENT PLAN

FIGURE 4: LOCATION OF KNOWN WEEDS WITHIN AND NEAR TO THE CATTLE HILL WIND FARM

an Diemen CONSULTING

PO Box 1 New Town TAS 7008

BASE DATA BY TASMAR © STATE OF TASMANIA
BASE IMAGE © MICROSOFT CORPORATION



DATUM: GDA94
GRID: MGA ZONE 55

TASMAR: WADDAMANA 4633
ECHO 4632
CLIENT: BARTEL CONSULTING

DATE: 1ST AUGUST 2017

4 Administrative Controls

The successful implementation of this Plan requires clear administrative controls and procedures.

4.1 Roles and Responsibilities

4.1.1 Proponent

The Proponent (P), or their delegated representative, is directly responsible for ensuring that:

- the Site Manager (SM) is briefed on the requirements of the Plan and its importance to the overall success of the construction phase of the wind farm;
- this Plan is complied with through regular assessments (at least one assessment per month) of the wind farm site and liaison with the SM; and
- any variations to this Plan are developed and approved by the EPA and the Department prior to implementation.

4.1.2 Site Manager

The Site Manager (SM) is directly responsible for ensuring that:

- this Plan is complied with, appropriately implemented and reviewed;
- reporting to the Proponent, or their delegated representative, the implementation of this Plan including any breaches to the Plan and how they were recorded and addressed; and
- staff and contractors are trained in weed hygiene measures, with emphasis on those measures relevant to their appointed tasks.

4.1.3 Staff and General Contractors

All staff and contractors that work within the wind farm site are responsible for:

- Applying the weed hygiene measures for which they have received training;
- Reporting to the SM breaches of this Plan, providing written details of the breach, and any measures that were immediately taken to reduce the likelihood of spreading/introducing weeds to the wind farm site; and
- Reporting occurrences of weeds to the SM using the *Weed Record Form* within a reasonable timeframe of detection.

4.1.4 Weed Spraying Contractors

In addition to their scope of work, weed spraying contractors are responsible for:

- Applying weed hygiene measures to vehicles and equipment prior to attending the wind farm site;
- Handling, storing and disposing of weed management related chemicals in accordance with best practice principles;
- Reporting to the SM any breaches of this Plan, providing written details of the breach, and any measures that were immediately taken to reduce the likelihood of spreading/introducing weeds to the wind farm site; and

- Reporting occurrences of weeds to the SM using the *Weed Record Form* within a reasonable timeframe of detection.

4.1.5 Expert Consultants

In addition to their scope of work, expert consultants engaged to conduct weed surveys and provide weed management advice are responsible for:

- Applying weed hygiene measures to vehicles and equipment prior to attending the wind farm site;
- Reporting to the SM any breaches of this Plan, providing written details of the breach, and any measures that were immediately taken to reduce the likelihood of spreading/introducing weeds to the wind farm site; and
- Reporting occurrences of weeds to the SM using the *Weed Record Form* within a reasonable timeframe of detection.

4.2 Inductions and Training

Staff and contractors will be equipped with the necessary knowledge to understand why –

1. strict weed control measures are necessary during the construction phase, and that
2. care needs to be taken with the operation and movement of machinery.

Training will be provided through the staff/contractor induction process.

4.2.1 General Training

Staff and contractors will be trained by a *suitably qualified ecologist* in the below items –

- Weed species that are known to occur in the wind farm site and local environment;
- Weed species that may be encountered in the wind farm site; and
- How to use the *Weed Record Form* and the process of advising the Site Manager.

Staff and contractors will be trained in –

- 5 The use of the *Weed Record Form*;
- 6 The use of the Log Book system (see section 4.3 Log Book for Machinery) for machinery;
- 7 The use of the colour coded system to flag weeds pre-construction; and
- 8 How to access information and advice to aid weed/plant identification.

4.2.2 Specialist Training

Additional training will be provided to staff and contractors where there are specialised weed management related tasks associated with their roles on the wind farm site. These include for example –

- Sourcing earth-based products to be brought to the wind farm site;
- Contractors who will be operating, moving and cleaning heavy machinery and equipment; and

- Contractors who will be excavating and handling earth-based material from the wind farm site.

4.3 Machine Log Book

A **Machine Log Book** for each machine/equipment is to be in place and maintained for the life of the construction phase. The Log Book is to be kept with each machine and used to record information about the movements of the machine within the wind farm site.

The use of the Log Book system will be included in staff induction and training processes.

The Log Book is to be used for recording, as a minimum, –

- the date of entry for the machine/equipment to the wind farm site, from where it has been floated and whom authorised the entry to the wind farm site.
- where and when machinery/equipment was washed down once within the wind farm site, and of where the machine was taken for use after it had been washed down.

4.4 Construction Environment Management Plan

The Construction EMP for the development will include the layout for construction purposes – this is referred to as the *construction area* within this Plan.

5 Preventative Management Actions

The most cost and time effective approach to weed management is to prevent the –

1. spread of weeds within the wind farm site; and the
2. introduction of weeds to the wind farm site that are not already present; and to
3. minimise the geographic extent of disturbed and/or bare soil upon which weeds can become established.

5.1 Education and Training

Training and inductions for staff and contractors will enhance the weed identification and management knowledge of those working on the wind farm site.

Information booklets/posters will be made available at the site office and used in the training and induction process (see section 4.2 Inductions and Training). These may include, in addition to others, the materials listed in Attachment 5.

The Site Manager or contractor can seek advice on the identification of a plant from a *suitably qualified ecologist*. In some cases, this could be achieved by sending images (jpg, tiff or similar) of the plant/weed via MMS or email for identification. Weed ‘detection’ surveys conducted by a *suitably qualified ecologist* (see section 7.1 Weed Surveys) should complement these measures.

5.2 Pre-Construction Flagging

Known occurrences of significant weeds within the wind farm site of relevance to construction will be flagged in the field. A metal peg with colour plastic tag can be a medium to long-term marker in the field.

A colour coded system is to be used with a colour information sheet provided in the Site Office and machinery Log Book. The use of the colour coded system will be included in staff induction and training processes.

5.3 Construction Materials

The highest risk of transporting propagules to the wind farm site is from the importation of gravel, soil, rock and other earth-based materials from sources where there are weeds (or their propagules) present.

Sources of earth-based material need to be checked for the presence of weeds and measures put in place (if they are not already) to manage the weeds at those locations prior to accepting any material from that source. Poor planning and not checking the source sites of earth-based material could cause considerable weed incursion problems in the wind farm site. This may cause excessive or unnecessary weed control costs.

Actions Required

- **Assessments are to be conducted by a *suitably qualified ecologist* of the source quarries to determine which, if any, weeds are present.**

- **A risk assessment for each earth-based material source will be done in accordance with the document HYGIENE PROTOCOLS FOR MOVEMENT OF GRAVEL AND SOIL BETWEEN SITES AND ROAD CONSTRUCTION AND MAINTENANCE (Attachment 6). The assessment must consider the level/likelihood of contamination of the quarry product with weed propagules (seeds and rhizomes).**
- **Weed control measures must be conducted/enhanced and then maintained at the source quarries prior to the importation of earth-based materials to the wind farm site.**
- **The source quarry for each earth-based product brought to site is to be recorded by the Site Manager.**

5.4 Machinery and Equipment Floated to Site

Heavy machinery, such as excavators and bulldozers, can carry large clods of dirt and mud in which propagules (eg seeds, rhizome) can be lodged. Machinery entering the wind farm site in a clean state substantially reduces the risk of introducing weed propagules to the site.

Actions Required

- **Machinery (eg. excavators, bulldozers, cranes, etc) must be brought into the wind farm site in a clean condition; free of weed propagules, clods of dirt and vegetative matter. This it to be demonstrated by an inspection described in the HYGIENE PROTOCOLS FOR VEHICLES AND HEAVY MACHINERY (Attachment 7). The relevant record form in Attachment 8 is to be used to record the assessment of machinery, vehicles and equipment and filed at the site office.**
- **If machinery and/or equipment is not clean then it will be 'washed down' using the designated washdown facility at the site office/compound (see Designated Washdown Facility).**
- **The Log Book for the machine/equipment is to be completed with the date of entry to the wind farm site, from where it has been floated and whom authorised its entry to the wind farm site.**

5.5 Vehicles Travelling to Site on Public Roads

Road transport trucks hauling turbine and other large infrastructure components pose little risk of transporting weed propagules to the wind farm site if they remain on the hard surface of the roads, even if the roads are unsealed. Nevertheless, they will be inspected as per the HYGIENE PROTOCOLS FOR VEHICLES AND HEAVY MACHINERY.

Actions Required

- **The relevant inspection depicted in the HYGIENE PROTOCOLS FOR VEHICLES AND HEAVY MACHINERY (Attachment 7) will be recorded using the relevant form in Attachment 8 and filed at the site office.**

5.6 Machinery Washdown within Site

5.6.1 Designated Washdown Facility

A designated washdown facility will be installed at the site office/compound. The design, functionality and operation of the washdown will be included within the CEMP.

5.6.2 In-field Washdown

Once within the wind farm site, the movement of machinery and equipment (limited to that equipment which contacts the soil and can transport soil) within the site needs to be managed to minimise the risk of spreading weed propagules.

In some cases, machinery may traverse areas where there is a high to medium risk of weed propagules being present (eg known thistle outbreaks) – the movement of machinery out of these areas once the works have been completed needs to be controlled to minimise any weed ‘drag’ into other areas. For example, trenching is linear earthworks which can intersect thistles patches – a washdown of machinery after traversing areas of known thistle outbreaks can help mitigate spreading seed (which may be present in the soil) further along the trench.

The following approach is to be applied when washing down machinery in-field.

Site Selection

The location of a temporary washdown should be decided by the Site Manager or their delegated representative using the following criteria:

- Water settlement ponds or areas designed for the capture of runoff from roads should be preferentially used for washdown if they are practical to access;
- If stormwater settlement ponds are not readily accessed, ensure washdown is conducted as close as possible to the source of the material being removed;
- Ensure run-off does not directly enter a watercourse or waterbody, a 30m buffer from any waterway or waterbody is desirable;
- Select a mud-free location (e.g. well grassed, gravel) which is gently sloped to drain effluent away from the washdown area;
- Allow adequate space to safely move tracked vehicles and allow safe vehicle access around the heavy machinery; and
- Pay attention to potential hazards near or at the washdown site (e.g. overhead powerlines, powerpoles and fences).

If there will be large quantities of effluent generated from the washdown (>1,000 litres of water generated in the one washing event) the washdown area should be bunded and a sump constructed to disperse the effluent.

In-field Washdown prescriptions

The procedure outlined in *PORTABLE VEHICLE/MACHINERY WASHDOWN UNITS* of the document *HYGIENE PROTOCOLS FOR VEHICLES AND HEAVY MACHINERY* (Attachment 7) are to be applied.

Recording in-field washdown locations

The Log Book (see section 4.3 Log Book for Machinery) is to be used to record where and when it was washed down, and of where the machine was taken for use after it had been washed down. These data are required to record washdown locations such that they can be subsequently checked for any undesirable plant species growing in these locations.

Actions Required

- **Once within the wind farm site, the movement of machinery and equipment (limited to that equipment which contacts the soil and can transport soil) needs to be managed to minimise the risk of spreading weed propagules.**
- **The Machine Log Book is to be used to record where and when machinery was washed down, and of where the machine was taken for use after it had been washed down.**

5.7 Vegetation Sheet and Soil/Vegetation Mix Reuse

Many weeds, such as thistles, are capable of quickly colonising disturbed soil. At the wind farm site, most thistles for example have been observed growing near wombat dens, animal tracks and cattle camps – areas with a high frequency of soil disturbance and little vegetative cover. The construction works for the wind farm will generate large areas of disturbed soil surface, albeit mostly linear in shape. These are ideal locations for the recruitment of weeds, especially thistles, if the bare soil is not covered or rehabilitated quickly.

