WEED RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >113	Low >56	Medium >31	High >14	Very High <14
Negligible <13	NO ACTION	NO ACTION	NO ACTION	NO ACTION	MONITOR
Low <39	NO ACTION	NO ACTION	NO ACTION	MONITOR	PROTECT SITES
Medium <101	MANAGE SITES	MANAGE SITES	MANAGE SITES	PROTECT SITES	CONTAIN SPREAD
High <192	MANAGE WEED	MANAGE WEED	PROTECT SITES	CONTAIN SPREAD	DESTROY INFESTATIONS
Very High >192	MANAGE WEED	PROTECT SITES & MANAGE WEED	CONTAIN SPREAD	DESTROY INFESTATIONS	ERADICATE FROM REGION

South East Pest Management Strategy

A regional biosecurity plan for the control of invasive species

Part 2: Pest Management Plan

Pest Risk Assessment

SUMMARY

The aim of this project is to determine the priority pest plants and pest animals of the South East region of South Australia. Prioritisation will allow the development of appropriate and strategic policies and actions to protect the region's biodiversity and the value of primary industries.

It is important to note that this risk assessment was carried out at a regional scale and will therefore not reflect all local situations or priorities. Such specific local issues can be reflected in local policies, however a regional approach is required for strategic planning purposes.

The project methodology follows the draft National Post-border Weed Risk Management Protocol developed by Standards Australia. A weed and pest risk assessment system developed by the Department of Water Land Biodiversity Conservation (DWLBC) was used to determine which pests pose the greatest threats to primary industries and the environment in the South East region. Various stakeholders assisted with specialist technical information on the pest plant and pest animal species and land use practices addressed in this project. The most appropriate management actions for these pests were then identified using a feasibility of control assessment system also developed by DWLBC.

The results of the project will provide the basis for the South East Natural Resource Management Board (herein referred to as 'the SE NRM Board') to complete regional weed policies. It will also assist the Board and other stakeholders to prioritise on ground works. Table 1.1 lists the priority pest plant and animal species identified by the assessment.

Table 1.1   Priority pest plant and pest animal list

\#   Environmental weeds

^   Agricultural weeds

Management Action	Declared Species		Non declared species
	Pest plants	**Pest animals**	
Alert List *Species that are not known to be present in the region and which represent a significant threat. Aims to prevent the species arriving and establishing in the management area*	Alisma Alligator weed Arrowhead Azzarola Broadkernel espartillo Broomrape Cabomba Calomba daisy Cane needlegrass Chilean needlegrass Coolatai grass Elodea Eurasian watermilfoil Horsetail Hydrocotyle Lagarosiphon Leafy elodea Mexican feathergrass Nightstock Pheasant's eye	Cane toad Common myna Feral pig House crow Indian ringneck Laughing dove Red-eared slider Red-whiskered bulbul Song thrush Tree sparrow Water buffalo	Blue mustard Parrot's feather Water primrose

Management Action	Declared Species		Non declared species
	Pest plants	Pest animals	
	Plumerillo Poison buttercup Primrose willow Ragwort Rhus tree Sagittaria Salvinia Senegal tea plant Serrated tussock Texas needlegrass Water caltrop Water dropwort Water hyacinth Water soldier		
Eradication from Region *Aims to remove the pest species from the management area*	Bridal veil# Golden dodder^	Dingo/ Wild dog^ Goat#^	
Destroy Infestations *Aims to significantly reduce the extent of the pest species in the management area*	Blackberry# Western cape bridal creeper# Innocent weed^ Pampas grass# Silverleaf nightshade^ #	Chital, Rusa & Sambar deer#^ Mallard# Red & Wapiti deer#^	Asparagus fern Tree of heaven White weeping broom
Contain Spread *Aims to prevent the ongoing spread of the pest species in the management area*	African feathergrass#^ Aleppo pine# Bathurst burr^ Boneseed# Caltrop^ Cape tulip (1& 2 leaf)^ Creeping knapweed^ Gorse#^ Hoary cress^ Salvation Jane^ Three corner jack^ Three horned bedstraw^ Variegated thistle^ Yellow burrweed^	Brown rat Fallow deer#^ Hog deer#^ Rabbit#^	Bluebell creeper# Dolichos pea# Erica# Radiata pine# Sallow wattle# Carp
Protect Sites *Aims to prevent spread of the pest species to key sites/assets of high economic, environmental and/or social value*	African boxthorn#^ African lovegrass#^ Bladder campion^ Cape broom# Cutleaf mignonette^ English broom# False caper^ Field bindweed^ Horehound^ Lincoln weed^ Noogoora burr^	Black rat#^	Apple of sodom^ Bedstraw^ Blue psoralea# Buckthorn# Coastal tea tree# Cootamundra wattle# Couch#^ Gazania# Goldfish Ivy#

Management Action	Declared Species		Non declared species
	Pest plants	Pest animals	
	Olive# # Slender thistle^ Solider thistle^ Spear thistle^ Wild carrot^ Willow spp.#^		Kikuyu#^ Marron Muskweed# Pepper tree Polygala# Sea wheatgrass# Shiny leaf coprosma# Spiny rush#^ Swamp oak#
Manage Pest *Aims to reduce the overall economic, environmental and/or social impacts of the pest species through targeted management*	Bridal creeper#	Feral cat# Fox#^ House mouse#^ Starling#^ Eurasian blackbird#^ Domestic pigeon#^	Acacia cyclops# Annual rye grass ^ Bracken fern^ Capeweed^ Coastal wattle# Desert ash# Fat hen^ Golden wreath wattle# Phalaris^ Pin cushion daisy^# Poa grass^# Poplars^# Pyp grass#^ Tall wheatgrass# Veldt grass# Wild oats#^ Wild radish^ Trout Carp gudgeon Gambusia Redfin
Manage Sites *Aims to maintain the overall economic, environmental and/or social value of key sites/assets through improved general pest management*	Buchan weed^# Dog rose# Onion grass^ Onion weed^ Perennial thistle^ Skeleton weed^ Soursob^ Sweet briar#	Hare	Blue periwinkle# Cotoneaster# Dock^ Fleabane^ Freesia# Marram grass# Silver grass^ South African weed orchid# Sweet pittosporum# Tagasaste# Williams grass^ Wireweed^ Tench
Monitor *Aims to detect any significant changes in the species 'pest risk*	Athel pine^# Chilean dodder^ Red dodder^ Hawthorn/ May#		Agave# Arum lily# Butterfly bush# English oak#

Management Action	Declared Species		Non declared species
	Pest plants	**Pest animals**	
	Prickly pear^# Wild artichoke^		Marguerite daisy# Ox tongue^ Sea spurge# Wandering jew#
Limited Action *The pest species would only be targeted for coordinated control in the management area if its local presence makes it likely to spread to land uses where it ranks as a higher priority.*			Bamboo# Blackberry nightshade^ Bulbil watsonia# Sorrell^ White arctotis

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Government of South Australia
South East Natural Resources
Management Board

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1   THE SOUTH EAST REGION

The South East Natural Resources Management (SE NRM) Region is situated in the South East corner of South Australia. It is bounded by the Victorian border to the east, the Southern Ocean to the south and west and the Murray Darling Basin Natural Resources Management Region to the north. The SE NRM region is made up of nine local government areas, these being the District Councils of Grant, Robe, and Tatiara, Kingston District Council, Naracoorte Lucindale Council, Wattle Range Council, Coorong Council, Southern Mallee District Council and the City of Mount Gambier. Mount Gambier is the main regional centre and the only city in the South East of South Australia. The principal townships are Bordertown, Keith, Kingston, Millicent, Naracoorte, Penola and Robe.

The highest annual rainfalls are found in the southern areas of the region where the average precipitation is approximately 850mm. Rainfall decreases in the north to approximately 450mm per annum. The majority of rain falls during the winter months, particularly in the coastal zones. The climate of the South East is a cool Mediterranean temperate climate; warmer in the Upper South East than the Lower South East.

The majority of soil types in the South East are sandy, including deep sands and sand over clay. These soils are scattered across the entire region and dominate in the north west of the region. Many of the soils of the coastal plains are associated with the ancient dune geological systems running north to south and are dominated by limestone substrate with deep sand and shallow red soils on the dunes and shallow black clays in the swales. Mt Gambier district has a large proportion of volcanic soils which are of high quality. Other patches of high quality soil includes peats in the Lower South East, well structured black clays in lower topographic areas and loam over clay soils east of the Naracoorte Range. Moderate to shallow red soils associated with limestone ridges are highly productive for the viticulture industry.

Primary production is varied across the region. In the southern zone, there is high forestry activity, dairy production and livestock production. In the north, large scale cropping, vineyards and grazing are the prominent practices. The majority of the SE NRM region consists of grazing lands (modified pasture) used for prime livestock (cattle and sheep) production. There is a large spread of native vegetation across the entire region, which varies greatly to include unique wetlands, mallee scrub, coastal vegetation and grassy woodlands.

The economic, environmental and social impact due to the presence of pest plants and pest animals is well documented (Sinden *et al.* 2004, Gong *et al.* 2009). At a national scale pest plants are suggested to impact upon agricultural production and loss of biodiversity to the tune of $4 billion per annum, while pest animals have a direct economic impact of at least $743 million per annum.

2 REGIONAL LAND USE

2.1 THE IMPORTANCE OF LAND USE AND ITS ROLE IN PEST MANAGEMENT

There are various factors which will determine the capacity of weeds and exotic animals to become "pests" and have an impact on a landscape. Climate and availability of natural resources are very important factors which allow pest plants and pest animals to invade and exploit their environment. Land use and its management are extremely important in the capacity of an individual species or combination of species to dominate a landscape.

The classification and description of land uses and its management is significant for the monitoring and evaluation of each pest plant and pest animal and the impacts on the costs of primary production, environment and social values.

While the full impact of climate change on pest plant populations is limited, it is known that land use and its management can change rapidly particularly in agricultural production, where the market place often determines which enterprises are undertaken in the short to medium term.

Climate and soils will be a limiting factor for the adoption of some land uses; however the use of irrigation or controlled environments such as glasshouse production can extend the land use options available.

The Australian Land Use and Management (ALUM) classification scheme has been agreed to by all state and territory authorities in Australia and is based on a classification system developed by Baxter and Russell in 1994.

Table 2.1, the ALUM classification Version 6 is a simple classification system, which provides the basis for measuring land use and its management across the whole of Australia at a range of landscapes, from National to catchment levels. It has six primary classes, which are then split into secondary and tertiary classifications to allow for more detailed land use categories.

Table 2.2, SE NRM Board land use consolidation shows the comparison between the land uses in the SE NRM region and the classification identified under the ALUM classification.

The adoption and use of the ALUM classification system will ensure that the SE NRM Board will be able meet national standards in monitoring and evaluating the impact of land use and its management on the presence of pest plants and pest animals.

Table 2.1   ALUM Classification version 6 – summary

D ALUM Classification V6 – summary

The minimum expected level of attribution relates to land use mapping programmes currently coordinated through BRS using the ALUM Classification (v6), as indicated below.