The excavation of existing ground-cover vegetation to facilitate construction of hardstands, roads and other structures provides an opportunity to reuse the root mass - referred to here as a 'vegetation sod'.

The careful excavation and placement of vegetation sods onto soil that has been disturbed/shaped into batters for roads etc can substantially reduce the amount of bare soil available for the recruitment of weeds. Even if the plants die or partially die in the vegetation sod it can still provide a means to cover bare soil, depriving weeds, such as thistles, of a high light environment.

Not all areas may be conducive to this form of management – some rocky areas, or areas where there is a shallow soil/vegetative root mass may not be amenable to being stripped as a single sod. There will also need to be a close by identified site (within the construction area) where the sods can be temporarily stored.

Vegetation is only to be cleared in an area when that area is needed for construction purposes.

The use of vegetation sods will be dependent upon the species composition of the sod itself – whether it is native or non-native dominated – as described below.

5.7.1 Native Species Dominated Vegetation Sheets

The re-use of native species rich vegetation sods can provide a native species seed source to facilitate quicker colonisation of bare ground, depriving weeds of a bare soil environment. This approach may reduce rehabilitation costs in the medium to long-term.

This weed control/rehabilitation technique is to be applied in and near habitat for Liawenee Greenhood, Crowded Leek orchid and Clover Glycine.

If vegetation sods are stored for a long period of time (2-3 weeks) they may dry-out and become friable, especially in the drier summer months. If this occurs the soil and vegetation it contains should be roughly mixed and applied directly to areas of bare soil which need to be rehabilitated.

Actions Required

- **Strips of sod (where they can be removed and relocated in a short period of time – days to a week) could be used to cover bare or stockpiled soil to minimise the risk of weed establishment and growth.**
- **This technique should be applied in and near habitat for Liawenee Greenhood, Crowded Leek orchid and Clover Glycine.**
- **The use of vegetation sods which support a high coverage of exotic herbs and grasses (see 5.7.2 Exotic Species Dominated Vegetation Sheets) should be avoided unless they are used in an area already with a high coverage of exotic pasture species.**

5.7.2 Exotic Species Dominated Vegetation Sheets

The re-use of vegetation sods are dominated by pasture grasses and herbs can provide a seed source to facilitate quicker colonisation of bare ground areas within pasture environments.

This weed control/rehabilitation technique is **not** to be applied in and near habitat for Liawenee Greenhood, Crowded Leek orchid and Clover Glycine.

If vegetation sods are stored for a long period of time (2-3 weeks) they may dry-out and become friable, especially in the drier summer months. If this occurs the soil and vegetation it contains should be roughly mixed and applied directly to areas of bare soil which need to be rehabilitated.

Actions Required

- **Strips of sod (where they can be removed and relocated in a short period of time – days to a week) could be used within pasture environments to cover bare or stockpiled soil to minimise the risk of weed establishment and growth.**
- **The use of vegetation sods which support a high coverage of exotic herbs and grasses (see 5.7.2 Exotic Species Dominated Vegetation Sheets) should be avoided unless they are used in an area already with a high coverage of exotic pasture species.**

6 Responsive Management Actions

It is critical that an appropriate response is initiated as soon as possible if –

1. weeds are spread in the wind farm site; and/or
2. weeds currently not present in the wind farm site are detected in the wind farm site.

Early detection is key to successful control/eradication measures for the lowest possible price. Weeds left undetected or unmanaged can become a major problem. Their impact may cost time and funds to ameliorate.

6.1 Physical Removal and/or Burying Material

It could be possible to physically remove and/or dispose of weeds when –

1. there are few plants and they cover a small area, or
2. they are weeds that can be easily pulled out without leaving a rhizome or rootstock behind.

6.1.2 Physical Removal of Seed and Mature Flowerheads

The removal of flowerheads and/or seed can assist with reducing the number of weed propagules that may otherwise spread within the wind farm site.

If weeds have seeds or well-developed/mature flowerheads present then these parts of the plant must be removed, bagged and disposed (buried) of prior to the main part of the plant being sprayed OR excavated and buried (see below). The placement of a plastic bag over the flowerhead, especially for thistles, is a relatively easy way to capture seeds prior to the cutting of the flower stem.

6.1.2 Burying Material

Excavated soil that -

- is known to contain propagules of weeds¹; or
- is likely to contain propagules of weeds²; or
- physically contains weed plants³ –

is to be buried within trenches, excavations for hardstands etc to prevent the re-use of the material on the wind farm site. The exception to managing weeds in this way are species that regenerate by a rhizome/rootstock/stolon which may reshoot and cause higher numbers of plants to regrow (eg Californian thistle and hawkweed).

¹ Excluding those species covered by the terms 'Pasture grasses (exotic)' and 'Pasture herbs (exotic)' described in Table 3.

² Excluding those species covered by the terms 'Pasture grasses (exotic)' and 'Pasture herbs (exotic)' described in Table 3.

³ Excluding those species covered by the terms 'Pasture grasses (exotic)' and 'Pasture herbs (exotic)' described in Table 3.

For the *Pasture grasses (exotic)* and *Pasture herbs (exotic)* groups, burial is not achievable because the species within each group are widespread across the wind farm site – not all soil can and should be buried. The weed spraying program will need to manage these weed groups in sensitive areas, including habitat of *significant flora species* and areas of works within the conservation covenant.

The burying of material is to be recorded in the Log Book (see section 4.3 Log Book for Machinery) noting –

- the weed(s) present;
- GPS location of the burial site; and
- date of burial.

Material managed in this way must –

- not to be moved more than 50m from its source location; and
- be buried at least 300mm (800mm for Californian thistle and hawkweed) below final surface level; and
- not be disturbed by future construction/excavation activities for the project.

The **Site Manager** must be advised when material is buried and provided a copy/photo of the Log Book page which documents the location of burial for inclusion into the GIS database for the project.

6.2 Weed Spraying Program

Despite mitigation and preventative measures, it is inevitable that weeds will grow in some areas during the construction of the wind farm. Some weed species germinate after soil disturbance, such as thistles and pasture herbs and grasses.

A Weed Spraying Program (the ‘Program’) will be implemented for the construction phase of the project.

The Program is to commence at a time suitable for the spraying of weeds - typically the growing season as herbicides are more readily absorbed by, and have greater effect on, actively growing plants.

The Program will be reviewed by a suitably qualified ecologist prior to each growing season (commencing September to October) and updated as new information about the occurrence of weeds within the wind farm site become available. The preparation of the Program may require site surveys for weed occurrences and/or assessments of previous weed spraying works to appraise outcomes.

The Program each year (or growing season) will take the form of a Works Plan which will comprise the following –

1. A map showing the areas where weeds occur, what species they are and a works area number (to reference to the associated spreadsheet); and
2. A spreadsheet like that contained in Attachment 3 will identify the works area, weed of concern and the management of that weed or group of weeds.

The Works Plan spreadsheet will be updated electronically with a new worksheet for each Work Plan, thus maintaining a record of the works recorded and completed. The printed version of the Works Plan once implemented will be signed by the officer responsible for the works and filed at the site office for future reference and/or auditing.

Works Plans will be compiled and summarised to identify the –

- Areas sprayed during the Program;
- Weed species sprayed;
- Follow-up monitoring schedule for each area; and
- Scheduled repeat spraying works (where required).

All weed spraying at the wind farm site will be in accordance with the DPIPW issued 'Guideline for Safe and Effective Herbicide Use near Water' (Attachment 4).

6.3 New Weed Incursion

If a weed not already known to occur in the wind farm site or construction area is found during surveys or works associated with construction, then advice is to be sought from a suitably qualified ecologist as to the way it should be managed and/or controlled.

The advice and information provided is to be integrated into this Plan and/or its procedures as recommended by the ecologist.

7 Performance Monitoring

The Plan must be flexible such that it can allow change to the focus of management actions, especially the weed spraying program, because the occurrence, extent and severity of weed infestations change over time.

7.1 Weed Surveys

The early detection of weeds that enter the wind farm site, especially near or within the habitat of Liawenee Greenhood, Crowded Leek Orchid and Clover Glycine, is important to ensure that any control/eradication program has the highest likelihood of success.

Weed surveys should be conducted at the most likely period of the year where detection is likely, but prior to seed set of weeds.

The following weed survey regime will be applied during the construction phase:

1. Surveys and assessments by a suitably qualified ecologist will be made at intervals determined by a suitably qualified ecologist to –
 - a. identify, record and map any new weed species not previously recorded;
 - b. assess and map the extent of known weed infestations to determine if they are becoming larger and/or more significant such that control measures can be modified; and
 - c. review/assess the weed control works that have been conducted and to provide advice, where necessary, on the management of weeds.
2. Areas where weed control/eradication works have occurred (eg spraying) will be assessed no more than 3 months after the treatment occurred to determine if the measures implemented were successful.
3. Where spraying measures have been unsuccessful, repetition and/or modification of the weed control technique(s) is to be employed.

7.2 Staff and Contractor Weed Records

Staff and contractors will have been trained and inducted in the use of the Weed Record Form which is to be used when weed locations are identified in the field.

The compilation of these data will provide a record of weed locations and abundance which can be used to assess and appropriately allocate the necessary resources to weed management.

8 Review of Plan and Procedures

The objectives, responsibilities and management actions described within this Plan will need to adapt to new information and data about the wind farm site as they become available.

8.1 Plan Review

The Plan will be reviewed every 6 months as part of ongoing environmental operations. The detection of a significant infestation of a noxious weed on the site or another major event (eg wildfire) may warrant a Plan review at a shorter interval.

8.2 Detection of listed species

If during construction activities a previously unrecorded species listed on the *Environment Protection and Biodiversity Conservation Act 1999* is encountered the person taking the action must immediately cease activities at the location of the species.

A report, prepared by a suitably qualified ecologist, must be submitted to the Department that includes population characteristics, proposed avoidance and mitigation measures and where relevant, proposed offsets to compensate for unavoidable impacts.

Activities in that area can only recommence when directed to in writing by the Department.

9 Reporting

9.1 Training and Induction of staff and contractors

The records of staff and contractor inductions will be made available to the Department within 5 business days of the request.

9.2 Machine Log Books

A copy of all or selected Machine Log Books will be provided to the Department within 5 business days of the request.

9.3 Inspection Sheets

A copy of the vehicle/machinery inspection sheets (see Attachment 8) will be completed for vehicle. Record sheets of machine and equipment inspections can be provided to the Department within 5 business days of the request.

9.4 Weed Incursions

The Department will be notified within 5 business days of a weed being recorded in the wind farm site that is in addition to the weeds already present in the site AND it poses a threat to the habitat of Liawenee Greenhood, Crowded Leek Orchid and Clover Glycine.

9.5 Weed Management Plan Implementation Reporting

The results of weed management, including the spraying program, will be reported on the wind farm website at the completion of each program cycle.

Attachment 1. Significant Flora Species Information

The conservation significant flora species at the Cattle Hill Wind Farm site are –

- Liawenee greenhood (*Pterostylis pratensis*);
- Crowded leek orchid (*Prasophyllum crebriflorum*); and
- Clover glycine (*Glycine latrobeana*).

Liawenee Greenhood (*Pterostylis pratensis*)

The listing status of *Pterostylis pratensis* is:

- *Threatened Species Protection Act 1995* – vulnerable
- *Environment Protection and Biodiversity Conservation Act 1999* – Vulnerable

This species is endemic to the Tasmanian Central Highlands at altitudes of between 850 to 1,100 m, and extends over an area of approximately 400 square kilometres, occupying an area of 20 or more hectares in total. It grows in subalpine *Poa* tussock grassland which is very exposed, low and open, with patches of often stunted *Olearia algida* and *Hakea microcarpa* scrub on red–brown loamy to clay soils derived from basalt.

More recent information, based on the surveys from Cattle Hill and others conducted mainly by Hydro Tasmania Consulting (Stephen Casey pers. comm.), suggests that there are many more plants and subpopulations than previously thought for this species across its range. This includes for example large and geographically extensive populations at Liawenee Moor, Miena, Todds Corner to the east of Great Lake, St Patricks Plains, Shannon Lagoon and nearby Barren Tier, Penstock Lagoon and the eastern side of Lake Echo.



This species in the Cattle Hill Wind Farm site occupies areas of *Poa* (mainly *Poa clivicola*) dominated grasslands. Most of the native grasslands in the study site appear to have been woodland or forest in the past (based on the presence of tree stumps, some standing living trees, and some ‘stump’ holes in the ground where stumps have rotted or been burnt out), and have been induced through land clearing and tree decline. *Pterostylis pratensis* was found in these modified areas, but it was generally low in abundance compared to areas where the landscape was originally less likely to have been heavily wooded by trees (e.g. frost hollows,

areas of *Eucalyptus pauciflora* woodland as opposed to areas having standing *Eucalyptus delegatensis* trees).

Most of the plants and suitable habitat, within the proposed wind farm site, occur in an area reserved under a Conservation Covenant between the landowner and the State of Tasmania (reserved under the *Nature Conservation Act 2002*).

Pterostylis pratensis was up-listed on the *Threatened Species Protection Act 1995* from rare to vulnerable in early 2008 as part of the Act's 5-year review.

The species qualified for vulnerable under criterion D:

- population estimated to number less than 1,000 mature individuals.

The species is listed as Vulnerable on the *Environment Protection and Biodiversity Conservation Act 1999* for similar reasons.

Based on the population size and the greater abundance of this species on the Tasmanian Central Highlands (based on this survey and others in the region in the 2009-11 flowering period), this species may no longer satisfy criterion D for a 'threatened' listing under the EPBC and TSPA.

Crowded Leek Orchid (*Prasophyllum crebriflorum*)

The listing status of *Prasophyllum crebriflorum* is:

- *Threatened Species Protection Act 1995* – endangered
- *Environment Protection and Biodiversity Conservation Act 1999* – Endangered

Prasophyllum crebriflorum was listed in 2008 as endangered on schedules of the *Threatened Species Protection Act 1995*. The species qualified for endangered status under Criterion D:

- fewer than 250 mature individuals and the species was known from fewer than 5 locations occupying less than 1 hectare in total

The species is listed as Endangered on the *Environment Protection and Biodiversity Conservation Act 1999* for similar reasons.

Prasophyllum crebriflorum is a small, fleshy, terrestrial orchid with a single green onion-like leaf up to 26 cm long. The flowering stem emerges from the end of the leaf and has a spike of crowded, widely opening reddish-brown flowers (Jones 2003). It is recognised by its crowded, widely opening, reddish-brown flowers, the labellum recurved just above the middle, the apical tail-like part of the labellum comprising about one-third of the length of the labellum and the labellum callus being smooth.



Prasophyllum crebriflorum is most like *Prasophyllum incorrectum* but that is a species of lowland grassland habitats (Jones 2003).

The Threatened Species Section (2010) provides a description of habitat for this Tasmanian endemic species:

‘*Prasophyllum crebriflorum* is known from 2 native grasslands in the Surrey Hills area in north-western Tasmania, and from 2 native grasslands and grassy woodlands on the southern part of the Central Plateau.

In north-western Tasmania, *Prasophyllum crebriflorum* occurs in montane tussock grassland dominated by *Poa labillardierei*, with scattered patches of the woody shrub *Hakea microcarpa*. Some individuals grow in fairly dense patches of *Poa labillardierei* tussocks but most occur in naturally open areas of more bare ground with herbs such as *Herpolirion novaezelandiae* and *Trachymene humilis* (Jones 2003).

The species grows in brown clay loams derived from Tertiary basalts at altitudes of 660–670 m elevation, with an annual rainfall greater than 2000 mm (Jones 2003, Craven 1998).

On the Central Plateau, *Prasophyllum crebriflorum* occurs in native grassland dominated by *Poa gunnii* and in grassy woodland with a sparse overstorey of *Eucalyptus gunnii*. The Central Highlands subpopulations occur on soils derived from Jurassic dolerite, at altitudes of 900-1050 m elevation.’

The Central Highlands population (northern extent of St Patricks Plains; included with Figure 1 of Threatened Species Section 2010) was discovered by the authors of this document and as such they are very familiar with the species’ identification and habitat in the Central Highlands.

Surveys within the December 2010 flowering period for the species of a few sites by the authors of this document identified an additional 3 populations; Skittleball Plains near Miena (>25 plants over 1 hectare), St Patricks Plains (south-eastern extent of the plain; 1 plant) and north and north-west of Bronte Lagoon near Bronte (2 sub-populations occurring at either extent of the plains between 14 Mile Road and Bronte Lagoon; >25 plants over several hectares and 1 plant respectively).

These additional sites were found in one day of surveying in areas that were likely to support the species based on the similarity of those habitats to that in which the species occurs. These environments included open grassy plains (mosaic of native and non-native species), eastern alpine heath vegetation, highland and lowland *Poa* grasslands, rockplate grasslands on basalt and dolerite soils and damp soaks dominated by *Poa* and *Empodisma* surrounded by eastern alpine heathland vegetation. In addition to sites where the species was recorded, there were several sites examined where it was not recorded. These sites included Todds Corner, Miena, The Steppes, Liawenee Moor (several sites towards Lake Augusta and Lake Ada, native grasslands at Liawenee) and some creekline vegetation along the Marlborough Highway towards Bronte.

The Threatened Species Section (Drs Wendy Potts and Richard Schahinger) advised in January and February 2011 that there are now recorded locations for this species at Noel Plain and Netherbey Plain (north-western grasslands near Surrey Hills), Waratah and Barren Tier.

The Threatened Species Section (2010) noted that:

‘The likelihood of additional subpopulations of *Prasophyllum crebriflorum* being discovered outside its currently known extent of occurrence is considered to be relatively low given the past survey efforts. However, the recent detection and recognition of the species on the Central Plateau, about 100 km southeast of the Surrey Hills location, suggests that additional discoveries may still be made in potential habitat. It should be noted that even if additional subpopulations were to be discovered, significant range extensions or increased population estimates (e.g. orders of magnitude) are not likely because of the relatively limited extent of the high elevation grassland habitat.’

Clearly, previous assertions that this species is restricted to Surrey Hills or even to Surrey Hills and St Patricks Plains (e.g. Threatened Species Section 2010), are incorrect. The species is more widespread in the Central Highlands and higher elevated areas of the north-west where there is suitable habitat.

Clover Glycine (*Glycine latrobeana*)

The listing status of *Glycine latrobeana* is:

- *Threatened Species Protection Act 1995* – vulnerable
- *Environment Protection and Biodiversity Conservation Act 1999* – Vulnerable

Glycine latrobeana is a small perennial herb that belongs to the pea family. It grows up to 10 cm tall and is generally found in native grasslands and grassy woodlands. The plant flowers from September to December. It reproduces from seed and may also spread from its root system (rhizomes).

The leaves look a lot like common pasture clover; three rounded leaflets from a single centre. The leaves are hairless on the upper surface and have silky hairs underneath. The leaflets are as long as 20 mm and as wide as 12 mm. The pea-like flowers are mauve to purple and up to 6 mm long. Each flower stalk is upright and has 3-8 flowers crowded near the end of the stalk.



Glycine latrobeana has a wide distribution across Victoria, South Australia, New South Wales and Tasmania (Threatened Species Unit 2003) where it occurs mainly in grassland and grassy woodland habitats, less often in dry forests, and only rarely in heathland. Populations occur from sea level to around 1,200 m altitude (900 m in Tasmania).

Carter and Sutter (2010) note for the species:

‘The species has suffered an extensive decline in distribution and abundance due to widespread degradation and destruction of habitat. About 140 populations containing about 7,000 plants have been recorded since 1980, but recent estimates have not been made for many populations. Populations also fluctuate widely between seasons, especially following disturbance which appears to stimulate germination. Current threats include grazing, weed invasion and altered fire regimes.’

A significant issue for this species is the fluctuations in abundance from year to year of the number and extent of plants within and between sites. This makes surveys to locate the species and assessments of impact to the species from developments difficult. Surveys over several flowering seasons may be warranted within a single location to compile data that can then be used to accurately determine the distribution and abundance of plants within that location.

Carter and Sutter (2010) list the following as key sites for the species in Tasmania:

- Cape Portland Conservation Area (Tasmanian Parks and Wildlife Service). Last recorded 1991, abundance unknown.
- Pontville Rifle Range (Commonwealth). 1,200 plants (1996)
- Remarkable Rock Forest Reserve (Forestry Tasmania). >100 plants (1996).
- Wayatinah Forest Reserve (Forestry Tasmania). Last recorded in 1987, abundance unknown.

References

- Carter, O and Sutter, G. 2010. National Recovery Plan for Clover Glycine *Glycine latrobeana*. Department of Sustainability and Environment, Melbourne.
- Craven B. (1998). Vegetation Management Plan for Surrey Hills Grassland Reserves, Northwest Tasmania. Unpublished report to North Forests Burnie.
- Johnson K and Gilfedder L (2007). Vegetation assessment of Lake Echo. Non-forest Vegetation Group, Department of Primary Industries and Water, Hobart.
- Jones DL (2003). A revisionary treatment of four species of *Prasophyllum* R.Br. (Orchidaceae) loosely related to *P. correctum* D.L.Jones. *Muelleria* **18** 99-109.
- Jones, D.L. (2004). Two new species of *Prasophyllum* R.Br. (Orchidaceae) from Tasmania. *The Orchadian* **14(8)**: 372-377.
- Jones, D., Wapstra, H., Tonelli, P. & Harris, S. (1999). The Orchids of Tasmania. Melbourne University Press, Carlton South, Victoria.
- Threatened Species Unit (2003). Draft Listing Statement: Clover glycine *Glycine latrobeana*, Department of Primary Industries, Water & Environment, Hobart.

Threatened Species Section (2010). Listing Statement for *Prasophyllum crebriflorum* (crowded leek-orchid), Department of Primary Industries, Parks, Water and Environment, Tasmania.

Threatened Species Section (2017). Threatened Tasmanian Orchids Flora Recovery Plan. Department of Primary Industries, Parks, Water & Environment, Hobart.

Attachment 2a. Weed Recording Procedure

WEED RECORDING PROCEDURE – CONSTRUCTION PHASE

CATTLE HILL WIND FARM

This Procedure outlines the way *weed records* will be collected, handled, stored and used during the construction phase of the Catt Hill Wind Farm.

The Procedure is to be used in conjunction with the *Weed Record Form*.

INDUCTIONS AND TRAINING

Staff and contractors will be trained by a suitably qualified person in the below –

- Weed species that are known to occur in the wind farm site and local environment;
- Weed species that may be encountered in the wind farm site; and
- How to use the Weed Record Form and the process of advising the Site Manager.

Staff and contractors will also be trained in the use of the *Weed Record Form*.