Australian Land Use and Management Classification Version 6 (November 2005)

I Conservation and Natural Environments	2 Production from Relatively Natural Environments	3 Production from Dryland Agriculture and Plantations	4 Production from Irrigated Agriculture and Plantations	5 Intensive Uses	6 Water
1.1.0 Nature conservation 1.1.1 Strict nature reserves 1.1.2 Wilderness area 1.1.3 National park 1.1.4 Natural feature protection 1.1.5 Habitat/species management area 1.1.6 Protected landscape 1.1.7 Other conserved area	**2.1.0 Grazing natural vegetation** **2.2.0 Production forestry** 2.2.1 Wood production 2.2.2 Other forest production	**3.1.0 Plantation forestry** 3.1.1 Hardwood production 3.1.2 Softwood production 3.1.3 Other forest production 3.1.4 Environmental	**4.1.0 Irrigated plantation forestry** 4.1.1 Irrigated hardwood production 4.1.2 Irrigated softwood production 4.1.3 Irrigated other forest production 4.1.4 Irrigated environmental	**5.1.0 Intensive horticulture** 5.1.1 Shadehouses 5.1.2 Glasshouses 5.1.3 Glasshouses (hydroponic)	**6.1.0 Lake** 6.1.1 Lake – conservation 6.1.2 Lake – production 6.1.3 Lake – intensive use
1.2.0 Managed resource protection 1.2.1 Biodiversity 1.2.2 Surface water supply 1.2.3 Groundwater 1.2.4 Landscape 1.2.5 Traditional indigenous uses		**3.2.0 Grazing modified pastures** 3.2.1 Native/exotic pasture mosaic 3.2.2 Woody fodder plants 3.2.3 Pasture legumes 3.2.4 Pasture legume/grass mixtures 3.2.5 Sown grasses	**4.2.0 Irrigated modified pastures** 4.2.1 Irrigated woody fodder plants 4.2.2 Irrigated pasture legumes 4.2.3 Irrigated legume/grass mixtures 4.2.4 Irrigated sown grasses	**5.2.0 Intensive animal production** 5.2.1 Dairy 5.2.2 Cattle 5.2.3 Sheep 5.2.4 Poultry 5.2.5 Pigs 5.2.6 Aquaculture	**6.2.0 Reservoir/dam** 6.2.1 Reservoir 6.2.2 Water storage – intensive use/farm dams 6.2.3 Evaporation basin 6.2.4 Effluent pond
1.3.0 Other minimal use 1.3.1 Defence 1.3.2 Stock route 1.3.3 Residual native cover 1.3.4 Rehabilitation		**3.3.0 Cropping** 3.3.1 Cereals 3.3.2 Beverage & spice crops 3.3.3 Hay & silage 3.3.4 Oil seeds 3.3.5 Sugar 3.3.6 Cotton 3.3.7 Tobacco 3.3.8 Legumes	**4.3.0 Irrigated cropping** 4.3.1 Irrigated cereals 4.3.2 Irrigated beverage & spice crops 4.3.3 Irrigated hay & silage 4.3.4 Irrigated oil seeds 4.3.5 Irrigated sugar 4.3.6 Irrigated cotton 4.3.7 Irrigated tobacco 4.3.8 Irrigated legumes	**5.3.0 Manufacturing and industrial**	**6.2.0 Reservoir/dam** 6.2.1 Reservoir 6.2.2 Water storage – intensive use/farm dams 6.2.3 Evaporation basin 6.2.4 Effluent pond
				5.4.0 Residential 5.4.1 Urban residential 5.4.2 Rural residential 5.4.3 Rural living	**6.3.0 River** 6.3.1 River – conservation 6.3.2 River – production 6.3.3 River – intensive use
		3.4.0 Perennial horticulture 3.4.1 Tree fruits 3.4.2 Oleaginous fruits 3.4.3 Tree nuts 3.4.4 Vine fruits 3.4.5 Shrub nuts fruits & berries 3.4.6 Flowers & bulbs 3.4.7 Vegetables & herbs	**4.4.0 Irrigated perennial horticulture** 4.4.1 Irrigated tree fruits 4.4.2 Irrigated oleaginous fruits 4.4.3 Irrigated tree nuts 4.4.4 Irrigated vine fruits 4.4.5 Irrigated shrub nuts fruits & berries 4.4.6 Irrigated flowers & bulbs 4.4.7 Irrigated vegetables & herbs	**5.5.0 Services** 5.5.1 Commercial services 5.5.2 Public services 5.5.3 Recreation and culture 5.5.4 Defence facilities 5.5.5 Research facilities	**6.4.0 Channel/aqueduct** 6.4.1 Supply channel/aqueduct 6.4.2 Drainage channel/aqueduct
		3.5.0 Seasonal horticulture 3.5.1 Fruits 3.5.2 Nuts 3.5.3 Flowers & bulbs 3.5.4 Vegetables & herbs	**4.5.0 Irrigated seasonal horticulture** 4.5.1 Irrigated fruits 4.5.2 Irrigated nuts 4.5.3 Irrigated flowers & bulbs 4.5.4 Irrigated vegetables & herbs	**5.6.0 Utilities** 5.6.1 Electricity generation/transmission 5.6.2 Gas treatment, storage and transmission	**6.5.0 Marsh/wetland** 6.5.1 Marsh/wetland – conservation 6.5.2 Marsh/wetland – production 6.5.3 Marsh/wetland – intensive use
				5.7.0 Transport and communication 5.7.1 Airports/aerodromes 5.7.2 Roads 5.7.3 Railways 5.7.4 Ports and water transport 5.7.5 Navigation and communication	**6.6.0 Estuary/coastal waters** 6.6.1 Estuary/coastal waters – conservation 6.6.2 Estuary/coastal waters – production 6.6.3 Estuary/coastal waters – intensive use
		3.6.0 Land in transition 3.6.1 Degraded land 3.6.2 Abandoned land 3.6.3 Land under rehabilitation 3.6.4 No defined use	**4.6.0 Irrigated land in transition** 4.6.1 Degraded irrigated land 4.6.2 Abandoned irrigated land 4.6.3 Irrigated land under rehabilitation 4.6.4 No defined use (irrigation)	**5.8.0 Mining** 5.8.1 Mines 5.8.2 Quarries 5.8.3 Tailings	
				5.9.0 Waste treatment and disposal 5.9.1 Stormwater 5.9.2 Landfill 5.9.3 Solid garbage 5.9.4 Incinerators 5.9.5 Sewage	

minimum level of attribution

Table 2.2   SE NRM Board land use consolidation

ALUM Classification V6_Primary land use	ALUM Classification V6_Secondary land	SENRMB land use
1 Conservation and natural environments	1.1 Nature conservation	Native Vegetation
	1.2 Managed resource protection	Native Vegetation
	1.3 Other minimal use	Native Vegetation
2 Production from relatively natural environments	2.1 Grazing natural vegetation	Grazing
3 Production from dryland agriculture and plantations	3.1 Plantation forestry	Forestry
	3.2 Grazing modified pastures	Grazing
	3.3 Cropping	Cropping
	3.4 Perennial horticulture	Perennial Horticulture
	3.5 Seasonal horticulture	Perennial Horticulture
4 Production from irrigated agriculture and plantations	4.1 Irrigated plantation forestry	Forestry
	4.2 Irrigated modified pastures	Irrigated Crops and Pastures
	4.3 Irrigated cropping	Irrigated Crops and Pastures
	4.4 Irrigated perennial horticulture	Perennial Horticulture
	4.5 Irrigated seasonal horticulture	Irrigated Crops and Pastures
5 Intensive uses	5.1 Intensive horticulture	Perennial Horticulture
	5.2 Intensive animal production	Grazing
	5.3 Manufacturing and industrial	Urban
	5.4 Residential	Urban
	5.5 Services	Urban
	5.6 Utilities	Urban
	5.7 Transport and communication	Urban
	5.8 Mining	Urban
	5.9 Waste treatment and disposal	Urban
6 Water	6.1 Lake	Aquatic
	6.2 Reservoir/dam	Aquatic
	6.3 River	Aquatic
	6.4 Channel and aqueduct	Aquatic
	6.5 Marsh/wetland	Aquatic
	6.6 Estuary/coastal water	Aquatic

Figure 2.1   Major land use of South East South Australia

Landuse - SE NRM Region
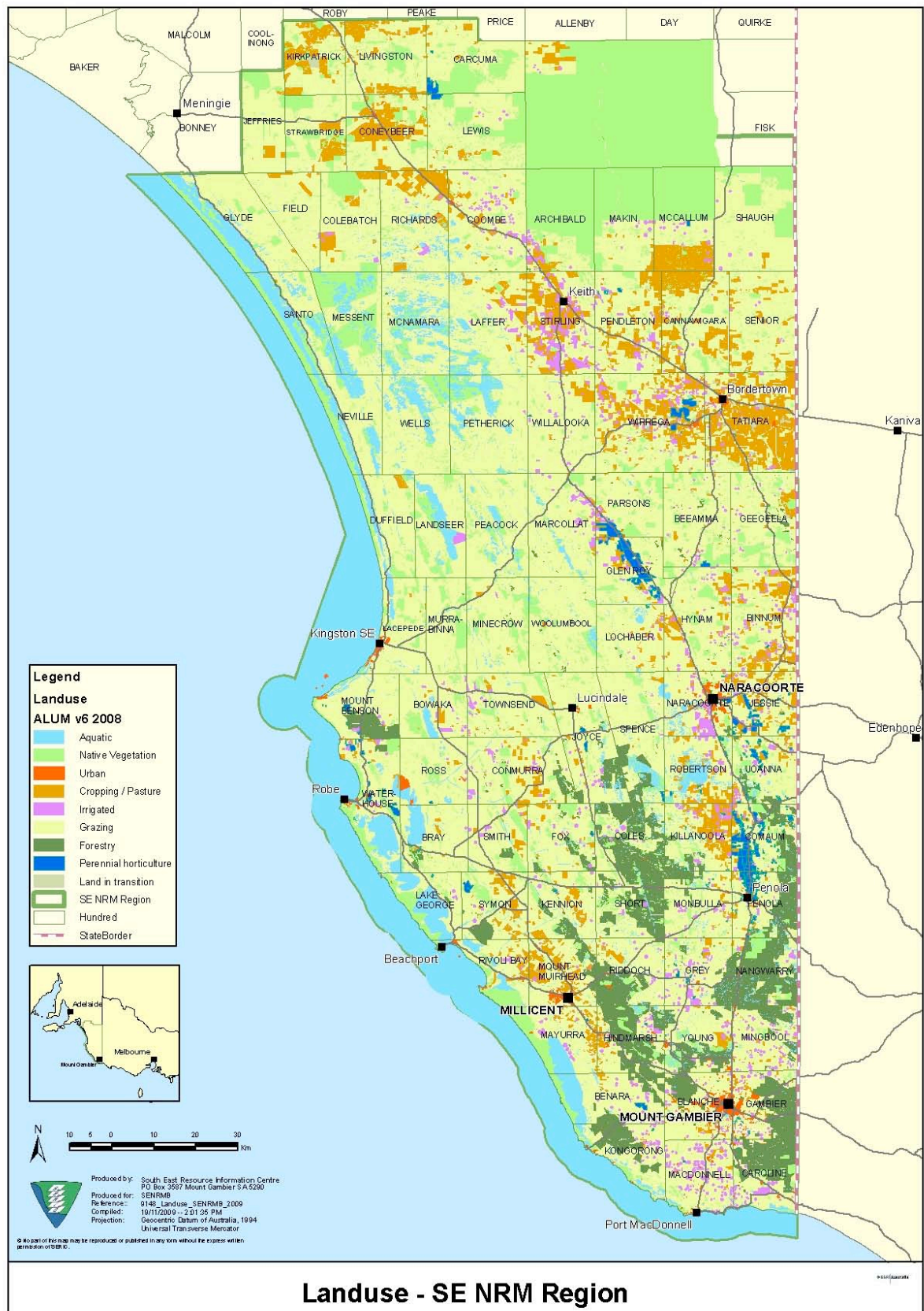
3   METHOD

3.1   WEED RISK ASSESSMENT

Determining priority pest plants allows effective and efficient policies to be developed that protect the economic, environmental and social assets of the region. Prioritisation is required in order to allocate limited human and financial resources for the most beneficial outcome for the region. Every pest plant assessed in this project has been assigned to a strategic management action category according to its results within the particular land use.

The species identified are a combination of the declared plant list under the *Natural Resources Management Act 2004* and other non-declared plants considered to be a pest in the South East NRM region.

3.1.1   Determining the weed list

In 2005 a comprehensive assessment process was undertaken by obtaining information from various stakeholders. This was a detailed and thorough process by which groups were formed for each land use consisting of professionals and community members active in each particular land use. As a group, members then undertook the weed risk assessment for the land use they were representing.

A second assessment was undertaken in 2009 by investigating and assessing other South Australian Natural Resource Management regional Weed Risk Assessments. Pest plants were identified which were not previously assessed in a particular land use, or were not assessed at all in the South East weed risk assessment in 2005.

3.1.2   Applying the SA Weed Risk Management System

In South Australia, a system to rank the importance of pest plants has been developed for use in planning control programs and in assessing new species for declaration. The Department of Water Land and Biodiversity Conservation Weed Risk Management Scoresheet, produced in consultation with regional Authorised Officers, were based on a ranking system developed to determine Weeds of National Significance in Australia.

Pest plants are assessed separately for different land uses so that the most important pest plants of different land uses can be accurately identified. This project assessed pest plants at a regional scale, which required some averaging of scores to account for the environmental differences across the region. This method will therefore provide a strategic regional context but may not reflect all local situations.

The assessment system consists of multiple-choice questions to derive scores for various characteristics of each pest plant. This process allows an objective assessment to be made on a pest plants threat rather than simply react to its presence and appearance. The South Australian Weed Management Guide can be seen in Appendix 1.

Weed Risk
The weed risk is determined by assessing the invasiveness, impacts and potential distribution for each species. Invasiveness is used as an indicator of a plant's rate of spread, with faster spreading species being considered more important for urgent control and thus of higher priority. The questions to determine a score for invasiveness relate to a plant's ability to establish, tolerance to routine control, reproductive ability and dispersal by natural and human-influenced means. The impacts assessment investigates the economic, environmental and social effects of pest plants, with the questions covering

effects on establishment and growth of desired plants, animal, human and environmental health as well as reduction in product quality and restriction to physical movement. Potential distribution considers the area of the land use at risk of invasion by the pest plant.

Scores for invasiveness, impacts and potential distribution are multiplied together to give the total weed risk score. The weed risk score was then divided into categories to allow comparison within the management action matrix. These categories can be seen below.