Additional training will be provided to staff and contractors where there are specialised weed management related tasks associated with their roles on the site, including for example –

- Sourcing earth-based products to be brought to the wind farm site;
- Contractors who will be operating, moving and cleaning heavy machinery and equipment; and
- Contractors who will be excavating and handling earth-based material from the wind farm site.

Staff and contractors inducted in this Procedure will be noted (with the date of the induction) by the Site Manager for auditing purposes.

Resources such as posters, booklets and access to a botanical expert is to be provided to ensure that weed identification is accurate and timely.

RECORDING WEED LOCATIONS

To maximise the likelihood of controlling and/or eradicating weeds in the wind farm site it is important that their detection in or near the wind farm site is recorded as early as possible. Locations of weeds, weed patches and weed infestations will be recorded using the *Weed Record Form*.

Weed Record Forms will be available to site staff and contracted workers in the glove box or similar of vehicles/machinery or from the site office.

WEED DISTRIBUTION AND LIFE CYCLE

The distribution of a weed(s) in a location should be classified as one of the following –

- a. single location (a few plants)
- b. patch (an area of about or less than 2x2m)
- c. extensive patch (an area more than 2x2m but less than 5x5m); or
- d. infestation (an area covered or occupied by the weed(s) greater than 5x5m)

Comments about each weed location – eg disturbed soil area, roadside location, on stockpile



etc – should be made so that the reason for the weed occurrence may also be identified.

Whether the weed is flowering or seed is present should be flagged as yes or no on the *Weed Record Form*.

REPORTING WEED DISTRIBUTION

The completed *Weed Record Form* is to be provided in a timely manner to the Site Manager or their delegated representative.

DATA HANDLING AND MAPPING

The record is to be entered into a GIS or similar for mapping and planning for weed spraying and remediation works.



Attachment 2b. Weed Record Form

WEED RECORD FORM

CATTLE HILL WIND FARM



Observer Name: Observation Date:.....

Reporters Name (if different): Reporting Date:.....

WHAT IS THE WEED?

Weed Name (s) –

Weed distribution (circle)– single location (a few plants) patch (<2x2m) extensive patch (>2x2m) infestation (>5x5m)

Comments about weed location – eg disturbed soil area, roadside location, on stockpile etc

Is the weed flowering? Yes No

Is there seed present? Yes No

WHAT IS THE LOCATION OF THE WEED(s)?

Location Description

Grid Coordinates:mEmN

Datum (GDA94/AGD66/WGS84): Mapping Method (i.e. GPS):.....

Estimated or GPS Accuracy (m):.....

SAMPLES AND PHOTOGRAPH

Was a sample collected and species verified by an expert? Yes No

Photograph taken? Yes No

If Yes, provide photograph file to the Site Manager with this form.

RECORD CONFIRMATION OF RECEIPT

Site Manager advisory date:

Signed:

DATA ENTRY CONFIRMATION

Date record entered into database:

Signed:



Attachment 3. Weed Spraying Program Work Plan – example spreadsheet

Date -

Cattle Hill Wind Farm
Weed Spraying Program Work Plan

Zones on Maps	Weeds Present	Actions required	Responsible person	Estimated start date	Estimated completion date	Tasks conducted	Date Completed	Signed

NOTES

Issued by -

Checked by -

Attachment 4. Guideline for Safe and Effective Herbicide Use near Water



Photograph: Lynn Broos

Guidelines for Safe and Effective Herbicide Use Near Waterways

The control and management of weeds near waterbodies is a challenge faced by many landholders across Tasmania. Waterbodies are particularly sensitive to herbicide contamination, so the decision to apply herbicides in the vicinity must be taken with great care.

Weed control near waterbodies requires a long-term commitment to eradication, perhaps 5–10 years or more, as the seed banks of many 'woody' weed species (eg blackberries, gorse) may remain viable for decades. Weeds can also spread along watercourses, making their control difficult. A staged, planned approach to weed control, alongside a program to re-establish native riparian species, is necessary to ensure the safe restoration of riparian areas. Restoring native vegetation helps to reduce the presence of weed species, ensures the stability of banks, shades the waterway (which helps prevent future weed invasion), and provides habitat for local fauna.

Definitions

For the purposes of this guideline, the following definitions apply:

Riparian land	Any land that adjoins, directly influences, or is influenced by a body of water at any time of the year.
Waterbody	Includes natural watercourses (streams, creeks, rivers), natural wetlands, ponds, lagoons, constructed drainage channels, dams and ponds, reservoirs and lakes.
Permanently inundated/perennial	These areas have water all year round.
Occasionally inundated/intermittent	These areas have water some time of the year.
Rarely inundated/ephemeral	These are areas that rarely contain water (eg areas that flood on rare occasions).
Toxicity	The inherent poisonous quality/qualities of a substance, measured by what size dose is likely to cause harm (acute toxicity is measured by the amount of active ingredient - mg/kg live body weight - required to kill 50% of a test group of animals - this is called LD50).

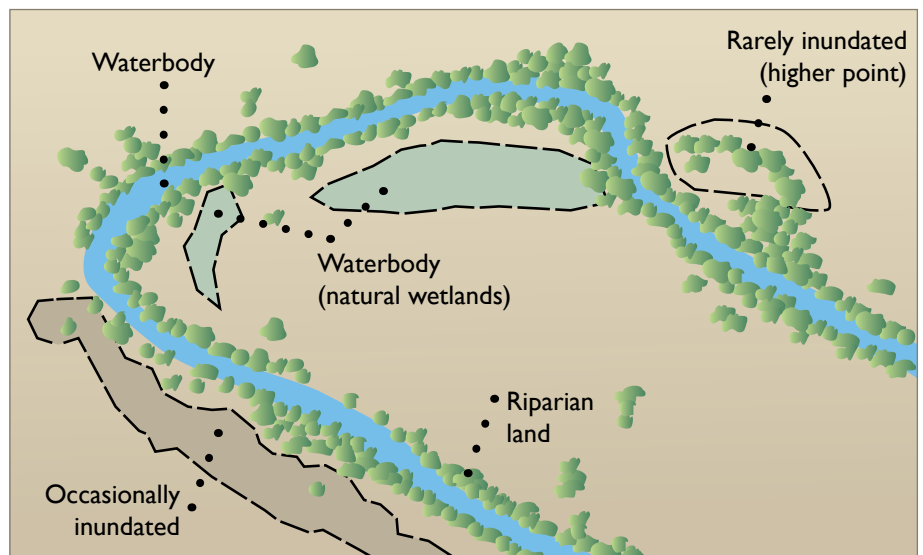


Figure 1: Appropriate and effective herbicide usage near water requires consideration of specific situations

A Planned Approach

Assess your site

What type of waterbody is it?

If your site is permanently inundated, you need to consider very carefully the choice of herbicide, recognising the risk to your aquatic ecosystem and the danger that the herbicide may pose to the surrounding environment. You also need to identify points of access to the site.

If your site is occasionally or rarely inundated, choose a time when the chance of rainfall is low and therefore the risk of runoff contaminated with herbicide is likely to be low. Figure 1. illustrates the different zones found in aquatic situations which may affect herbicide use.

What types of weeds are present?

Identify the species of weed and the extent of the infestation. Table 2 details the recommended herbicide control for a number of riparian weeds, the method and time of year for application. It also suggests alternatives to the use of chemicals.

Do the weeds have value at the site?

Consider whether the weeds are serving a useful purpose at the site. They may be acting as a buffer to control erosion, or as a filter to promote water quality. They may have a value to animal species as a source of food or shelter.

If you believe that you have native plants or animals that might be adversely affected by your proposed weed control, seek professional advice.

You may be able to stage the removal of weeds to minimise any impact on erosion or on animal life. You will almost certainly need to restore the habitat once weeds have been eradicated.

Are native species present at the site?

Identify any native plant species at your site. You may need to protect these species from overspray or mark them to prevent accidental spraying. These native plants will be the starting point to restoring the riparian zone.

Choose your control method

Landholders should always consider non-chemical solutions as a preferred option before deciding to use herbicides. These include biological control (eg by introduction of gorse mite, see photo below), slashing, mulching, controlled grazing (controlling timing, intensity and frequency), or hand removal. Often a combination of chemical and non-chemical methods is most appropriate. Whichever method or combination of methods is used, it is important to consider the potential negative impacts on the environment and limit these as much as possible.



Biological agents such as Gorse spider mite may be options for use near waterways, courtesy of Tasmanian Institute of Agriculture.

Understanding herbicides

Herbicides are designed to control and eradicate pest plants ('weeds'). However, it is important to realise that many herbicides have toxic effects in aquatic ecosystems. Native plants, invertebrates, frogs and fish may be harmed by herbicides. The inappropriate use of herbicides may also cause significant risks to human health where water is pumped from a bore for domestic use, or flows to reservoirs.

Herbicides can enter waterbodies either directly through spray or spray drift, or they can move into waterbodies via surface water run-off or leaching and sub-surface draining.

Herbicides can be broadly classified according to their chemical structures and modes of action. Table 1 shows the three major types of herbicide.

Table 1: Herbicide classification

Pre-emergent (residual)	These herbicides are designed to inhibit the germination of pest plants. They are therefore applied before the pest plant germinates and are often residual in the soil for long periods. They are generally not considered to be safe for use near waterbodies and are not recommended for use due to their persistence in the environment.
Knockdown non-selective	These herbicides are designed to be applied directly to the target pest plant, either through being sprayed onto foliage or applied directly to the cambium layer using any of the direct application methods described in Table 3. They may vary in mode of action and some may persist as residues in the environment.
Selective	Selective herbicides are designed to act on only one type of pest plant. Generally, selective herbicides will control either broadleaf (eg capeweed), grasses (eg phalaris) or woody weeds (eg broom). These herbicides are useful when the focus may be on controlling a particular weed species (eg phalaris amongst native shrubs). These herbicides may persist as residues in the environment.

Herbicides applied to the edge of a waterbody, or in wetted areas around its edge, must be registered for use in aquatic environments by the Australian Pesticides & Veterinary Medicines Authority (APVMA).

Consider the tools available to mitigate against offsite movement of your pesticide

PIRI-Tas

PIRI-Tas is a simple screen tool that predicts the off-site migration potential of pesticides into surface or ground-water. PIRI-Tas assesses both the likelihood of off-site-migration and the risk to different species based on the toxicity of the pesticide to a range of aquatic organisms.

PIRI-Tas is a risk indicator and uses a risk-based approach to decision making by taking into consideration a range of factors associated with site conditions, soil and environmental scenarios, pesticide properties, application rates and time of spraying as well as considering impacts on target species being protected by receiving environments. PIRI-Tas outputs can also be used to construct annual spray schedules to assist with future planning.

PIRI was first developed by CSIRO and is being used both nationally and internationally by a number of organisations. PIRI-Tas CD's and onsite training are available for free through the DPIPWE to key users of chemical pesticides, including those in the agriculture, forestry, amenity, glasshouse and municipal sectors.

Further information is available at <http://www.dpipwe.tas.gov.au/inter.nsf/WebPages/SSKA-7JA3N4?open>

Consider integrated pest management (IPM)

Integrated pest management (IPM) is a planned approach that coordinates environmentally acceptable methods of pest control with careful and minimal use of toxic pesticides. IPM programs are based on a comprehensive assessment of local conditions, including factors such as climate, season, the biology of the pest species, and government regulations.

Strategies employed may include the staged removal of weeds, biological control and re-planting of riparian areas with native species to discourage the regeneration of weeds.

Consult and plan

Draw up a calendar for action. The time of year when herbicides will be most effective on the weed should be a major influence on the make-up of this calendar. Herbicides are generally most effective during the growing season of the weed rather than when it is dormant or approaching dormancy. The staged removal of weeds over several seasons may be less disturbing to your aquatic environment and minimise any adverse impact on fauna.

Consult with neighbours who may be affected by your weed control operation, especially if you think there is any risk of spray drift to adjoining properties or downstream. You may also decide to seek advice from experts before taking further action, or approach commercial spray contractors to assess your particular situation.

If the work involves a significant length of river or multiple properties it is advisable to develop a plan that covers all aspects of the weed control work and restoration, including potential risks. You should also be mindful of:

- feasibility/practicability of the work
- physical characteristics of the job site
- optimal pest control method, including alternatives to herbicides
- characteristics of the herbicide (physical, chemical and environmental)
- buffer zones
- the possibility of spray drift and other off-target migration
- weather conditions.

Do you need to spray?

It is recommended that only trained, licensed contractors carry out spraying operations near waterbodies because of the sensitivity of these environments. Check that they have experience and an understanding of the issues around using herbicides near aquatic environments.

The following points are critical to the application of herbicides near waterbodies:

- Always follow the label
- When you are working near the edge of a waterbody, direct the spray away from the waterbody where possible.
- Spray only to the extent of covering foliage with droplets.
- Spray when weather is calm; strong winds may carry herbicide drift into waterbodies.
- Use a flat fan nozzle and a low pump/spray pressure to reduce the likelihood of spray drift.
- Do not spray when rainfall is forecast within four hours as herbicide can be washed off the pest plant and run off into aquatic ecosystems.

Appropriate herbicides and application

The type of weed problem will determine both the type of herbicide and its application method. Table 2 shows recommended herbicide and application methods for some common weeds, along with alternatives to herbicide use. Table 3 illustrates application techniques and equipment need to undertake control works.

Uses described in this table are either covered by the respective product label or Off-label Permit No. 13160 issued by the Australian Pesticides and Veterinary Medicines Authority.

Table 2. Common weeds and recommended treatment and herbicides

Area	Weed	Permitted Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Recommended Herbicide Control Technique	Non-chemical Alternatives
Permanently inundated/ perennial	Submerged and partially submerged plants				
	Parrot's feather (<i>Myriophyllum aquaticum</i>)	Glyphosate (registered for aquatic use only) Don't add surfactants!	Roundup Biactive® or Weedmaster Duo®	Foliar spray	Hand removal and excavation (with roots/rhizomes) can be used as part of a well planned approach. Care must be taken to avoid losing fragments
	Egeria (<i>Egeria densa</i>)				
	Canadian Pondweed (<i>Elodea canadensis</i>)				
	Cumbungi (<i>Typha</i> spp)				Hand removal (small plants) Excavation (with roots/rhizomes) Cultivation (expose roots/rhizomes to frosts) Cut into soil surface regularly (to cut rhizomes) Drowning by cutting stems and leaves below water surface
	<i>Glyceria</i> (syn. <i>Poa aquatica</i> or reed sweet grass) (<i>Glyceria maxima</i>) NB Take extreme caution not to spread <i>Glyceria</i> seed through soil transport (eg on machinery)			Foliar spray (combine with dense local native species revegetation for long-term results through stream shading) Wiper	Clearance or drainage of growth area (combine with dense re-vegetation of local native species for long-term results through stream shading)
	Woody weeds				
	Blackberry (<i>Rubus fruticosus</i>)	Glyphosate (registered for aquatic use only) Don't add surfactants!	Roundup Biactive® or Weedmaster Duo®	Cut and paint with Roundup Biactive® or Weedmaster Duo®	Hand removal (small plants) Controlled grazing (goats or sheep only) can be effective Bio-control (eg gorse mite, blackberry rust) where other techniques are not suitable Gorse mulching combined with follow-up grazing and revegetation on mulched sites
	Gorse (<i>Ulex europaeus</i>)				
	Trees				
	Hawthorn (<i>Crataegus monogyna</i>)	Glyphosate (registered for aquatic use only) Don't add surfactants!	Roundup Biactive® or Weedmaster Duo®	Cut and paint Drill or stem injection Axe or frill and paint Foliar spray hawthorn and crack willow (only spray to a height of 2m)	Hand removal (small plants) Controlled grazing can assist in limiting Hawthorn regrowth and thicket density
	Crack Willow (<i>Salix fragilis</i>)				
	Sycamore (<i>Acer pseudoplatanus</i>)				



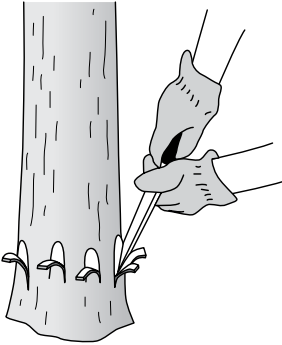
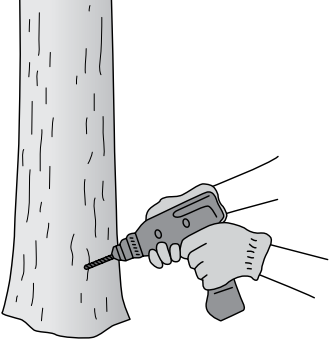
The product trade names in this publication are supplied on the understanding that no preference between equivalent products is intended and that the inclusion of a product does not imply endorsement by DPIPWE over any other equivalent product from another manufacturer.

Table 2. Common weeds and recommended treatment and herbicides continued

Area	Weed	Permitted Herbicide (active ingredient)	Example of commercial product (concentration of active ingredient)	Recommended Herbicide Control Technique	Non-chemical Alternatives
Occasionally or rarely inundated sites	Woody weeds				
	Blackberry (<i>Rubus fruticosus</i>)	Metsulfuron-methyl Triclopyr Triclopyr + Picloram	eg Associate or Brush-Off® eg Garlon 600® eg Grass-up™ or Grazon Extra®)	Foliar spray	Hand removal (small infestations) Controlled grazing by goats can be effective Bulldoze and deep cultivate (in suitable circumstances) Bio-control (a rust with limited impact)
	Gorse (<i>Ulex europaeus</i>)	Glyphosate (registered for aquatic use only) Triclopyr Triclopyr + Picloram	eg Roundup Biactive® or Weedmaster Duo® eg Garlon 600® eg Grass-up™ or Grazon Extra®)	Cut and paint Foliar spray, preferably Garlon 600®	Mulching/bulldozing/slashing combined with follow-up grazing and revegetate on mulched sites Bio-control (e.g gorse mite) where other techniques are not suitable
	English Broom (<i>Cytisus scoparius</i>)	Glyphosate (registered for aquatic use only). Metsulfuron-methyl Triclopyr herbicide Triclopyr + Picloram	eg Roundup Biactive® or Weedmaster Duo® eg Associate or Brush-Off® eg Garlon 600® eg Grass-up™ or Grazon Extra®)	Cut and paint. Foliar spray, preferably Garlon 600® (only if under 2m in height)	Hand removal. Mechanical removal (eg rip or bulldoze) Mulching/bulldozing/slashing of hawthorn combined with follow-up grazing and revegetate on mulched sites
	Montpellier Broom (<i>Genista monspessulana</i>)				
	Trees				
	Hawthorn (<i>Crataegus monogyna</i>)	Glyphosate (registered for aquatic use only). Metsulfuron-methyl Triclopyr herbicide Triclopyr + Picloram	eg Roundup Biactive® or Weedmaster Duo® eg Associate or Brush-Off® eg Garlon 600® eg Grass-up™ or Grazon Extra®)	Cut and paint Foliar spray, preferably Garlon 600® (only if under 2m in height)	Hand removal Mechanical removal (eg rip or bulldoze) Mulching/bulldozing/slashing of hawthorn combined with follow-up grazing and revegetate on mulched sites
	Sycamore (<i>Acer pseudoplatanus</i>)	Glyphosate (registered for aquatic use only)	eg Roundup Biactive® or Weedmaster Duo®	Stem injection, cut and paint (plus foliar spray for young plants)	Hand removal Bulldoze and revegetate Plough-in small plants
	Herbaceous plants				
	Ragwort (<i>Senecio jacobaea</i>)	MCPA Metsulfuron-methyl	eg MCPA 500 or L.V.E Agritone eg Associate or Brush-Off®	Foliar spray	Hand removal Controlled grazing (sheep) Ploughing/cultivation (combine with dense revegetation of local native plants for long-term results through shading)
	Paterson's curse (<i>Echium plantagineum</i>)				
	Thistles (eg <i>Cirsium arvense</i>)				

More information on weed identification and weed control can be found at www.dpipwe.tas.gov.au/weeds

Table 3. Herbicide application techniques

Illustration	Method	Type of weed	Equipment Required	Notes
	Foliar Spray	Herbaceous plants, Woody weeds	Knapsack Vehicle mounted tank Herbicide mix Personal protective equipment (see product label)	Ensure herbicide is being applied at right concentration and rate to cover the foliage of the pest plant with fine droplets and avoid run-off. A flat fan nozzle and low pump pressure will assist in reducing spray drift
	Cut and paint	Woody weeds, shrubs and trees	Saw, chainsaw, loppers Herbicide mix Personal protective equipment (goggles and gloves as a minimum) Brush/sponge for herbicide application	Ensure herbicide is applied quickly to cut stump (within 15 seconds in most cases) Apply during active growth period of plant for best results Do not apply herbicide to the point of run-off
	Frilling	Shrubs and trees	Axe, hatchet Herbicide mix Personal protective equipment (goggles and gloves as a minimum) Brush for herbicide application	Frill trunk thoroughly, also treat major surface roots where visible Expose sapwood and apply herbicide to it immediately For deciduous species, apply during active growth period
	Drill and poison	Shrubs and trees	Drill Application bottle, injection gun Herbicide Personal protective equipment (goggles and gloves as a minimum)	Drill to sapwood only and apply herbicide to drill hole immediately Drill and fill major surface roots where appropriate For deciduous species, apply during active growth period

Illustrations: Brett Littleton ILS Design Unit

After Spraying

Clean up

Equipment should always be cleaned in a safe location where spills can be contained and will not result in environmental harm. Using water to clean equipment will further dilute any residual herbicide to low levels, and the resulting solution is best sprayed onto a lawned area or bare ground taking the following precautions:

- Do not apply wash-water to the point of saturation so that run-off occurs.
- Do not apply wash-water along boundary fence lines as this will increase the chance of herbicides escaping from your property.
- Do not dispose of wastewater into areas where children play, or pets have access, as low levels of herbicide are still likely to be present.
- Do not deposit wastewater where it will run into waterways, drainage lines or stormwater systems.

Disposal

If you do happen to have surplus spray mix or herbicide waste, label it with the herbicide name, including any risk and safety information displayed on the original label. Store it safely until it can be disposed of appropriately. Contact a chemical collection organisation eg Chem Clear.

You must follow label directions for the disposal of wastes and herbicide containers. Only dispose of waste herbicides at authorised collection centres, such as licensed waste disposal centres.

Do not dispose herbicide waste:

- through sewerage systems, where it can interfere with the sewage treatment process
- down the drain or gutter; where it can pass through the stormwater system and into waterways
- to landfill via dumping or domestic waste, as it can contaminate soil and leach into groundwater and stormwater.

Monitor, evaluate and follow up

Monitor

Observe and keep records of your weed problems and the impact of any measures you take to control them. This could involve:

- the use of visual records, including property maps, aerial and other photography
- the use of a calendar or diary to record when actions were taken.