Frequency Band	Weed Risk Score	Weed Risk
80 - 100% (top 20% of possible scores)	192+	*Very high*
60 - 80%	< 192	*High*
40 - 60%	< 101	*Medium*
20 - 40%	< 39	*Low*
0 - 20% (bottom 20% of possible scores)	< 13	*Negligible*

Feasibility of control

Within the landuse the feasibility of controlling the pest plant is also an important consideration in prioritising control efforts. Feasibility of control consists of scores for control costs, current distribution and persistence. Control costs investigate how detectable the plant is, general accessibility to infestations, operating costs, labour costs and level of cooperation expected from landholders. The current distribution of the pest plant within its landuse is calculated together with the spatial pattern of the plant, i.e. is it widespread, restricted or scattered. The persistence considers how effective the targeted control is, maximum time to reproduction, maximum longevity or production of propagules and the likelihood of ongoing dispersal. The scores for control costs, current distribution and persistence are multiplied to give a feasibility score. These scores are divided into categories similar to the weed risk, as seen below:

Frequency Band	Feasibility Score	Feasibility of Containment
80 - 100% (top 20% of possible scores)	113+	*Negligible*
60 - 80%	< 113	*Low*
40 - 60%	< 56	*Medium*
20 - 40%	< 31	*High*
0 - 20% (bottom 20% of possible scores)	< 14	*Very High*

3.1.3   Determine Regional Weed Management Priorities

By comparing a weed's risk score to its feasibility of control score, recommendations can be made for the most appropriate management action. This allows priority to be allocated to those pest plants that have a high risk and are feasible to control. Pest plants that are very low risk will not be recommended for control over other higher priority species, even if they are present. Likewise, species that are widespread but not feasible to control will not rank as a high priority. A matrix for completing this comparison is shown in Table 3.1. The management categories are described below:

Table 3.1   Regional management guidelines based on weed risk and feasibility of containment

WEED RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >113	*Low* >56	*Medium* >31	*High* >14	*Very High* <14
Negligible <13	LIMITED ACTION	LIMITED ACTION	LIMITED ACTION	LIMITED ACTION	MONITOR
Low <39	LIMITED ACTION	LIMITED ACTION	LIMITED ACTION	MONITOR	MONITOR
Medium <101	MANAGE SITES	MANAGE SITES	MANAGE SITES	PROTECT SITES	CONTAIN SPREAD
High <192	MANAGE WEED	MANAGE WEED	PROTECT SITES	CONTAIN SPREAD	DESTROY INFESTATIONS
Very High >192	MANAGE WEED	PROTECT SITES & MANAGE WEED	CONTAIN SPREAD	DESTROY INFESTATIONS	ERADICATE

ALERT

3.1.4 Guiding principles for each of the management categories in the weed risk matrix:

ALERT
This category refers to species that are not known to be present in the management area but which represent a significant threat. Such species would score "0" in Feasibility of Containment due to their absence.
This management category aims to prevent the species arriving and establishing in the management area through:
- Prevention of entry to management area
- Ongoing surveillance for incursions of the species (e.g. nursery inspections)
- Training and awareness activities for the community to enable early detection

ERADICATE
This management category aims to remove the weed species from the management area through:
- Detailed surveillance and mapping to locate all infestations
- Destruction of all infestations including seedbanks
- Prevention of entry to management area and movement and sale within
- Removal and prohibition of all cultivated plants
- Monitoring progress towards eradication

DESTROY INFESTATIONS
This management category aims to significantly reduce the extent of the weed species in the management area through:
- Detailed surveillance and mapping to locate all infestations
- Destruction of all infestations, aiming for local eradication at feasible sites
- Prevention of entry to management area and movement and sale within the region

- Prohibiting cultivated growth
- Monitoring progress towards reduction

CONTAIN SPREAD

This management category aims to prevent the ongoing spread of the weed species in the management area through:

- Surveillance and mapping to locate all infested properties
- Control of all infestations, aiming for a significant reduction in weed density
- Prevention of entry to management area and movement and sale within the region
- Preventing spread from cultivated plants (if grown)
- Monitoring change in current distribution

PROTECT SITES

The weed may be of limited current distribution but only threatens limited industries/habitats (lower weed risk). Or the weed may be more widespread but is yet to invade/impact upon many key industries/habitats (higher weed risk).This management category aims to prevent spread of the weed species to key sites/assets of high economic, environmental and/or social value through:

- Surveillance and mapping to locate all infested areas
- Identification of key sites/assets in the management area
- Control of infestations in close proximity to key sites/assets, aiming for a significant reduction in weed density
- Limits on movement and sale of species within management area
- Preventing spread from cultivated plants (if grown) in close proximity to key sites/assets
- Monitoring change in current distribution within and in close proximity to key sites/assets

MANAGE WEED

This management category aims to reduce the overall economic, environmental and/or social impacts of the weed species through targeted management including:

- Research and development of integrated weed management (IWM) packages for the species, including herbicides and biological control where feasible
- Promoting IWM packages to landholders
- Monitoring decrease in weed impacts with improved management
- Identifying key sites/assets in the management area and ensuring adequate resourcing to manage the weed species

MANAGE SITES

This management category aims to maintain the overall economic, environmental and/or social value of key sites/assets through improved general weed management such as:

- Promoting general IWM principles to landholders, including the range of control techniques, maintaining competitive vegetation/crops/pastures, hygiene and property management plans.
- Identifying key sites/assets in the management area and ensuring adequate resourcing to manage these to maintain their values
- Broaden focus beyond weeds to all threatening processes

MONITOR

This management category aims to detect any significant changes in the species' weed risk by:

- Monitoring the spread of the species and review any perceived changes in weediness

LIMITED ACTION
The weed species would only be targeted for coordinated control in the management area if its local presence makes it likely to spread to land uses where it ranks as a higher priority.
- Undertake control measures if required for the benefit of other land uses at risk
- Otherwise limited advice to land managers if required.

3.2   VERTEBRATE PEST RISK ASSESSMENT

Determining priority pest animals allows effective and efficient policies to be developed that protect the economic, environmental and social assets of the region. Prioritisation is required in order to allocate limited human and financial resources for the most beneficial outcome for the region. Every pest animal assessed in this project has been assigned to a strategic management action category according to its results within the particular land use.

The pest animals assessed in this report are declared under the Natural Resources Management Act 2004. Non declared species are acknowledged as potential pests but due to time constraints and the scope of this project they were not put through the risk management system.

3.2.1   Determining the pest list

A steering group was formed consisting of members with expert knowledge of each of the land uses. Criteria were defined to exclude some species on the basis of not present in the region, widespread in the region and not present but poses a risk to the region. Some animals were assessed on the basis that the species is present in captivity but not found in feral/wild populations, such as pigs and water buffalo.

3.2.2   Applying the SA Pest Risk Management System

The SA Pest Animal Risk Management Guide was developed by the Animal and Plant Control Group of the Department for Water, Land and Biodiversity Conservation (DWLBC), in cooperation with staff of Rural Solutions SA and Natural Resource Management Boards to help in prioritising pest animals for control programs.

This guide was based on and consistent with the SA Weed Risk Assessment System developed by Dr John Virtue for Animal and Plant Control Boards in South Australia (now integrated into Natural Resource Management Boards).   The pest animal risk assessment system can be broadly applied to many geographic scales and for any land use.   Other existing risk assessment systems have been used in the development of this guide (see references).

The assessment process involves a series of questions to compare the relative risk and feasibility of control of different pest animals. Pest animals are assessed separately for various *land uses* so that the most important pest animals of different land uses can be identified.

While the initial pest animal list for each land use within the SE NRM region was determined through the consultation process, the pest attribute information (i.e. distribution, growth habit, reproduction capability, control methods etc) was obtained from various sources of literature.

The key features of the risk assessment process are explained in the following sections. This information has been adapted from the *SA Pest Animal Risk Management System and Guide – June 2007*.

Comparative Pest Risk (CPR)

The pest animal risk questions are divided into three main criteria: **Invasiveness**, **Impacts** and **Potential distribution**.

Invasiveness is used as an indicator as to how fast the pest animal can spread within a particular land use. It takes account of how well the pest animal can establish, reproduce and disperse.

Impacts criteria determines the **potential** economic, environmental and social effects of a pest animal, with the questions covering the pest animal's effect on establishment and growth of desired plants and animal, human and environmental health as well as reductions in product quality, and limits on physical movement.

Potential distribution considers what proportion of a land use is at risk from the pest animal in question. This will depend on the climate and habitat preferences of the pest animal. For example, some pest animals may only be suited to higher rainfall areas, or may only be a problem on sandy well-drained soils.

Scores for invasiveness, impacts and potential distribution are multiplied to give a comparative pest animal risk score, that is:

Comparative Pest Risk = Invasiveness _ Impacts _ Potential distribution

Dividing the scores into bands of 20% provides discreet classes of pest risk.

Frequency Band	Comparative Pest Risk (CPR) Score	Pest Animal Risk
80 - 100% (top 20% of possible scores)	157+	*Very high*
60 - 80%	84 -156	*High*
40 - 60%	31-83	*Medium*
20 - 40%	10-30	*Low*
0 - 20% (bottom 20% of possible scores)	<10	*Negligible*

Feasibility of containment (FOC)
The feasibility of containment questions are divided into three main criteria; **Control costs**, **Current distribution** and **Persistence**.

Control costs consider the costs associated with the detection of the pest animal, on-ground control, enforcement /education needs, and achieving landholder commitment.

Current distribution considers the proportion of the land use currently occupied, and the overall pattern of pest animal populations.

Persistence refers to how long it takes to eradicate the pest animal. It considers the efficacy of targeted control actions, susceptibility to control actions, re-colonisation and persistence in the land use.

The score for feasibility of containment is calculated by adjusting then multiplying the control costs, current distribution and persistence scores, that is:

Feasibility of Containment = Control Costs _ Current Distribution _ Persistence

Dividing the scores into bands of 20% provides discreet classes for feasibility of containment.

Frequency Band		Feasibility of Containment (FOC) Score	Feasibility of Containment
80 - 100%	(top 20% of possible scores)	>111	*Negligible*
60 - 80%		111-55	*Low*
40 - 60%		31-54	*Medium*
20 - 40%		13-30	*High*
0 - 20%	(bottom 20% of possible scores)	<13	*Very High*

3.2.3 Pest Animal Management Action Priorities

By comparing the comparative pest risk and the feasibility of containment of each pest animal in a matrix a management action is identified that defines the pest management priorities for each land use. For example a pest animal with a high Comparative Pest Risk (CPR) and high Feasibility of Containment (FOC) will be assigned a higher priority management action than a pest animal with a high CPR and low FOC.

The pest risk assessment results are typically displayed as a matrix, as shown in Table 3.2. Management actions for each sector of the matrix and explanatory notes for each management action are described in the remainder of this section.

Table 3.2   Pest animal risk assessment management action matrix

COMPARATIVE PEST RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >111	*Low* 111-55	*Medium* 31-54	*High* 13-30	*Very High* <13
Negligible <10	NO ACTION	NO ACTION	NO ACTION	NO ACTION	MONITOR
Low 10-30	NO ACTION	NO ACTION	NO ACTION	MONITOR	PROTECT SITES
Medium 31-83	MANAGE SITES	MANAGE SITES	MANAGE SITES	PROTECT SITES	CONTAIN SPREAD
High 84-156	MANAGE PEST ANIMAL POPULATIONS	MANAGE PEST ANIMAL POPULATIONS	PROTECT SITES	CONTAIN	DESTROY POPULATIONS
Very High >157	MANAGE PEST ANIMAL POPULATIONS	PROTECT SITES & MANAGE PEST ANIMAL POPULATIONS	CONTAIN SPREAD	DESTROY POPULATIONS	ERADICATE FROM REGION

3.2.4 Guiding principles for each of the management categories in the vertebrate pest matrix

ERADICATE FROM REGION

This management category aims to remove the pest animal species from the region through:
- Detailed surveillance and mapping to locate all populations
- Destruction of all populations including juveniles
- Prevention of entry to region and keeping, movement and sale within the region
- Monitoring progress towards eradication

DESTROY POPULATIONS

This management category aims to significantly reduce the extent of the pest animal species in the region through:
- Detailed surveillance and mapping to locate all populations
- Destruction of all populations, aiming for local eradication at feasible sites
- Prevention of entry to region and keeping, movement and sale within the region
- Considering quarantine provisions
- Monitoring progress towards reduction

CONTAIN SPREAD

This management category aims to prevent the ongoing spread of the pest animal species in the region through:
- Surveillance and mapping to locate all infested properties
- Enforcing control of all populations, aiming for a significant reduction in pest animal density through high level initial control and sustained management
- Controlling entry, movement and keeping under permit conditions
- Monitoring change in current distribution

PROTECT SITES

The pest animal may be of limited current distribution but only threatens limited industries/habitats (lower pest animal risk), or the pest animal may be more widespread but is yet to invade/impact upon many key sub-regional industries/habitats (higher pest animal risk). This management category aims to prevent spread of the pest animal species to key sites/assets of high economic, environmental and/or social value through:
- Surveillance and mapping to locate all infested sub-regions
- Identification of key sites/assets in the region
- Enforcing control of populations in close proximity to key sites/assets, aiming for a significant reduction in pest animal density
- Controlling entry, movement and keeping under permit conditions
- Monitoring change in current distribution within and in close proximity to key sites/assets

MANAGE PEST ANIMAL POPULATION

This management category aims to reduce the overall economic, environmental and/or social impacts of the pest animal species through targeted management, including:
- Research and development of integrated pest animal management (IPM) packages for the species, including cultural, chemical and biological control where feasible
- Promoting IPM packages to landholders
- Monitoring decrease in pest animal impacts with improved management
- Identifying key sites/assets in the region and ensuring adequate resources to manage the pest animal species

MANAGE SITES

This management category aims to maintain the overall economic, environmental and/or social value of key sites/assets through improved general pest animal management, such as:

- Promoting general IPM principles to landholders, including the range of control techniques and farm management practices.
- Identifying key sites/assets in the region and ensuring adequate resources to manage these to maintain their values
- Broaden focus beyond pest animals to all threatening processes

MONITOR

This management category aims to detect any significant changes in the species' pest animal risk by:

- Monitoring the spread of the species and review any perceived changes in pest animal invasiveness.