Evaluate

Evaluate the success of any weed control program by considering the current extent of the weed problem and reviewing your control measures. Important questions might include:

- Is my weed control work going to plan, or do my goals need reviewing?
- What is the appropriate weed control measure now?
- Is there a need for external (expert) assistance?

Follow up

Re-implement weed control actions following the results of your monitoring and evaluation. Continue to monitor this follow-up work, and so begin an ongoing cycle of weed management.

These guidelines have been updated by Kiowa Fenner and are based on guidelines prepared by Michael Noble and Janice Miller.

Important disclaimer

To the extent permitted by law, the Tasmanian Department of Primary Industries, Parks, Water and Environment (including its employees and consultants) excludes all liability to any person for any consequences, including but not limited to all losses, damages, costs, expenses and any other compensation, arising directly or indirectly from using this material (in part or in whole) contained in this publication



Tasmania
Explore the possibilities

CONTACT DETAILS

Invasive Species Branch

1300 668 550

www.dpipwe.tas.gov.au/weeds

Attachment 5. Weed Information References

WEBSITES

Department of Primary Industries, Parks, Water and Environment

<http://dpiwpe.tas.gov.au/invasive-species/weeds>

Tasmanian DPIWPE webpage with information about weed management, identification and control.

Australian Government – Weeds in Australia

<http://www.environment.gov.au/biodiversity/invasive/weeds/>

Australian Government webpage with information about weed management, identification and control.

Dennis Morris Weeds Database

library.dpiwpe.tas.gov.au/public/weeds/

Dennis Morris (1924-2005) was the Weed Officer with the Dept of Agriculture from 1961 to 1985, and an honorary member of the Tasmanian Herbarium for more than 30 years. He authored and illustrated handbooks and other publications on the topic of Tasmanian weeds. This is a database of his illustrations compiled from original drawings held by the agency.

Weeds Australia - Home of the National Weed Plan Executive Committee

weeds.ala.org.au/

This site has been created by the National Weeds Plan Executive Committee to promote access to key weed policies, regulations, current issues, national initiatives, research, extension, training and personnel. A valuable and useful addition to this site has been a database of all declared weeds in Australia searchable by weed name and State.

Australian Pesticides and Veterinary Medicines Authority

<http://www.apvma.gov.au/>

The APVMA operates the Australian system which evaluates, registers and regulates agricultural and veterinary chemicals. Before an agricultural or veterinary chemical product can enter the Australian market, it must go through the APVMA's rigorous assessment process to ensure that it meets high standards of safety and effectiveness. This site documents information about the registration status of herbicides, current herbicide reviews and extensive information about the registration of herbicides.

Australian National Botanic Gardens

www.anbg.gov.au

Contains extensive information, databases and images on plants (including weeds), botany and horticulture.

Tasmanian Herbarium

http://www.tmag.tas.gov.au/collections_and_research/tasmanian_herbarium

The Tasmanian Herbarium forms a part of the Tasmanian Museum and Art Gallery. This site provides information about the Tasmanian Herbarium and accesses the Tasmanian Vascular Plant Census, a database of vascular plants (including weeds) recorded from Tasmania.

Tasmanian Farmers and Graziers Association (TFGA)

www.tfga.com.au

The TFGA is the peak farmer representative organisation in Tasmania.

University of Florida, Centre for Aquatic and Invasive Plants

aquat1.ifas.ufl.edu/welcome.html

The Invasive Plant Information Retrieval System contains excellent aquatic plant information and images.

BOOKS

Auld, BA & Medd, RW (1987)

Weeds - An Illustrated Botanical Guide to the Weeds of Australia

Inkata Press, Melbourne

Blood, K (2001)

Environmental Weeds: A Field Guide for SE Australia

CH Jerram & Assoc and CRC for Weed Management Systems

Goninon, C (2000)

Weeding Roadsides - A Guide to Effective Weed Management on Roadsides

Department of Primary Industries, Water and Environment, Tasmania

Groves, RH; Shepherd, RCH & Richardson, RG (1995)

The Biology of Australian Weeds - Volume 1

RG and FJ Richardson, Melbourne

Knox, J (Ed) (1999)

The Glove Box Guide to Grass and Legume Identification in Tasmanian Pastures

Department of Primary Industries, Water and Environment, Tasmania

Lamp, C & Collet, F (1989) (3rd Edition)

Field Guide to Weeds in Australia

Inkata Press, Melbourne

Lane, P; Morris, D & Shannon, G (1999)

Common Grasses of Tasmania - An Agriculturalists' Guide

Tasmanian Environment Centre Inc, Hobart

Moerkerk, MR & Barnett, AG (1998)

More Crop Weeds

RG and FJ Richardson, Melbourne

Muyt, A (2001)

Bush Invaders of South-East Australia: A Guide to the Identification and Control of Environmental Weeds found in South-East Australia

RG and FJ Richardson, Melbourne

Sainty, GR & Jacobs, SWL (1994) (3rd Edition)

Waterplants in Australia - A Field Guide

Sainty and Associates, Darlinghurst, NSW

Attachment 6. Hygiene Protocols Movement of soil and gravel

HYGIENE PROTOCOLS

FOR MOVEMENT OF GRAVEL AND SOIL BETWEEN SITES AND ROAD CONSTRUCTION AND MAINTENANCE

BACKGROUND

Movement of infected gravel, sand, soil or water during road construction and maintenance is a key way that *Phytophthora cinnamomi* (root rot) is introduced to new areas. The presence of Chytrid frog disease is also strongly associated with the presence of gravel roads. Quarries and landscaping nurseries are major dispersal points for soil borne pathogens such as *Phytophthora*.



High risk activities for the spread of pest and diseases include moving and distributing soil and road construction and maintenance. Photos courtesy of Forestry Tasmania.



GENERAL HYGIENE PROCEDURE

- Follow *Hygiene protocols for vehicles and heavy machinery*.
- Apply rigorous planning and hygiene protocols (including **Disinfection**) when working in Phytophthora Management Areas (refer to Appendix B), areas with endemic or threatened frog species (refer to Appendix D) or remote areas and where it is not possible to *thoroughly* clean and dry vehicles, heavy machinery and equipment between sites. Ensure you **Check Clean** and **Disinfect before you arrive** and **between sites**.
- When taking gravel, fill, soil or similar material to a Phytophthora-free site that has vegetation sensitive to Phytophthora (see next point), ensure that it is from a quarry that is certified as free of Phytophthora.

This can be done by either sourcing the material from a quarry that has been certified within the last 12 months as Phytophthora-free or by arranging a weed and disease survey to provide current certification. As it is not compulsory for quarries to undertake weed and disease surveys, payment for the survey will need to be negotiated between the quarry manager and the person purchasing the quarry material.

The weed and disease survey required for certification can be undertaken by some environmental consultants and Forestry Tasmania. Contact DPIPWE Biodiversity Monitoring Section within Wildlife and Conservation (ph (03) 6233 6556) or Forestry Tasmania, Biology and Conservation section for information on this process.

While there is currently no register of Tasmanian quarries that have been inspected and certified as Phytophthora-free this may be possible in the future if there is sufficient demand.

- For species and forest communities sensitive to Phytophthora refer to pages 5 – 8 of *Flora Technical Note No. 8: Management of Phytophthora cinnamomi in production forests* (FPA 2006) on the Forest Practices Authority website - www.fpa.tas.gov.au (then search for Flora Technical Notes)
- For information on maintaining quarries free of Phytophthora refer to pages 12 – 14 of *Flora Technical Note No. 8: Management of Phytophthora cinnamomi in production forests* (FPA 2006) on the Forest Practices Authority website - www.fpa.tas.gov.au (then search for Flora Technical Notes)
- For more detailed information on hygiene actions during road construction and maintenance refer to pages 10 - 11 *Flora Technical Note No. 8: Management of Phytophthora cinnamomi in production forests* (FPA 2006) on the Forest Practices Authority website - www.fpa.tas.gov.au (then search for Flora Technical Notes)
- Wherever possible take water for road construction/maintenance from a treated town water supply or from a waterway within the sub-catchment where the road is being constructed and avoid dumping this water into waterways or wet or boggy areas.



- Try to minimise run-off when watering gravel roads during construction and maintenance.
- Undertake road maintenance wherever possible in dry weather.
- Roads should be kept free of potholes to prevent puddles forming and potentially harbouring freshwater diseases.
- Where earth, stones, boulders, shingle, metal, minerals, gravel, silt or sand are being extracted from a waterway, they should be piled on high ground near to where they were extracted and be left to drain back into the waterway. Prevent drainage into a new waterway.



Rutting of roads, particularly in winter, may create potholes that can harbour freshwater diseases. Photo courtesy of Forestry Tasmania.

Attachment 7. Hygiene Protocols Heavy Machinery and Vehicles

HYGIENE PROTOCOLS FOR VEHICLES AND HEAVY MACHINERY

The following protocols have been adapted from the *Tasmanian Washdown Guidelines for Weed and Disease Control: Machinery, Vehicles and Equipment* (DPIPWE, Edition 1, 2004) and *Flora Technical Note No. 8: Management of *Phytophthora cinnamomi* in production forests* (FPA 2006). For more information refer to the full guidelines at:

- DPIPWE website - www.dpipwe.tas.gov.au (then follow links to Weeds Pests and Diseases, Plant Diseases, Phytophthora, Phytophthora Publications, Washdown Procedures).
- Forest Practices Authority website - www.fpa.tas.gov.au (then search for Flora Technical Notes).

BACKGROUND

Passenger vehicles and heavy machinery (including trucks, tractors, mowers, slashers, trailers, backhoes, graders, dozers, excavators, skidders and loaders) are major vectors for the spread of soil borne fungal diseases such as *Phytophthora cinnamomi* (root rot) and terrestrial weeds.

As a minimum, apply the standard **Check Clean Dry** protocols (page 14) to all your clothing, footwear, equipment, vehicles and heavy machinery **before** going into the field.

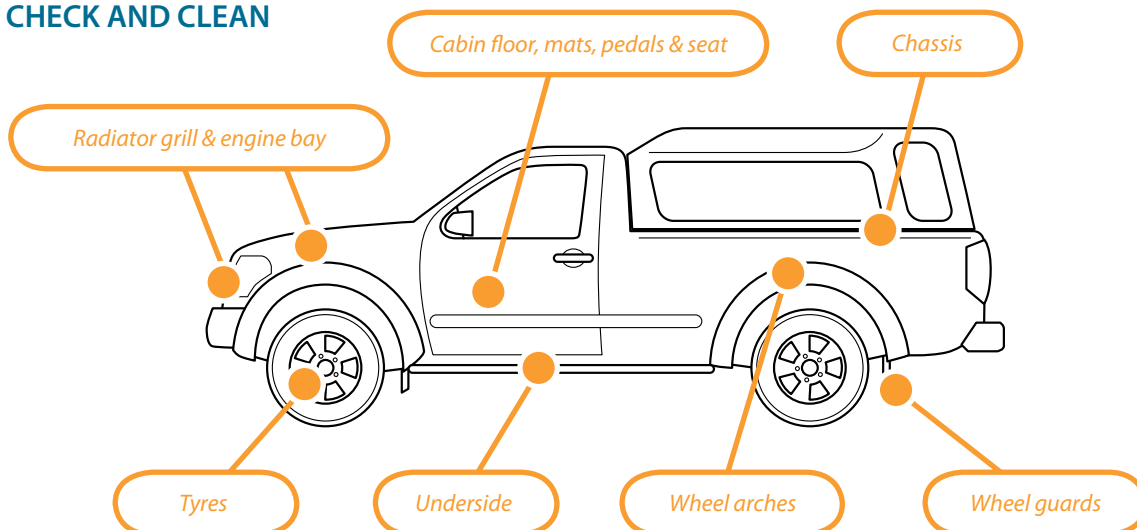
Vehicles and heavy machinery that stay on formed and sealed roads have a low risk of spreading disease and weeds and on-site cleaning is not essential. However on-site vehicle washdown is particularly important when using vehicles and machinery off (sealed) roads.