NO ACTION

The pest animal species is perceived to be of insufficient risk to warrant any investment in regional strategic management actions.

4   RESULTS

For this assessment the South East region was divided into the following land uses, listed below according to the largest percentage of area occupied.

- Grazing
- Native vegetation
- Cropping
- Forestry
- Aquatic
- Urban
- Irrigated crops and pastures
- Perennial horticulture

This section provides the results of pest plant and pest animal assessment by land use categories. Within each land use sub-section, a description of its location and key pest plant and pest animal species are then discussed.

4.1   GRAZING

4.1.1   Description

As the dominant land use in the South East region, dryland grazing comprises approximately 57% or 1,613,598 hectares of generally improved pastures. Primarily, stock includes sheep and cattle, with a small number of specialist farms producing goats, deer and pigs. Pastures predominantly consist of grass species, clover and lucerne, dependant on soil type, rainfall, temperature and other variables. Some farms are intensively managed, with high inputs and subsequent returns, while others are based on a minimalist approach. Variable environmental factors such as rainfall and soil type play a significant role in the range and distribution of pest species across this land use.

4.1.2   Assumptions

Pest Plants

The assumption of this land use is that there is very little pest plant control conducted by landowners. The main method of control is spray grazing using a broadleaf herbicide spray such as 2,4D amine/MCPA formulation to increase the sugar levels in the plant to make them more palatable to stock. This reduces the volume of seed produced by the plant by reducing its ability to flower. This technique is commonly used for Salvation Jane and thistles.

Pest animals

Pest animal control is conducted seasonally on an as needs basis. The main method of control is 1080 baiting for foxes conducted during lambing and 1080 poisoned oats for rabbits during late summer. Shooting is used as a control technique by some landholders.

Figure 4.1   Map of grazing land use

Landuse - Grazing - SE NRM Region

4.1.3   Results

Tables 4.1 and 4.2 show the results from the weed risk assessment of the grazing land use. Tables 4.3 and 4.4 show the results from the vertebrate pest risk assessment.

Table 4.1   Weed risk assessment results table for grazing land use

Grazing	Invasiveness	Impacts	Potential Distribution	Comparative Weed Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
African boxthorn	6.7	3.2	2.0	42	Medium	5.3	1.3	4.5	30	High
African feathergrass	6.0	2.1	4.0	51	Medium	3.3	0.1	3.6	1	Very High
African lovegrass	6.7	2.1	4.0	56	Medium	2.7	0.9	4.5	11	Very High
African rue	5.3	2.6	2.0	28	Low	3.3	0.0	2.7	0	Very High
Apple of sodom	6.7	4.2	4.0	112	High	4.7	1.7	5.5	42	Medium
Bathurst burr	6.0	3.7	2.0	44	Medium	2.7	0.1	6.4	1	Very High
Blackberry	7.3	5.3	2.0	77	Medium	4.7	0.4	5.5	11	Very High
Bladder campion	7.3	2.1	1.0	15	Low	4.0	0.1	3.6	1	Very High
Bracken fern	3.3	2.6	4.0	35	Low	4.7	3.3	5.5	85	Low
Broadkernel espartillo	7.3	4.2	6.0	185	High	3.3	0.0	4.5	0	Very High
Broomrape	7.3	3.2	6.0	139	High	7.3	0.0	6.4	0	Very High
Buchan weed	4.0	2.1	4.0	34	Low	4.7	5.0	3.6	85	Low
Calomba daisy	4.7	2.1	4.0	39	Medium	1.3	0.1	5.5	1	Very High
Caltrop	6.0	2.6	4.0	63	Medium	4.0	0.4	6.4	11	Very High
Cane needlegrass	7.3	4.2	8.0	247	Very High	3.3	0.0	4.5	0	Very High
Cape tulip - 1 leaf	6.7	4.2	2.0	56	Medium	4.0	0.1	6.4	2	Very High
Cape tulip - 2 leaf	5.3	4.2	2.0	45	Medium	4.0	0.1	7.3	2	Very High
Capeweed	6.7	3.2	8.0	168	High	4.0	6.7	5.5	145	Negligible
Chilean needlegrass	7.3	6.8	8.0	401	Very High	3.3	0.0	3.6	0	Very High
Coolatai grass	5.3	3.7	8.0	157	High	3.3	0.0	3.6	0	Very High

Creeping knapweed	4.0	2.6	4.0	42	**Medium**	5.3	0.0	4.5	0	**Very High**
Cutleaf mignonette	5.3	2.1	4.0	45	**Medium**	3.3	2.5	3.6	30	**High**
Dock	4.0	1.6	2.0	13	**Negligible**	2.7	5.0	5.5	73	**Low**
Dodder (Chilean & red)	8.7	2.1	1.0	18	**Low**	5.3	0.4	7.3	16	**High**
Dog rose	4.0	2.1	4.0	34	**Low**	4.0	3.3	1.8	24	**High**
False caper	6.0	2.6	4.0	63	**Medium**	4.0	1.3	6.4	32	**Medium**
Gorse/ Furze	6.0	4.7	2.0	57	**Medium**	4.0	0.1	4.5	2	**Very High**
Horehound	6.7	4.7	6.0	189	**High**	2.7	2.5	5.5	36	**Medium**
Innocent weed	5.3	3.2	4.0	67	**Medium**	4.7	0.1	3.6	1	**Very High**
Khaki weed	6.0	4.7	4.0	114	**High**	4.7	0.1	4.5	2	**Very High**
Lincoln weed	6.7	1.6	4.0	42	**Medium**	4.0	0.9	6.4	23	**High**
Mexican feathergrass	8.7	4.7	8.0	328	**Very High**	5.3	0.1	6.4	3	**Very High**
Noogoora burr complex	5.3	2.6	2.0	28	**Low**	2.7	0.1	6.4	1	**Very High**
Onion grass	6.0	1.6	6.0	57	**Medium**	4.7	3.3	7.3	113	**Negligible**
Onion weed	6.0	1.6	6.0	57	**Medium**	4.7	3.3	7.3	113	**Negligible**
Parramatta grass	7.3	2.1	4.0	62	**Medium**	4.0	2.5	5.5	55	**Medium**
Perennial thistle	7.3	2.1	4.0	62	**Medium**	4.0	2.5	5.5	55	**Medium**
Plumerillo	7.3	2.1	4.0	62	**Medium**	4.0	2.5	5.5	55	**Medium**
Prickly acacia	7.3	2.1	4.0	62	**Medium**	4.0	2.5	5.5	55	**Medium**
Ragwort	7.3	2.1	4.0	62	**Medium**	4.0	2.5	5.5	55	**Medium**
Salvation Jane	5.3	4.7	8.0	202	**Very High**	3.3	2.5	5.5	45	**Medium**
Serrated tussock	8.0	5.3	10.0	421	**Very High**	5.3	0.0	4.5	0	**Very High**
Silver grass	6.7	1.6	8.0	84	**Medium**	4.7	5.0	4.5	106	**Low**
Skeleton weed	7.3	1.6	4.0	46	**Medium**	5.3	1.7	7.3	65	**Low**
Slender thistle	4.7	3.2	8.0	118	**High**	3.3	5.0	4.5	76	**Low**
Silverleaf nightshade	6.7	3.2	6.0	126	**High**	5.3	0.1	6.4	3	**Very High**
Soldier thistle	5.3	3.7	6.0	118	**High**	3.3	5.0	4.5	76	**Low**
Sorrell	3.3	2.1	4.0	28	**Low**	3.3	6.7	4.5	101	**Low**

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Soursob	4.0	1.1	4.0	17	**Low**	2.7	3.3	7.3	65	**Low**
Spear thistle	4.0	3.2	8.0	101	**High**	3.3	5.0	4.5	76	**Low**
Spiny rush	6.7	4.7	4.0	126	**High**	6.0	1.7	4.5	45	**Medium**
Texas needlegrass	6.7	3.7	4.0	98	**Medium**	2.7	0.0	5.5	0	**Very High**
Three cornered jack	6.7	3.7	4.0	98	**Medium**	2.7	0.1	5.5	1	**Very High**
Variegated thistle	5.3	3.7	6.0	118	**High**	2.0	2.5	4.5	23	**High**
Water dropwort	5.3	4.7	6.0	152	**High**	3.3	1.3	5.5	23	**High**
Wild artichoke	3.3	3.2	2.0	21	**Low**	5.3	0.9	5.5	27	**High**
Yellow burrweed	5.3	4.7	6.0	152	**High**	3.3	2.1	5.5	38	**Medium**

Table 4.2 Weed risk assessment matrix for grazing land use

WEED RISK	FEASIBILITY OF CONTAINMENT				
	Negligible *>113*	*Low* *>56*	*Medium* *>31*	*High* *>14*	*Very High* *<14*
Negligible *<13*		Dock			
Low *<39*		Bracken fern, Buchan weed, Sorrell, Soursob		Dodder (Chilean & red), Dog rose, Wild artichoke	Bladder campion, Noogoora burr,
Medium *<101*	Onion grass, Onion weed	Skeleton weed, Silver grass	False caper, Parramatta grass, Perennial thistle,	African boxthorn, Cutleaf mignonette, Lincoln weed	African feathergrass, African lovegrass, Bathurst burr, Blackberry, Caltrop, Cape tulips, Creeping knapweed, Gorse, Innocent weed, Three Corner jack
High *<192*	Cape weed	Slender thistle, Soldier thistle, Spear thistle,	Apple of sodom, Horehound, Salvation Jane, Spiny rush, Yellow burr weed	Variegated thistle	Silverleaf nightshade, Khaki weed
Very High *>192*					

Table 4.3   Vertebrate pest risk assessment results for grazing land use

GRAZING	Invasiveness	Impacts	Potential Distribution	Comparative Pest Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
European rabbit	9.1	4.8	10.0	436	Very High	5.9	6.7	5.0	196	Negligible
Red fox	7.3	6.0	10.0	436	Very High	6.7	10.0	7.3	485	Negligible
Goat	7.3	4.0	10.0	291	Very High	5.3	1.7	2.7	24	High
European hare	4.5	2.0	6.0	55	Medium	8.0	5.0	8.2	327	Negligible
Dingo, Wild dog	5.5	6.0	10.0	327	Very High	4.7	0.9	2.7	11	Very High
Hog deer	6.4	3.2	8.0	163	Very High	7.3	0.8	2.7	17	High
Red & Wapiti deer	6.4	3.6	10.0	229	Very High	6.0	3.3	3.6	73	Low
Rusa, Chital & Sambar deer	6.4	3.6	10.0	229	Very High	6.0	1.3	2.7	20	High
Fallow deer	6.4	3.6	10.0	229	Very High	6.0	3.3	3.6	73	Low

Table 4.4   Vertebrate pest risk assessment matrix for grazing land use

COMPARATIVE PEST RISK	FEASIBILITY OF CONTAINMENT				
	Negligible *>111*	*Low* *111-55*	*Medium* *31-54*	*High* *13-30*	*Very High* *<13*
Negligible *<11*					
Low *11-34*					
Medium *35-88*	HARE				
High *89-168*					
Very High *>168*	RABBIT, FOX	FALLOW, RED & WAPITI DEER		GOAT, HOG DEER, RUSA, SAMBAR & CHITAL DEER	WILD DOG / DINGO

4.1.4   Summary - Grazing

Pest Plants

From this assessment it is seen in table 4.2 that Silverleaf nightshade and Khaki weed are ranked in the Destroy Infestations category. As a result the regional management actions will aim to significantly reduce the extent of these weeds.

It was found that a large number of weeds were feasible to contain the spread at the regional scale. Some of these weeds included African feathergrass, Bathurst burr, Blackberry, Caltrop, Cape tulip, Creeping knapweed, Gorse, Innocent weed and Three corner jack.

Pest Animals

According to table 4.3 populations of Wild dog/Dingo have been identified as being able to be eradicated from the region, while Goat, Hog deer, Sambar, Rusa and Chital deer have management actions targeted at reducing their populations and limiting their spread throughout the region.

4.2   NATIVE VEGETATION

4.2.1   Description

While almost 20% or 554,762 hectares of the South East region is comprised of native vegetation, this represents only 13% of the original vegetation in the area prior to European settlement. Large parcels of this land use are publicly owned, including crown lands, national parks or local government owned. There are a range of different ecosystems across the region dependant on soil type, topography, rainfall and nutrient availability. These include coastal heath, mallee scrub, grassy woodlands and wetland environments. There is some overlap between the native vegetation land use and aquatic land use, especially in coastal conservation zones such as Canunda National Park.

Pest plants invading bushland are difficult to control due to poor accessibility to infestations and limited resources for control. Many of the pest plants in native vegetation are garden escapees such as Dolichos pea and Bridal creeper. These plants impact on the native vegetation by smothering plants and competing for water, nutrients and sunlight, thus reducing the ability of the native plants to survive and reproduce.

There is a significant risk associated with pest plants in native vegetation, particularly the severe impact that can be seen as a result of competition. Management of native vegetation in the South East is limited by availability of public and private expertise and the lack of return on investment in pure dollar terms. As yet, a suitable method of calculating the financial returns of environmental works has not been adopted.

4.2.2   Assumptions

Pest plants

It is presumed that there is no continual routine pest plant control being conducted in native vegetation across the South East. Some species may be targeted for control due to funding being available, such as the Western Cape bridal creeper. Alternatively pest plants may be controlled in areas of very high conservation value, i.e. to protect threatened species.

The products and services obtained from the land use are conservation and recreational values. Biological control is considered routine control for pest plants where it is available, such as Bridal creeper rust fungus.

Whilst Coastal wattle is indigenous to the coastal area of the South East region, its increasing range and dominance inland is of concern to native vegetation managers, hence it was included in the weed list. As a native plant, Coastal wattle is protected by the Native Vegetation Act 1991 in some situations and advice should be sought from the Native Vegetation Council before any clearance or control is undertaken.

Native plants from other states have also demonstrated their weed potential in the South East. Of particular concern are Sallow wattle, Golden wreath wattle, Bluebell creeper and Coastal tea tree. Because these species are not indigenous to the region control may be carried out without legislative exemption.

Vertebrate Pests

Pest management is conducted through occasional use of 1080 poisoned baits for fox and rabbit control. Shooting is very rarely used as a control in National Parks. Biological control for rabbits is present in the region but not an adequate control measure on its own.

Figure 4.2   Map of native vegetation land use

Landuse - Native Vegetation - SE NRM Region

4.2.3   Results

In tables 4.5 and 4.6 the results are shown from the weed risk assessment for the native vegetation land use. Tables 4.7 and 4.8 show the vertebrate pest risk assessment results.

Table 4.5   Weed risk assessment results table for native vegetation land use

Native Vegetation	Invasiveness	Impacts	Potential Distribution	Comparative Weed Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
Acacia cyclops	7.3	3.2	8.0	185	High	6.0	2.1	4.5	57	Low
African boxthorn	5.3	5.3	4.0	112	High	5.3	1.3	5.5	36	Medium
African feathergrass	6.0	2.1	4.0	51	Medium	3.3	0.1	3.6	1	Very High
African lovegrass	6.7	2.1	4.0	56	Medium	2.7	0.9	4.5	11	Very High
Agave	3.3	2.1	0.5	4	Negligible	7.3	0.0	7.3	0	Very High
Aleppo pine	6.0	5.3	6.0	189	High	5.3	0.9	4.5	22	High
Apple of sodom	5.3	4.2	4.0	90	Medium	4.7	1.7	5.5	42	Medium
Arum lily	4.7	2.6	0.5	6	Negligible	5.3	0.1	6.4	3	Very High
Asparagus fern	7.3	3.7	6.0	162	High	5.3	0.1	7.3	3	Very High
Athel pine	4.7	1.6	1.0	7	Negligible	7.3	0.1	7.3	4	Very High
Azzarola	7.3	4.2	2.0	62	Medium	7.3	0.1	7.3	4	Very High
Bamboo	3.3	3.2	2.0	21	Low	6.0	0.9	7.3	40	Medium
Blackberry	7.3	4.2	4.0	124	High	6.0	0.9	5.5	30	High
Blackberry nightshade	4.0	2.1	1.0	8	Negligible	5.3	1.8	6.4	59	Low
Blue periwinkle	5.3	3.7	4.0	79	Medium	6.0	0.9	7.3	40	Medium
Blue psoralea	4.7	2.6	1.0	12	Negligible	5.3	0.1	6.4	3	Very High
Bluebell creeper	8.0	5.3	2.0	84	Medium	8.7	0.1	9.1	7	Very High
Boneseed	8.7	3.2	4.0	109	High	6.0	0.9	5.5	30	High
Bridal creeper	7.3	5.3	10.0	386	Very High	5.3	6.7	6.4	226	Negligible
Bridal creeper (Western Cape)	7.3	5.3	6.0	232	Very High	6.0	0.4	7.3	18	High

Bridal veil	7.3	5.3	6.0	232	**Very High**	6.0	0.1	7.3	**4**	**Very High**
Buckthorn	8.0	3.2	6.0	152	**High**	6.7	2.1	3.6	**51**	**Medium**
Bulbil watsonia	4.7	2.1	2.0	20	**Low**	6.7	1.7	3.6	**40**	**Medium**
Butterfly bush	4.7	2.1	1.0	10	**Negligible**	4.7	0.1	5.5	**2**	**Very High**
Cane needlegrass	6.7	4.2	2.0	56	**Medium**	4.0	0.1	6.4	**2**	**Very High**
Cape broom	4.7	2.6	2.0	25	**Low**	3.3	0.1	4.5	**1**	**Very High**
Cape tulip - 1 leaf	6.7	4.2	2.0	56	**Medium**	6.0	2.1	5.5	**68**	**Low**
Cape tulip - 2 leaf	6.7	4.2	2.0	56	**Medium**	6.0	2.1	5.5	**68**	**Low**
Carrot	7.3	2.6	2.0	39	**Low**	6.0	0.1	5.5	**3**	**Very High**
Chilean needlegrass	5.3	1.6	2.0	17	**Low**	3.3	0.1	3.6	**1**	**Very High**
Coastal tea tree	7.3	3.7	4.0	108	**High**	6.0	2.1	2.7	**34**	**Medium**
Coastal wattle	8.0	5.3	10.0	421	**Very High**	6.0	3.3	8.2	**164**	**Negligible**
Common lantana	8.0	5.3	10.0	421	**Very High**	6.0	3.3	8.2	**164**	**Negligible**
Coolatai grass	5.3	1.6	4.0	34	**Low**	3.3	0.1	3.6	**1**	**Very High**
Cootamundra wattle	4.0	3.2	2.0	25	**Low**	4.7	0.1	6.4	**2**	**Very High**
Cotoneaster	8.0	3.2	6.0	152	**High**	6.7	0.9	6.4	**39**	**Medium**
Desert ash	7.3	3.7	6.0	162	**High**	6.0	2.1	5.5	**68**	**Low**
Dodder (Chilean & red)	6.0	1.6	4.0	38	**Low**	4.7	0.9	5.5	**23**	**High**
Dog rose	6.0	2.6	4.0	63	**Medium**	4.0	1.3	6.4	**32**	**Medium**
Dolichos pea	7.3	5.8	2.0	85	**Medium**	6.0	0.1	7.3	**4**	**Very High**
English broom	5.3	5.8	1.0	31	**Low**	5.3	0.1	6.4	**3**	**Very High**
English oak	4.0	2.6	1.0	11	**Negligible**	5.3	0.1	6.4	**3**	**Very High**
Erica*	6.0	3.7	4.0	88	**Medium**	6.7	0.1	6.4	**4**	**Very High**
False caper	5.3	1.6	6.0	51	**Medium**	6.0	3.3	4.5	**91**	**Low**
Fountain grass	8.0	2.6	6.0	126	**High**	6.0	0.1	4.5	**2**	**Very High**
Freesia	5.3	2.1	4.0	45	**Medium**	8.7	2.1	6.4	**115**	**Negligible**
Gazania sp.	6.7	2.6	4.0	70	**Medium**	3.3	1.8	4.5	**27**	**High**
Golden wreath wattle	6.7	3.2	6.0	126	**High**	6.7	2.5	7.3	**121**	**Negligible**
Gorse/ Furze	4.7	5.8	2.0	54	**Medium**	6.7	0.1	6.4	**4**	**Very High**

Horehound	4.7	1.6	4.0	29	**Low**	6.0	2.5	6.4	95	**Low**
Ivy (Cape & English)	3.3	4.2	1.0	14	**Low**	5.3	0.1	6.4	3	**Very High**
Marguerite daisy	2.0	1.6	4.0	13	**Negligible**	6.7	0.1	8.2	5	**Very High**
Marram grass	8.0	2.6	2.0	42	**Medium**	8.0	3.3	8.2	218	**Negligible**
May/ Hawthorn	3.3	4.7	2.0	32	**Low**	5.3	0.9	5.5	27	**High**
Mexican feathergrass	8.7	4.7	8.0	328	**Very High**	5.3	0.1	6.4	3	**Very High**
Olive	6.0	3.7	8.0	177	**High**	7.3	0.9	6.4	43	**Medium**
Pampas grass	6.7	4.7	6.0	189	**High**	4.7	0.1	8.2	3	**Very High**
Pepper tree	2.7	2.6	2.0	14	**Low**	4.7	1.8	6.4	52	**Medium**
Phalaris	6.0	4.2	4.0	101	**High**	6.7	5.0	6.4	212	**Negligible**
Pin cushion daisy	6.0	4.2	4.0	101	**High**	6.7	5.0	6.4	212	**Negligible**
Polygala	6.7	4.2	4.0	112	**High**	6.7	0.9	5.5	33	**Medium**
Poplars spp.	4.7	4.2	4.0	79	**Medium**	6.7	2.1	6.4	88	**Low**
Prickly pear	5.3	4.7	1.0	25	**Low**	6.0	0.9	3.6	20	**High**
Pyp grass	6.7	4.7	6.0	189	**High**	6.0	5.0	3.6	109	**Low**
Radiata pine	6.7	4.7	4.0	126	**High**	6.0	0.9	3.6	20	**High**
Rhus tree	4.0	5.8	4.0	93	**Medium**	6.0	0.1	3.6	2	**Very High**
Sallow wattle	8.0	5.3	10.0	421	**Very High**	5.3	2.5	4.5	61	**Low**
Sea spurge	4.0	2.6	2.0	21	**Low**	6.7	0.4	5.5	15	**High**
Sea wheatgrass	4.7	4.2	2.0	39	**Medium**	6.7	0.4	5.5	15	**High**
Serrated tussock	8.0	2.6	6.0	126	**High**	5.3	0.0	4.5	0	**Very High**
Shiny leaf coprosma	6.0	3.2	2.0	38	**Low**	6.7	0.1	5.5	3	**Very High**
Skeleton weed	7.3	1.6	6.0	69	**Medium**	6.7	1.7	7.3	81	**Low**
Slender thistle	7.3	1.6	4.0	46	**Medium**	5.3	1.7	7.3	65	**Low**
South African weed orchid	6.7	1.1	8.0	56	**Medium**	8.0	3.3	4.5	121	**Negligible**
Spiny rush	6.0	3.2	4.0	76	**Medium**	5.3	1.3	5.5	36	**Medium**
Sweet briar	6.0	2.6	4.0	63	**Medium**	4.7	2.1	4.5	44	**Medium**
Sweet pittosporum	4.7	3.2	4.0	59	**Medium**	4.7	2.1	5.5	53	**Medium**
Tagasaste	5.3	3.7	4.0	79	**Medium**	4.7	2.5	6.4	74	**Low**
Tall wheatgrass	6.0	5.8	4.0	139	**High**	6.7	5.0	6.4	212	**Negligible**

Texas needlegrass	5.3	3.7	4.0	**79**	**Medium**	5.3	0.0	8.2	**0**	**Very High**
Veldt grass	7.3	4.2	4.0	**124**	**High**	6.7	5.0	6.4	**212**	**Negligible**
Wandering jew	4.0	2.6	0.5	**5**	**Negligible**	5.3	0.1	6.4	**3**	**Very High**
Weeping white broom	8.0	3.7	6.0	**177**	**High**	4.7	0.1	7.3	**3**	**Very High**
White arctotis	5.3	2.1	2.0	**22**	**Low**	6.0	2.1	5.5	**68**	**Low**
Wild artichoke	3.3	3.2	2.0	**21**	**Low**	5.3	0.9	5.5	**27**	**High**
Wild oats	4.7	2.6	8.0	**98**	**Medium**	8.0	8.3	3.6	**242**	**Negligible**
Williams grass	4.7	2.6	8.0	**98**	**Medium**	8.0	8.3	3.6	**242**	**Negligible**
Yellow burrweed	5.3	4.2	1.0	**22**	**Low**	3.3	0.9	5.5	**17**	**High**