Apply rigorous planning and hygiene protocols that include **Disinfection** when working in *Phytophthora* Management Areas (refer to Appendix B), areas with endemic or threatened frog species (refer to Appendix D) or remote areas and where it is not possible to *thoroughly* dry vehicles, heavy machinery and equipment between sites. Ensure you **Check Clean and Disinfect before you arrive and between sites.**

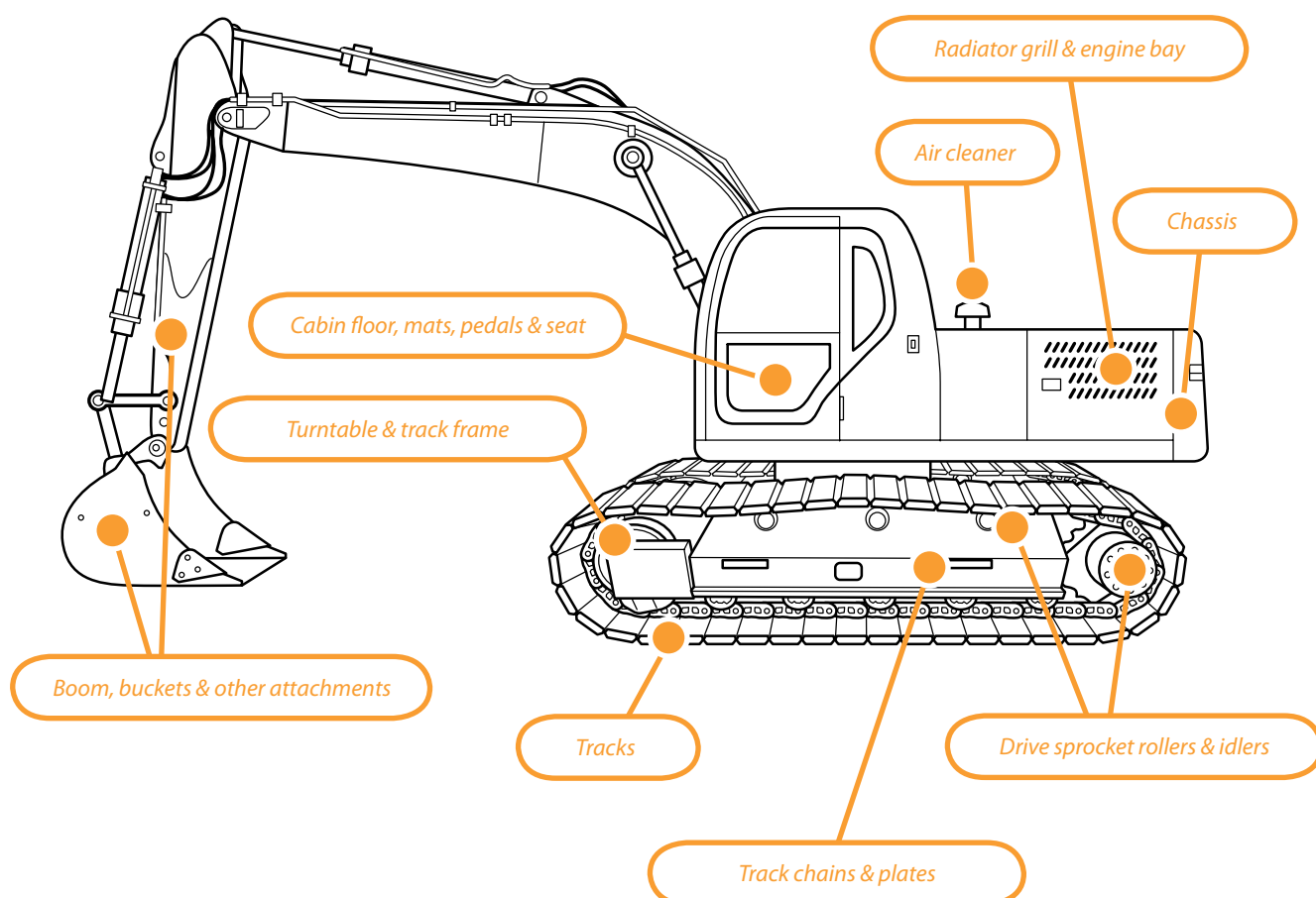
BEFORE GOING INTO THE FIELD

- Consult with the relevant land manager to identify any specific hygiene protocols that apply to vehicles and machinery.
- Inspect vehicles and heavy machinery for mud, soil, plant material and debris and ensure they are clean and dry. Pay particular attention to the underside, tracks, rollers, tyres, wheel arches, guards, blades, bucket, other attachments, spare tyres, chassis, engine bay, radiator and grill, tray, cabin, foot wells, pedals, mats and seats.

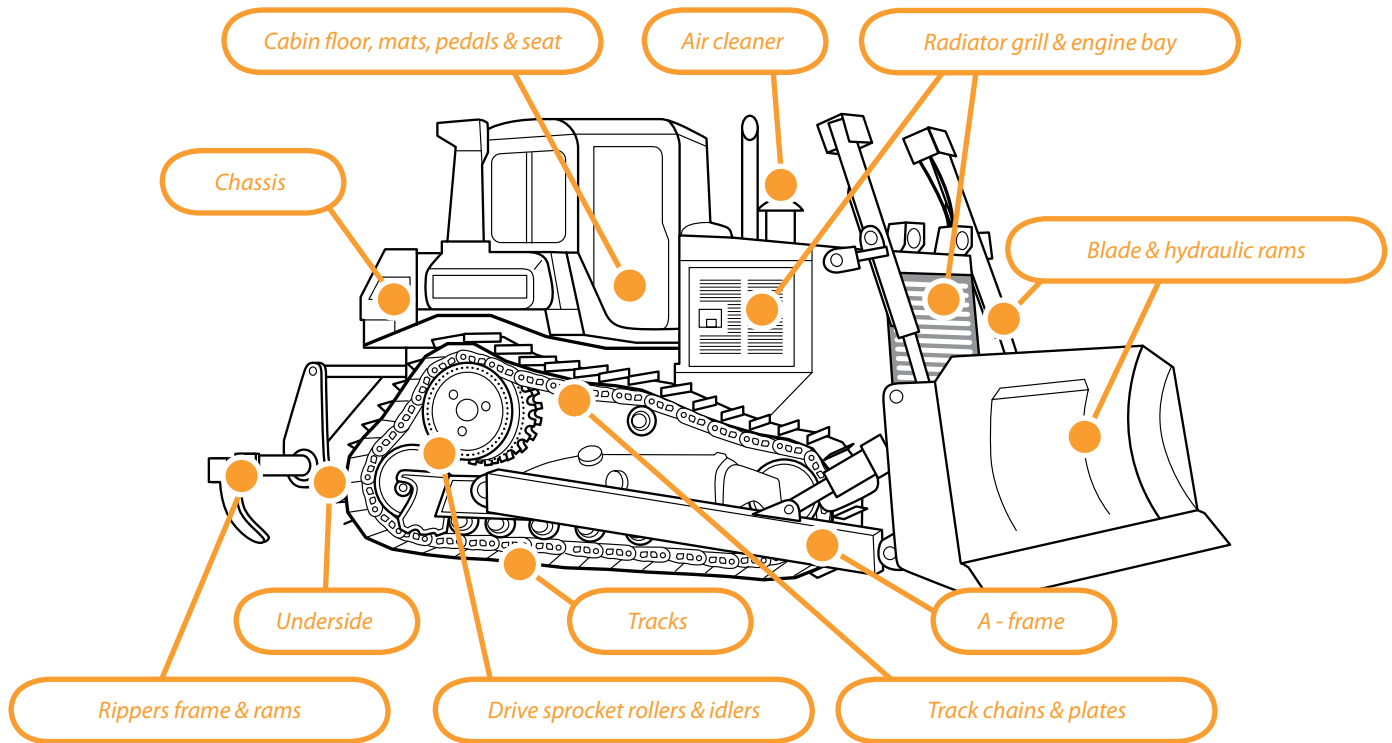
4WD VEHICLE WITH KEY SPOTS TO CHECK AND CLEAN



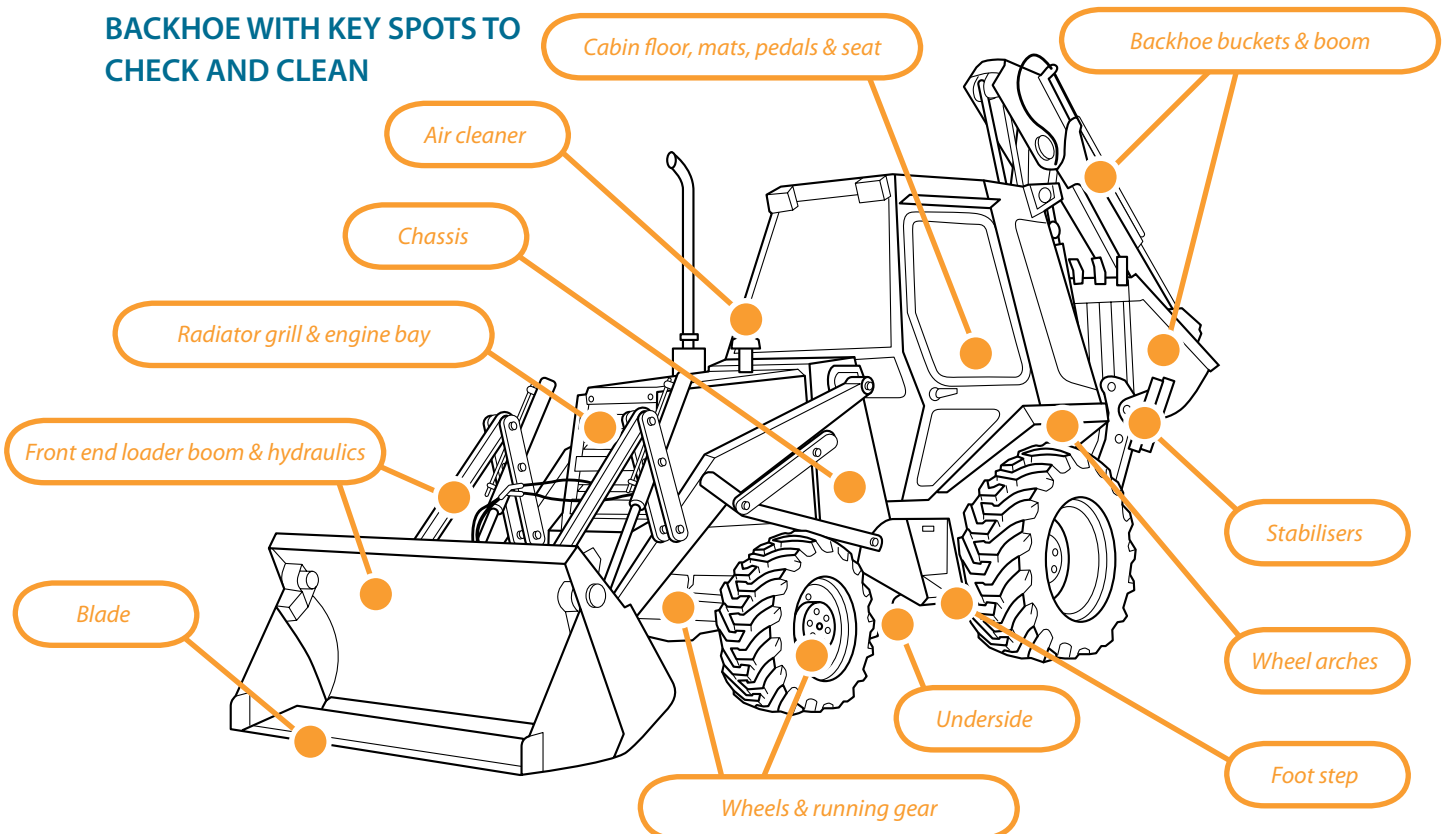
EXCAVATOR WITH KEY SPOTS TO CHECK AND CLEAN



BULLDOZER WITH KEY SPOTS TO CHECK AND CLEAN



BACKHOE WITH KEY SPOTS TO CHECK AND CLEAN





SELECTING A FIELD WASHDOWN SITE FOR VEHICLES AND MACHINERY

Vehicle/heavy machinery washdown is most effective where access can be controlled and entry points, roads or tracks are not open to general use. When selecting a washdown site, consider the following:

- Washdown should be done at the point of departure from a previous operation, preferably at a designated washdown facility with a well-drained hard surface.
- Where there are large quantities of effluent or there is a risk of extensive run-off (e.g. during road construction), the washdown area should be bunded i.e. an impervious spill area constructed.
- Washdown at the edge of (or near) any areas where pests, weeds or pathogens need to be contained. Ideally choose a site where the land slopes gently away from the washdown area and back into the potentially infected area, or into an adjacent area not susceptible to the problem (e.g. a paddock).
- Select a site where the run-off will not enter a watercourse, waterbody or roadside drain: A buffer of at least 30m is required.
- Select a mud-free site (e.g. well grassed, rocky, gravel, bark or timber corded).
- Avoid sensitive vegetation or wildlife habitat e.g. remnant native vegetation and areas with threatened species.
- Mark or record washdown sites for the land manager to enable subsequent monitoring and weed control.

GENERAL HYGIENE PROCEDURE

For general vehicle/machinery cleaning, the following standards apply.

- Elevate heavy machinery with boom arm to enable underside to be accessed. Tyres can be placed under equipment to allow underside to dry.
- Remove any guards, covers or plates that can quickly and easily be removed and replaced.
- Check the vehicle inside and out for any lodged mud, soil, seeds, algae, plant and other debris or substrate material.
- Knock off large clods of dirt with a crowbar or stiff brush.
- Clean with a high pressure hose and stiff brush or crowbar to further remove clods, starting from the top of the vehicle and working down to the bottom. Remember to clean undersides, tracks, rollers, tyres, wheel arches, guards, blades and buckets, chassis, engine bays, radiator and grill, tray, spare tyres and other attachments.
- When spraying with disinfectant solution be sure to only use the minimum amount of water needed to adequately disinfect all equipment and only add the amount of disinfectant required (see Appendix A). Before adding disinfectant to tank release any surplus water (present in tank).
- Allow the disinfectant solution to remain in contact with surfaces for at least 1 minute and wherever possible allow vehicles and equipment to drip dry.
- Avoid driving through any cleaning water/waste.

- Clean the interior (including floor, foot wells, mats, pedals, seats, under seats), air cleaners, radiator grills and engine bays with vacuum, compressed air device or brush off.

No clods of dirt or debris should be present after washdown. If smeared soil stains or soil lodged in difficult-to-access areas remain then ensure these areas have been thoroughly treated with disinfectant solution and allowed to drip dry.



After physical removal of soil and dirt a high pressure hose is used to further remove clods. Machinery has been elevated with boom arm to enable cleaning underside. Photo courtesy of Forestry Tasmania.



Removal of soil and dirt from bulldozer treads using crow bar. Photo courtesy of Forestry Tasmania.



Portable vehicle washdown unit is used to provide water with disinfectant. Note any surplus water present in the tank should be drained to limit the amount of disinfectant released into the environment. Photo courtesy of Forestry Tasmania.



After cleaning and disinfecting, bulldozer is left to dry. Maintaining elevation with tyres allows the underside to dry. Photo courtesy of Forestry Tasmania.

PORTABLE VEHICLE/MACHINERY WASHDOWN UNITS

Mobile washdown units and/or small self-assembled systems are one option. A pump and high pressure hose is the best means to remove all dirt and debris, particularly from places that are difficult to access. A shovel, crowbar and stiff brush are also needed to remove stubborn dirt. A blowdown device, compressor or portable blower can also be used along with a small brush to remove dry dirt (e.g. from air cleaner and radiators).

Refer to Appendix J for the prototype and specifications required for a mobile washdown unit.



Mobile washdown units with high pressure pump, hose and compressed air unit (for blow down of slasher decks, interior, air cleaners, radiator grills etc). Photo courtesy of NRM South/ Southern Tasmanian Councils Authority.



DESIGNATED WASHDOWN FACILITY

Purpose built wash bays are the best option for cleaning large vehicles or machinery. These washdown facilities should have a well drained hard surface and include effective effluent management systems to protect the environment. Commercial washdown facilities are available for vehicles and small trucks at most large towns. However on-site checking and cleaning of vehicles should be undertaken first, especially after working in contaminated areas (areas with known Phytophthora or Chytrid – refer to Appendices B and C).

Attachment 8. Washdown Record Sheets

CLEANING/INSPECTION LIST FOR UTILITY/4WD				
Date:		Site:		
Vehicle:		Registration/ID:		
Area	Contamination point	Inspected	Cleaned	Method
Engine bay	Front grill			
	Radiator and other cooling cores or fins			
	Grill or recess under wipers			
	Engine mounts			
	Top of gearbox			
	Battery recess/tray			
	Any recesses on engine or manifold			
	Air cleaner (including element)			
Cabin	Footwells			
	Carpets and mats			
	Seats			
	Tool boxes			
	Air vents			
Wheels and arches	Tyre treads			
	Rims and wheel caps			
	Wheel arches			
	Mud flaps and brackets			
	Brakes			
Tray	Body of tray (especially any recesses)			
	Mats and toolboxes			
	Around fuel tank caps			
Under carriage	Chassis rails			
	Struts and stabilisers			
	Steering components			
	Axels and differentials			
	Spare tyre and mounts			
	Guards			
	Fuel Tank			
Attachments	Bull bar			
Cleaning method: Mechanical (M), Compressed Air (CA), Vacuum (V), High Pressure Water (HPW), Low Pressure Water (LPW)				
Inspected by:		Signature:		
Cleaned by:		Signature:		

CLEANING/INSPECTION LIST FOR AN EXCAVATOR				
Date:		Site:		
Vehicle:		Registration/ID:		
Area	Contamination point	Inspected	Cleaned	Method
Engine bay	Engine bay floor			
	Fan shroud and radiator cores			
	Air filters (shake/tap filters to determine if clean)			
	Glacier plate (near radiator)			
Cabin	Footwells			
	Carpets and mats			
	Seats			
	Tool boxes			
	Air vents			
Excavation body	Hollow section chassis channels			
	Channels for hydraulic hoses from driven motor			
	Counterweight void spaces			
	Removable track adjuster guards and lubrication points			
	Turret pivot area			
	Arms/booms - pivot points			
Bucket/Blade	Between teeth of adapters			
	Wear plates			
Rear blade (Stabiliser)	Wear plates			
	Hollow section arms			
	Hollow section blade			
Cleaning method: Mechanical (M), Compressed Air (CA), Vacuum (V), High Pressure Water (HPW), Low Pressure Water (LPW)				
Inspected by:		Signature:		
Cleaned by:		Signature:		

CLEANING/INSPECTION LIST FOR TRACK TYPE DOZERS				
Date:		Site:		
Vehicle:		Registration/ID:		
Area	Contamination point	Inspected	Cleaned	Method
Engine	Check radiator core and engine area for residues.			
	Remove and check the air filter/cleaner (these often require destruction where they are clogged with QRM).			
	Check carefully the void space between the oil and radiator cores.			
	Battery Box - Lift/remove the battery to check for contamination (battery box may be at side/rear or under seat).			
Drivers cab	Check externally under and around driver's cab.			
	Check under mats in cab.			
	Remove/lift seat; remove/lift floor pans to allow checking to top of transmission.			
	Check air conditioner filter (if fitted) – shake/tap filter to check if clean			
	Check externally under and around driver's cab.			
	Check under mats in cab.			
Body	Belly plates should be removed to allow inspection and cleaning			
	Rear plates at back of dozer should be removed to allow inspection and cleaning.			
	Hydraulic cover plates should be removed to allow inspection and cleaning.			
Tracks/track frame	Examine tracks carefully.			
	Ensure inspection/cover plates are removed to allow inside track area.			
	Check idler wheels (these support the tracks).			
Fuel cells	Are removable therefore dirt etc can pack between the tank and the frame.			
Blade	Ensure that edge of blade top/bottom is not split – this allows soil to be packed very tightly in the hollow.			
	Check cutter points/wear blades.			
	Check carefully the pivot points and adaptors at the rear of the front blade – these allow the blade to change height and angle. Sometimes soil has compacted and is difficult to dislodge.			

Area	Contamination point	Inspected	Cleaned	Method
	Check trunction arms			
	Check all hollow sections			
Ripper support frame is usually hollow	Check carefully if any contaminants have entered this section. The tynes may need to be removed.			
Tynes	Tynes need careful inspection. Contamination may often be removed by water blasting, but tynes may need to be removed in some cases.			
Ripper points	A pin holds on the ripper points. Dirt can compact under the ripper points.			
All areas	Check if any sections or channels are hollow and determine if there is a possible entry point for contamination. Check if plates are covering a compartment or space that may have collected dirt/trash.			
Cleaning method: Mechanical (M), Compressed Air (CA), Vacuum (V), High Pressure Water (HPW), Low Pressure Water (LPW)				
Inspected by:		Signature:		
Cleaned by:		Signature:		

CLEANING/INSPECTION LIST FOR WHEELED LOADERS & COMPACTORS

Date:		Site:			
Vehicle:			Registration/ID:		
Area	Contamination point	Inspected	Cleaned	Method	
Engine and running gear	Air cleaner and air filters				
	Air conditioner unit				
	Under and around removable fuel cells				
	Brake assemblies				
Canopy/cabin	Hollow channels				
	Void space between cab and body (bird's nests have been found here)				
	Footwells				
	Carpets and mats				
	Seats				
Body	Feet of adaptors on compactors				
	Hydraulic points				
	Articulation points of hydraulics				
	Counterweight void spaces				
	Between dual wheels				
Bucket/Blades	Blade wear plates				
	Blade teeth and adaptors				
Cleaning method: Mechanical (M), Compressed Air (CA), Vacuum (V), High Pressure Water (HPW), Low Pressure Water (LPW)					
Inspected by:		Signature:			
Cleaned by:		Signature:			

CLEANING/INSPECTION LIST FOR DUMP TRUCKS				
Date:		Site:		
Vehicle:		Registration/ID:		
Area	Contamination point	Inspected	Cleaned	Method
Engine and running gear	Air cleaner			
	Air conditioner unit			
Cabin	Footwells			
	Carpets and mats			
	Behind and under seats			
	Tool boxes			
	Air vents			
Body	Hollow channels in tray frame			
	Between dual wheels (where applicable)			
Cleaning method: Mechanical (M), Compressed Air (CA), Vacuum (V), High Pressure Water (HPW), Low Pressure Water (LPW)				
Inspected by:		Signature:		
Cleaned by:		Signature:		