Table 4.6   Weed risk assessment matrix for native vegetation land use

WEED RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >113	Low >56	Medium >31	High >14	Very High <14
Negligible <13		Blackberry nightshade			Agave, Athel pine, Marguerite daisy, Wandering jew, Arum lily, English oak, Butterfly bush
Low <39		Horehound, White arctotis	Bamboo, Bulbil watsonia, Pepper tree	Dodder (Chilean & red), Hawthorn, Prickly pear, Wild artichoke, Yellow burr weed, Sea spurge	Cape broom, Wild carrot, Cootamundra wattle, English broom, Erica, Shiny leaf coprosma, Ivy, Blue psoralea
Medium <101	Freesia, Marram grass, South African weed orchid, Wild oats, William grass	Cape tulip 1 & 2 leaf, False caper, Poplars, Skeleton weed, Slender thistle, Tagasaste	Apple of Sodom, Blue periwinkle, Dog rose, Spiny rush, Sweet briar, Sweet pittosporum	Gazania, Sea Wheatgrass	African lovegrass, African feathergrass, Bluebell creeper, Dolichos pea, Erica, Gorse, Rhus tree
High <192	Golden wreath wattle, Phalaris, Pin cushion daisy, Tall wheatgrass, Veldt grass	Acacia cyclops, Desert ash, Pyp grass	African boxthorn, Buckthorn, Coastal tea tree, Cotoneaster, Olive, Polygala	Aleppo pine, Blackberry, Boneseed, Radiata pine	Asparagus fern, Fountain grass, Pampas grass, White weeping broom
Very High >192	Bridal creeper, Coastal wattle, Marguerite daisy	Sallow wattle		Western cape bridal creeper	Bridal veil

Table 4.7   Vertebrate pest risk assessment results table for native vegetation land use

NATIVE VEGETATION	Invasiveness	Impacts	Potential Distribution	Comparative Pest Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
European rabbit	10.0	5.2	8.0	416	Very High	7.1	5.0	6.3	221	Negligible
Red fox	7.3	6.0	10.0	436	Very High	6.7	10.0	7.3	485	Negligible
Goat	8.2	4.8	8.0	314	Very High	6.7	1.3	3.6	30	High
Cat	8.2	5.6	10.0	458	Very High	9.3	10.0	7.3	679	Negligible
European hare	4.5	2.0	6.0	55	Medium	8.7	8.3	6.4	460	Negligible
House mouse	7.3	2.8	10.0	204	Very High	9.3	10.0	9.1	848	Negligible
Black rat	7.3	4.0	10.0	291	Very High	8.7	8.3	8.2	591	Negligible
Wild Dog/ Dingo	6.4	6.0	4.0	153	High	6.7	0.0	3.6	0	Very High
Hog deer	7.3	4.0	1.0	29	Low	8.0	0.9	5.5	40	Medium
Red & Wapiti deer	7.3	4.8	8.0	279	Very High	8.0	4.2	7.3	242	Negligible
Sambar, Chital & Rusa Deer	7.3	4.8	8.0	279	Very High	8.0	2.5	7.3	145	Negligible
Fallow deer	7.3	4.8	10.0	349	Very High	8.0	6.7	7.3	388	Negligible
Common starling	6.4	3.2	8.0	163	Very High	8.7	8.3	9.1	657	Negligible
Eurasian blackbird	6.4	1.2	6.0	46	Medium	7.3	8.3	9.1	556	Negligible
Mallard	9.1	1.2	0.5	5	Negligible	6.7	0.9	9.1	56	Low

Table 4.8   Vertebrate pest risk assessment matrix for native vegetation land use

COMPARATIVE PEST RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >111	Low 111-55	Medium 31-54	High 13-30	Very High <13
Negligible <11		MALLARD			
Low 11-34			HOG DEER		
Medium 35-88	HARE BLACKBIRD				
High 89-168					WILD DOG/ DINGO
Very High >168	STARLING RUSA, CHITAL, SAMBAR RED & WAPITI DEER, CAT FOX, BLACK RAT, FALLOW DEER, RABBIT, MOUSE			GOAT	

4.2.4   Summary – Native Vegetation

Pest plants

Bridal veil assessed in native vegetation land use resulted as a very high weed risk and high feasibility of containment, thus the management action is to eradicate this species from the region.

Western Cape bridal creeper resulted in a very high weed risk and a high feasibility to control, in comparison, the common form of Bridal creeper had a very high risk assessment but the feasibility to control the weed was negligible. Therefore the management actions for both differ greatly. For common Bridal creeper efforts are to be directed in reducing the overall environmental impact it has through targeted management which includes the use of biological control.

Vertebrate Pests

Due to the inaccessibility of potential wild populations of pest animals the feasibility of control is reduced, thus the management actions of some pest animals are different to other land uses. In table 4.7 the management action for Goats in native vegetation is assessed as Destroy Populations, which requires dramatically reducing the populations and limiting their spread to their areas.

Dingoes are widely accepted as having been on the Australian mainland for some 4000-5000 years. During this time, they assumed the role of the top-order mammalian predator, with both the Thylacine and Tasmanian devil becoming extinct after arrival of the Dingo. While some people consider the Dingo to be an alien species, there is greater scientific evidence emerging as to its likely benefit in helping maintain ecosystem balance in the presence of other threats - namely other more recently introduced predators such as foxes and cats. The evidence suggests that Dingoes actively maintain large home ranges, within which foxes and cats are either suppressed in density or even excluded. As the Dingo does not hunt as efficiently as the predators that it suppresses, a wide range of native small terrestrial vertebrates are actually found to be better represented in their presence, than from areas where the Dingo is absent. In this way, the decline of some of Australia's small mammals may be connected with the decline of the Dingo across a large part of the continent. While the Dingo (or wild dogs) are still considered by many people to be a pest, particularly from an agricultural point of view, the evidence does not support them being considered one in the environmental land use.

The efforts in controlling Dingoes according to the risk assessment should be aimed at preventing the ongoing spread of these species in the region, although in a regional context these species will be aimed at eradication due to their low populations.

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4.3 CROPPING

4.3.1 Description

Predominant in the Upper South East, surrounding Bordertown and Coonalpyn, dryland cropping is a lucrative industry that produces an annual income of approximately $122 million per year. Occupying around 11% or 305,867 hectares, there is clear delineation between the rainfall and temperature bands of the upper and lower areas of the region. In the north, wheat, barley, canola and oats are featured, while the southern area is the centre for the production of beans, peas and lupins. The range and distribution of pest species in cropping country is also severely affected by temperature and rainfall as well as the variety of crop species in production.

Crop species with higher water needs, such as lucerne are generally found under irrigated crops and pasture.

### 4.3.2 Assumptions

Pest plants

The majority of the pest plants of concern within a cropping situation are those that cannot be controlled through everyday weed management practices. Assumed management for cereals include pre-sowing cultivation or knockdown herbicides, pre-emergent sprayed at sowing for grasses and broadleaf weeds and one post-emergent broadleaf spray. Assumed management for pulse crops are same as above, but the post-emergent spray is for grasses rather than for broadleaf weeds.

Vertebrate Pests

The majority of pests of concern within a cropping situation are herbivores. There is very little pest management undertaken within this land use. Some 1080 poisoned oats baiting may occur for rabbits in the late summer to lower numbers before the next crop is planted.

Figure 4.3   Map of cropping land use

Landuse - Cropping / Pasture - SE NRM Region
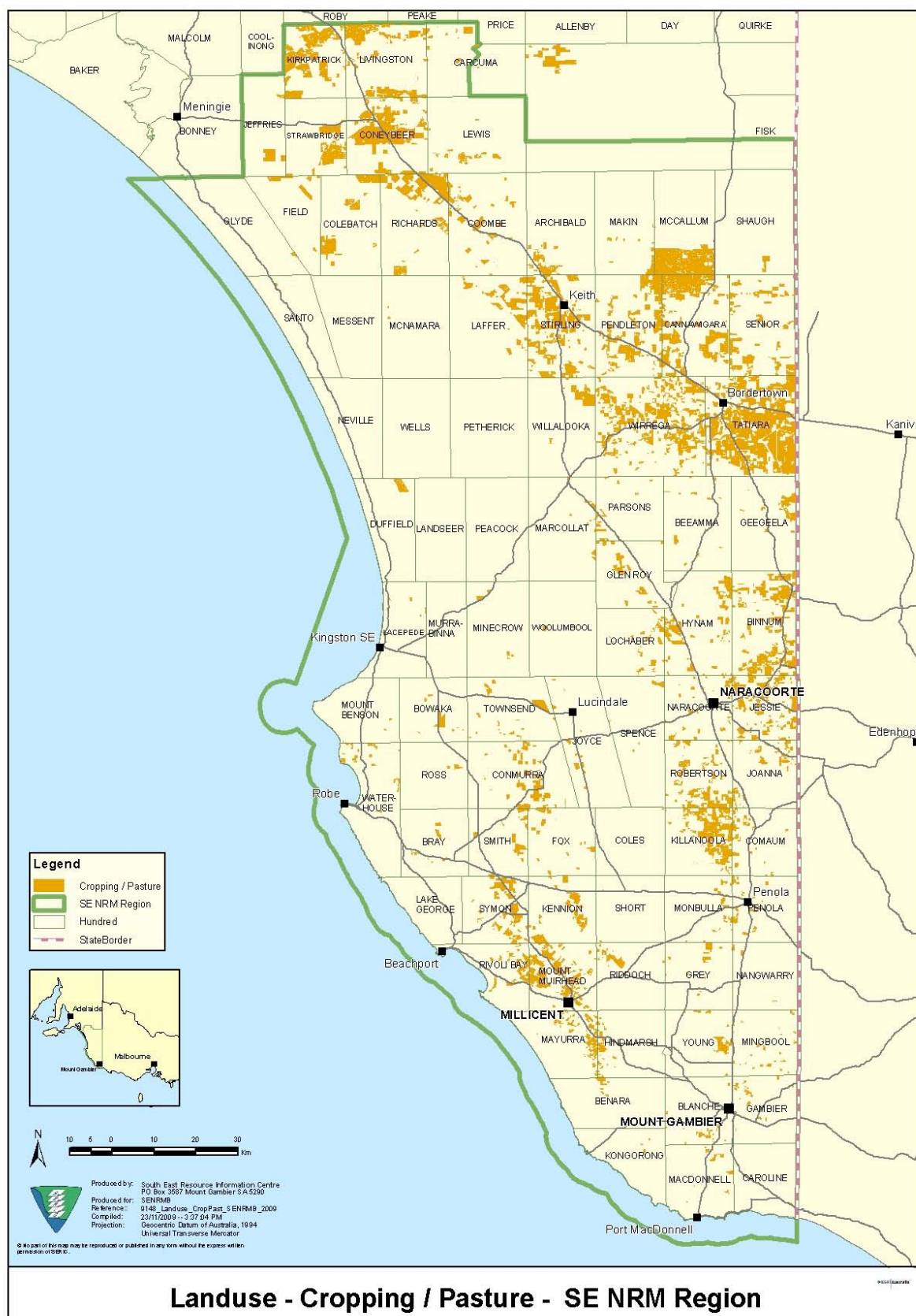
4.3.3 Results

In tables 4.9 and 4.10 the weed risk assessment results are shown for the cropping land use. In tables 4.11 and 4.12 the results from the vertebrate pest risk assessment are shown.

Table 4.9   Weed risk assessment results table for cropping land use

Crop-Pasture Rotation	Invasiveness	Impacts	Potential Distribution	Comparative Weed Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
Alkali sida	6.0	3.2	1.0	19	Low	2.7	0.0	6.4	0	Very High
Annual ryegrass	6.7	2.1	8.0	112	High	4.7	8.3	5.5	212	Negligible
Apple of sodom	4.0	3.7	4.0	59	Medium	4.0	2.1	4.5	38	Medium
Bathurst burr	6.0	3.2	4.0	76	Medium	2.7	0.9	6.4	16	High
Bedstraw	5.3	2.6	1.0	14	Low	4.0	0.1	3.6	1	Very High
Bifora	5.3	2.6	1.0	14	Low	4.0	0.1	3.6	1	Very High
Bladder campion	5.3	2.6	1.0	14	Low	4.0	0.1	3.6	1	Very High
Blue mustard	5.3	2.6	1.0	14	Low	4.0	0.1	3.6	1	Very High
Broomrape	7.3	2.6	4.0	77	Medium	4.0	0.0	6.4	0	Very High
Buchan weed	6.0	2.6	1.0	16	Low	4.7	2.5	5.5	64	Low
Calomba daisy	6.0	2.6	4.0	63	Medium	4.0	0.4	6.4	11	Very High
Caltrop	6.0	2.6	6.0	95	Medium	4.0	0.4	6.4	11	Very High
Capeweed	6.7	1.6	2.0	21	Low	3.3	3.3	3.6	40	Medium
Couch	8.0	2.6	6.0	126	High	4.0	3.3	6.4	85	Low
Creeping knapweed	3.3	3.7	6.0	74	Medium	5.3	0.1	4.5	2	Very High
Cutleaf mignonette	5.3	2.1	4.0	45	Medium	3.3	2.1	3.6	25	High
Dock	8.0	2.6	4.0	84	Medium	4.0	3.3	5.5	73	Low
Field bindweed	6.7	1.6	4.0	42	Medium	0.0	3.3	3.3	30	High
Field garlic	4.7	1.6	2.0	15	Low	0.0	3.3	0.1	0	Very High
Fleabane	6.0	2.1	6.0	76	Medium	4.7	5.0	7.3	170	Negligible
Hoary cress	5.3	2.1	6.0	67	Medium	2.7	0.8	5.5	12	Very High
Horehound	6.0	3.2	10.0	189	High	2.0	5.0	4.5	45	Medium

Innocent weed	6.7	2.1	8.0	**112**	**High**	3.3	0.4	5.5	**8**	**Very High**
Lesser loosestrife	4.0	3.2	4.0	**51**	**Medium**	4.7	0.0	3.6	**0**	**Very High**
Lincoln weed	6.7	1.6	4.0	**42**	**Medium**	4.0	0.9	6.4	**23**	**High**
Muskweed	6.0	2.6	1.0	**16**	**Low**	1.3	0.4	2.7	**2**	**Very High**
Nightstock	4.7	1.1	1.0	**5**	**Negligible**	2.7	0.1	2.7	**1**	**Very High**
Pheasant's eye	3.3	2.6	2.0	**18**	**Low**	4.0	0.1	4.5	**2**	**Very High**
Salvation Jane	4.7	2.6	10.0	**123**	**High**	2.7	6.7	3.6	**65**	**Low**
Skeleton weed	8.0	1.6	6.0	**76**	**Medium**	5.3	1.7	7.3	**65**	**Low**
Silverleaf nightshade	8.7	2.1	6.0	**109**	**High**	6.0	0.4	7.3	**18**	**High**
Soursob	5.3	1.1	8.0	**45**	**Medium**	2.7	3.3	7.3	**65**	**Low**
Tall wheatgrass	6.0	5.8	4.0	**139**	**High**	6.7	5.0	6.4	**212**	**Negligible**
Three-horned bedstraw	4.7	2.6	4.0	**49**	**Medium**	2.7	0.1	4.5	**1**	**Very High**
Variegated thistle	4.0	3.2	2.0	**25**	**Low**	2.7	0.9	4.5	**11**	**Very High**
Wild oats	7.3	3.2	8.0	**185**	**High**	2.0	8.3	3.6	**61**	**Low**
Wild radish	5.3	2.6	8.0	**112**	**High**	2.7	8.3	5.5	**121**	**Negligible**
Yellow burrweed	5.3	4.7	6.0	**152**	**High**	3.3	5.0	5.5	**91**	**Low**

Table 4.10   Weed risk assessment matrix for cropping land use

WEED RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >113	Low >56	Medium >31	High >14	Very High <14
Negligible <13					
Low <39		Buchan weed	Capeweed		Bedstraw, Bladder campion, Field garlic, Variegated thistle
Medium <101	Fleabane	Dock, Skeleton weed, Soursob	Apple of sodom	Bathurst burr, Cutleaf mignonette, Field bindweed, Lincoln weed	Caltrop, Creeping knapweed, Hoary cress, Three horned bedstraw
High <192	Annual ryegrass, Tall wheatgrass, Wild radish	Couch, Salvation Jane, Wild oats, Yellow burr weed	Horehound	Silverleaf nightshade	Innocent weed
Very High >192					

Table 4.11   Vertebrate pest risk assessment results table for cropping land use

CROPPING	Invasiveness	Impacts	Potential Distribution	Comparative Pest Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
European rabbit	10.0	3.2	10.0	320	Very High	3.5	2.5	5.0	44	Medium
Goat	7.3	3.2	7.3	186	Very High	2.0	0.9	2.7	5	Very High
European hare	4.5	0.8	4.5	36	Medium	5.3	2.5	6.4	85	Low
House mouse	6.4	6.0	6.4	382	Very High	6.0	2.1	8.2	102	Low
Black rat	6.4	4.0	6.4	204	Very High	6.7	1.8	7.3	85	Low
Hog deer	6.4	2.0	6.4	51	Medium	2.7	0.9	3.6	8	Very High
Wapiti & Red deer	6.4	2.8	6.4	143	High	2.7	0.9	3.6	9	Very High
Rusa, Chital & Sambar deer	6.4	2.8	6.4	143	High	2.7	0.9	3.6	9	Very High
Fallow deer	6.4	2.8	6.4	143	High	2.7	2.1	3.6	20	High

Table 4.12   Vertebrate pest risk assessment matrix for cropping land use

COMPARATIVE PEST RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >111	Low 111-55	Medium 31-54	High 13-30	Very High <13
Negligible <11					
Low 11-34					
Medium 35-88		HARE			HOG DEER
High 89-168				FALLOW DEER	RED, WAPITI, RUSA, SAMBAR & CHITAL DEER
Very High >168	MOUSE	BLACK RAT	RABBIT		GOAT

4.3.4   Summary - Cropping

Pest plants

For the cropping land use the management action for Innocent weed populations is targeted destruction and local eradication where feasible as the assessment recognised the very high risk and high feasibility for containment of this species.

Caltrop, Hoary cress, Three horned bedstraw, Silverleaf nightshade and Yellow burr weed are all categorised as Contain Spread, which aims to prevent the ongoing spread of the weed species in the management area through surveillance and mapping to locate all infested properties, control of all infestations and aiming for a significant reduction in weed density.

Vertebrate pests

For the cropping land use Red, Wapiti, Chital, Rusa and Sambar deer populations are to be targeted for destruction and local eradication where feasible, as the assessment has recognised that they pose a very high risk and still have a high feasibility for containment. However, Fallow and Hog deer are targeted for the control of all populations, aiming for a significant reduction in pest animal density through high-level initial control and sustained management. This is the same management action for Rabbits.

4.4   FORESTRY

4.4.1   Description

Forestry is an industry that supports extensive employment in the region, and is currently undergoing significant changes in species and management. Softwood plantations (Radiata pine) have dominated the landscape in the Lower South East for many decades; however there has been recent and rapid expansion of hardwood plantations (predominantly Tasmanian Blue Gums). In 2008, forestry comprised 5% or 144,108 hectares in the higher rainfall areas south of Kingston and Lucindale.

4.4.2   Assumptions

Pest plants

The main pest plant control effort (herbicides) is at pre-planting when the weeds compete with young seedlings for space and nutrients. Pest plant control is generally only carried out within the first two years after establishment. Greater canopy cover of mature trees usually reduces weed infestations within plantations. Plantations are sometimes grazed.

Vertebrate pests

The main control effort is at pre-planting when the young seedlings are susceptible to grazing by herbivores. Access to sites for pest control is only possible within the first two years. Some 1080 fox baiting occurs in plantations where livestock are grazed once trees have established.

Figure 4.4   Map of forestry land use

Landuse - Forestry - SE NRM Region
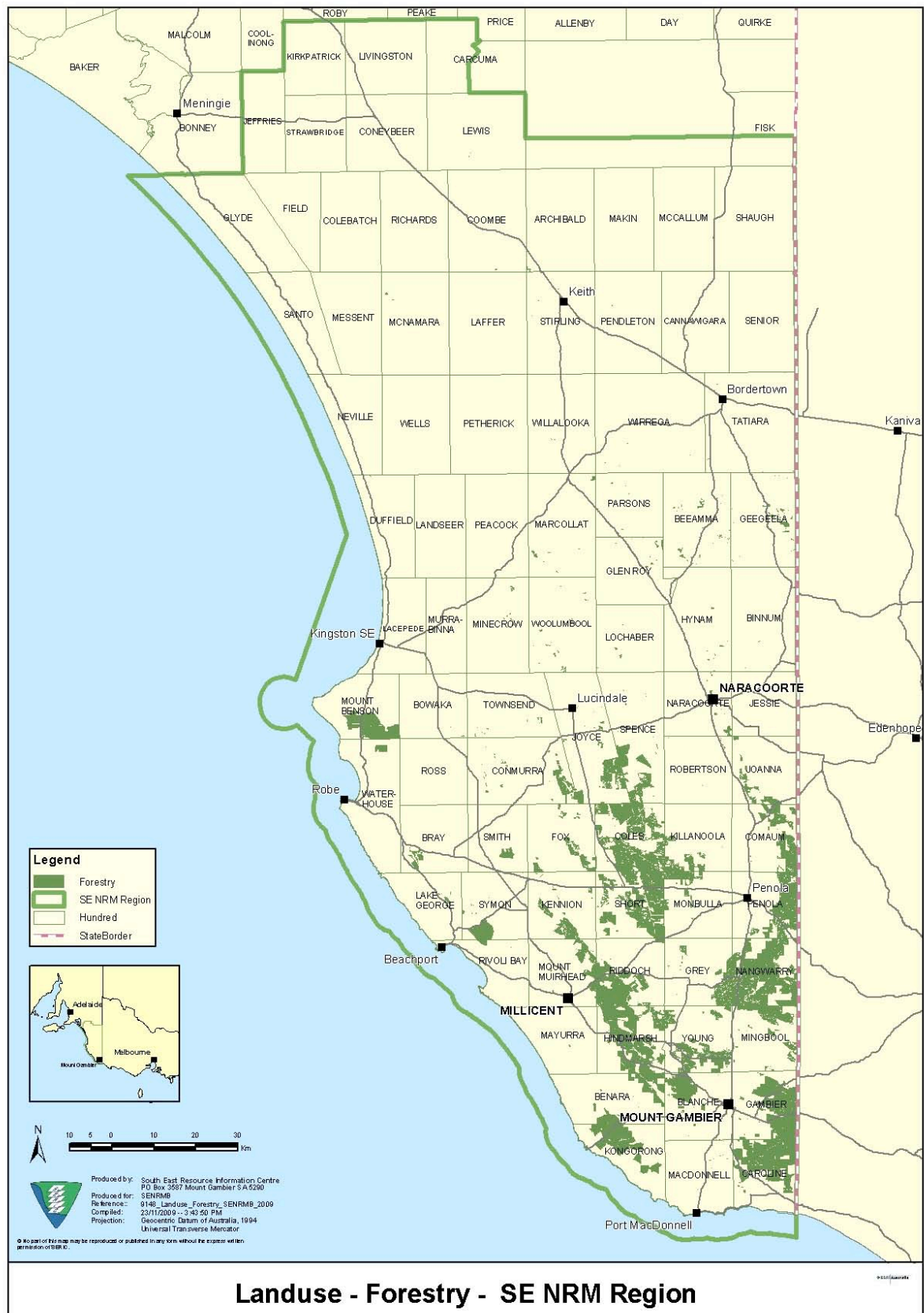
4.4.3 Results

In tables 4.13 and 4.14 the results of the weed risk assessment are shown for the forestry land use. Tables 4.15 and 4.16 show the results of the vertebrate pest risk assessment.

Table 4.13   Weed risk assessment results table for forestry land use

Forestry	Invasiveness	Impacts	Potential Distribution	Comparative Weed Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
African boxthorn	4.0	3.2	2.0	25	Low	5.3	1.3	4.5	30	High
African feathergrass	3.3	2.1	1.0	7	Negligible	3.3	0.1	5.5	2	Very High
Bathurst burr	6.0	3.7	2.0	44	Medium	2.7	0.1	6.4	1	Very High
Blackberry	7.3	2.6	6.0	116	High	4.7	0.4	6.4	12	Very High
Blue mustard	5.3	1.1	1.0	6	Negligible	4.0	0.1	3.6	1	Very High
Bluebell creeper	6.0	2.1	8.0	101	High	3.3	1.3	8.2	34	Medium
Boneseed	7.3	1.1	6.0	46	Medium	2.7	0.4	4.5	5	Very High
Bracken fern	6.7	3.2	6.0	126	High	2.7	5.0	6.4	85	Low
Bridal creeper	7.3	5.3	10.0	386	Very High	5.3	6.7	6.4	226	Negligible
Bridal veil	7.3	5.3	6.0	232	Very High	6.0	0.1	7.3	4	Very High
Cape broom	4.7	2.6	2.0	25	Low	3.3	0.1	4.5	1	Very High
Couch	6.7	2.6	6.0	105	High	4.0	2.1	6.4	53	Medium
Dock	4.0	0.5	6.0	13	Negligible	2.7	2.1	5.5	30	High
Fleabane	3.3	1.6	6.0	32	Low	3.3	6.7	5.5	121	Negligible
Gorse/ Furze	5.3	2.6	4.0	56	Medium	4.0	0.1	6.4	2	Very High
Innocent weed	6.7	2.1	4.0	56	Medium	3.3	0.4	5.5	8	Very High
Kikuyu	6.0	2.6	6.0	95	Medium	3.3	1.8	7.3	42	Medium
Pampas grass	4.0	2.6	6.0	63	Medium	3.3	0.1	5.5	2	Very High
Phalaris	5.3	4.2	6.0	135	High	3.3	6.7	7.3	162	Negligible
Sallow wattle	8.0	5.3	10.0	421	Very High	5.3	2.5	4.5	61	Low
South African weed orchid	6.0	1.1	4.0	25	Low	7.3	0.9	7.3	49	Medium
Wireweed	4.0	2.1	6.0	51	Medium	3.3	5.0	4.5	76	Low

Table 4.14   Weed risk assessment matrix for forestry land use

WEED RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >113	Low >56	Medium >31	High >14	Very High <14
Negligible <13				Dock	African feathergrass
Low <39	Fleabane		South African weed orchid	African boxthorn	Cape broom
Medium <101		Wireweed	Kikuyu		Bathurst burr, Boneseed, Gorse, Innocent weed, Pampas grass
High <192	Phalaris	Bracken fern	Bluebell creeper, Couch		Blackberry
Very High >192	Bridal creeper	Sallow wattle			Bridal veil

Table 4.15 **Vertebrate pest risk assessment results table for forestry land use**

FORESTRY	Invasiveness	Impacts	Potential Distribution	Comparative Pest Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
European rabbit	10.0	2.8	10.0	224	Very High	5.9	3.3	6.3	123	Negligible
Red fox	7.3	1.6	7.3	116	High	6.0	8.3	5.5	273	Negligible
Goat	8.2	2.8	8.2	229	Very High	5.3	2.1	1.8	20	High
European hare	4.5	1.6	4.5	58	Medium	7.3	3.3	6.4	156	Negligible
Hog deer	7.3	2.4	7.3	70	Medium	6.0	0.8	2.7	14	High
Wapiti & Red deer	7.3	2.4	7.3	70	Medium	6.0	3.3	3.6	73	Low
Rusa, Chital & Sambar deer	7.3	2.4	7.3	70	Medium	6.0	1.7	2.7	27	High
Fallow deer	7.3	2.4	7.3	70	Medium	6.0	3.3	3.6	73	Low

Table 4.16   Vertebrate pest risk assessment matrix for forestry land use

COMPARATIVE PEST RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >111	Low 111-55	Medium 31-54	High 13-30	Very High <13
Negligible <11					
Low 11-34					
Medium 35-88	HARE	RED, WAPITI & FALLOW DEER		RUSA & HOG DEER, SAMBAR & CHITAL DEER	
High 89-168	FOX				
Very High >168	RABBIT			GOAT	

4.4.4   Summary - Forestry

Pest plants

As shown in the forestry management matrix in table 4.14, Bridal veil has a very high weed risk and is very high in feasibility of containment. Thus it is recommended that all infestations are eradicated from the region. Bridal veil was also classified in this category in the native vegetation land use and as a result eradication efforts should be coordinated across these two land uses. Other pest plants which are very high in the feasibility of containment category are Bathurst burr, Boneseed, Gorse, Innocent weed, Pampas grass and Sallow wattle. These pest plants are classed as Contain Spread, thus aiming to prevent the ongoing spread of the weed species in the region.

Pest plants classed in the Limited Action category are Dock, Bridal creeper, Fleabane and South African weed orchid. These species have a low weed risk and/or low feasibility of containment thus any action would not be of significant benefit to the whole land use. In some cases control may be warranted, such as in the establishment of tree seedlings. This is the same for Phalaris and Bracken fern, which have high weed risk but feasibility of containment is minimal.

Bracken fern is a native plant in the South East but has a significant impact on the establishment of tree seedlings; therefore it has been considered as a weed within this land use. As a native plant, Bracken fern is protected by the Native Vegetation Act 1991 and advice should be sought from the Native Vegetation Council before any clearance or control is undertaken.

Vertebrate Pests

According to table 4.16 Goats pose the highest risk to the forestry land use. When management actions are undertaken in the native vegetation and grazing land uses they should also occur at similar levels in the forestry land use, as it could potentially provide harbour or refuge sites for many transient pest animals.

4.5   AQUATIC

4.5.1   Description

Historically, the majority of the South East region was seasonally or permanently inundated with water due to low lying topography, soils prone to waterlogging and a lack of natural drainage. Since 1860's, the development of an extensive drainage network and changing climatic factors has resulted in very few intact wetlands remaining. For the purposes of this risk assessment, the aquatic land use category comprises approximately 2% of the region and includes wetlands, lakes, creeks and streams, drains and any area with permanent surface water.

4.5.2   Assumptions

Pest plants

There is no routine pest plant management in the land use due to the inaccessibility to most sites. Both environmental impacts and water quality issues were considered when undertaking the assessment. Species which occur in areas subject to flooding are also included in this landuse, for example Willows and Blackberry. In some cases livestock may have access to waterways.

Vertebrate pests

There is no routine pest animal management in the land use due to the inaccessibility to most sites and no viable option for poisons in wet areas. Shooting may occur in areas on private property.

Figure 4.5   Map of aquatic land use

Landuse - Aquatic - SE NRM Region

4.5.3   Results

In tables 4.17 and 4.18 the results of the weed risk assessment of the aquatic land use are shown. Tables 4.19 and 4.20 show the results for the vertebrate pest risk assessment.

Table 4.17   Weed risk assessment results table for aquatic land use

Aquatic	Invasiveness	Impacts	Potential Distribution	Comparative Weed Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
Athel pine	4.7	1.6	4.0	29	Low	7.3	0.0	7.3	0	Very High
Blackberry	8.0	4.7	6.0	227	Very High	0.9	7.3	0.0	49	Medium
Dodder (Chilean & red)	6.0	0.5	1.0	3	Negligible	0.1	7.3	0.0	4	Very High
Pepper tree	2.7	2.6	2.0	14	Low	1.8	6.4	0.0	52	Medium
Spiny rush	6.0	3.2	8.0	152	High	0.0	36.4	0.0	36	Medium
Swamp oak	6.0	7.4	6.0	265	Very High	6.7	1.7	5.5	61	Low
Willows - seeding	6.0	5.3	1.0	32	Low	0.0	6.0	0.1	0	Very High

Table 4.18   Weed risk assessment matrix for aquatic land use

WEED RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >113	Low >56	Medium >31	High >14	Very High <14
Negligible <13					Dodder (Chilean & red)
Low <39			Pepper tree		Athel pine, Noogoora burr, Willows (seeding)
Medium <101					
High <192			Spiny rush		
Very High >192		Swamp oak	Blackberry		

Table 4.19   Vertebrate pest risk assessment results table for aquatic land use

AQUATIC	Invasiveness	Impacts	Potential Distribution	Comparative Pest Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
Black rat	7.3	5.2	8.0	303	Very High	7.3	3.3	6.4	156	Negligible
Brown rat	7.3	5.2	4.0	151	High	6.0	0.9	3.6	20	High
Mallard	8.2	4.8	10.0	393	Very High	5.3	0.8	3.6	16	High
Carp	10.0	6.0	8.0	480	Very High	8.0	0.9	7.3	53	Medium
Carp gudgeon	10.0	2.8	8.0	224	Very High	10.7	3.3	7.3	259	Negligible
Gambusia	11.8	4.4	8.0	416	Very High	10.7	3.3	8.2	291	Negligible
Goldfish	10.0	4.0	8.0	320	Very High	8.7	1.3	7.3	79	Low
Marron	8.2	5.2	4.0	170	Very High	10.0	0.8	8.2	69	Low
Redfin	10.9	5.2	6.0	340	Very High	10.0	5.0	8.2	409	Negligible
Trout (Rainbow)	7.3	5.2	4.0	151	High	8.7	1.3	7.3	79	Low
Tench	8.2	3.2	2.0	52	Medium	9.3	0.9	5.5	47	Medium

Table 4.20   Vertebrate pest risk assessment matrix for aquatic land use

COMPARATIVE PEST RISK	FEASIBILITY OF CONTAINMENT				
	Negligible *>111*	*Low* *111-55*	*Medium* *31-54*	*High* *13-30*	*Very High* *<13*
Negligible *<11*					
Low *11-34*					
Medium *35-88*			TENCH		
High *89-168*		TROUT		BROWN RAT	
Very High *>168*	BLACK RAT, CARP GUDGEON, GUMBUSIA, REDFIN,	GOLDFISH, MARRON	CARP	MALLARD	

4.5.4   Summary - Aquatic

Pest plants

Willow species have been classified into the Protect Sites category, which is defined as the prevention of spread to key sites of environmental importance. In this case Willows have a limited current distribution, so therefore it is feasible to protect sites from Willow invasion, even though they have a low weed risk. The Willow species assessed for this project were the seed producing species in the Weeds of National Significance (WoNS) list. Blackberry is also a WoNS and has been allocated to Contain Spread classification to prevent ongoing spread of this species in the region.

Vertebrate Pests

Mallard is located in the Destroy Infestations category, which aims to destroy all infestations in the region. Brown rat and Carp have been classified as Contain Spread which aims to contain the spread of pests in the region.

Although not declared under the Natural Resources Management Act 2004 fresh water fish have been assessed to identify the risk they pose to the aquatic land use in the South East. Assessments were completed on the advice of professionals in the field of fresh water fish ecology and biology.

4.6   URBAN

4.6.1   Description

In total, the South East region consists of approximately 2.8 million hectares and supports a population of approximately 62,000 people. Of this regional population, half are located within the City of Mount Gambier and surrounding areas. This distribution limits the ability for individuals across the large, less populated rural areas to control and manage pest species. In urban areas, the focus for pest control and eradication is on maintaining public amenity and safety. Common areas for concern include sports fields and parks, as well as footpaths. Control methods may be limited in urban areas due to inability to use poisons or baits, combined with differing public perceptions.

4.6.2   Assumptions

Pest plants

Councils and landholders undertake regular mowing and irregular spot-spraying using low volatility herbicides such as Glyphosate. In the South East most lawns and gardens are watered all year round.

Garden weeds or plants that are simply disliked because they are a nuisance are not considered in this assessment. Effects on quality of the land use are focused on damage to physical infrastructure (e.g. roads, paths, buildings) and the impact they may have on a person.

Vertebrate Pests

Pest animal management is through trapping and habitat modification, and minimal use of poisoned baits where possible.

Figure 4.6   Map of urban land use

Landuse - Urban - SE NRM Region

4.6.3   Results

Tables 4.21 and 4.22 show the results of the weed risk assessment for the urban land use. Tables 4.23 and 4.24 show the results for the vertebrate pest risk assessment.

Table 4.21   Weed risk assessment results table for urban land use

Urban	Invasiveness	Impacts	Potential Distribution	Comparative Weed Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
African boxthorn	4.0	4.7	1.0	19	Low	2.7	0.9	4.5	11	Very High
Aleppo pine	6.0	5.3	6.0	189	High	5.3	0.9	4.5	22	High
Apple of sodom	6.7	4.2	4.0	112	High	4.7	1.7	5.5	42	Medium
Athel pine	4.7	1.6	1.0	7	Negligible	0.0	7.3	0.1	0	Very High
Blackberry	6.0	4.7	1.0	28	Low	3.3	0.1	5.5	2	Very High
Bridal creeper	7.3	5.3	10.0	386	Very High	5.3	6.7	6.4	226	Negligible
Caltrop	6.0	4.7	4.0	114	High	4.7	0.9	3.6	16	High
Coolatai grass	5.3	1.6	2.0	17	Low	3.3	0.1	3.6	1	Very High
Couch	8.0	2.6	6.0	126	High	4.0	2.1	6.4	53	Medium
False caper	5.3	4.7	1.0	25	Low	5.3	0.1	8.2	4	Very High
Gazania sp.	6.0	1.6	2.0	19	Low	6.0	0.1	6.4	3	Very High
Innocent weed	6.7	4.7	1.0	32	Low	4.7	0.1	4.5	2	Very High
Khaki weed	6.0	4.7	4.0	114	High	4.7	0.1	4.5	2	Very High
Kikuyu	8.0	2.6	6.0	126	High	4.0	2.1	6.4	53	Medium
Pin cushion daisy	6.0	4.2	4.0	101	High	6.7	5.0	6.4	212	Negligible
Poa grass	6.0	2.1	8.0	101	High	6.7	5.0	6.4	212	Negligible
Prickly pear	5.3	4.7	4.0	101	High	6.0	0.9	3.6	20	High
Soursob	5.3	1.1	8.0	45	Medium	2.7	3.3	7.3	65	Low
Tree of heaven	6.0	5.8	4.0	139	High	6.0	0.0	3.6	0	Very High
Willows - seeding	6.0	5.3	1.0	32	Low	0.0	0.0	6.0	5	Very High

Table 4.22   Weed risk assessment matrix for urban land use

WEED RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >113	Low >56	Medium >31	High >14	Very High <14
Negligible <13					Athel pine
Low <39					African boxthorn, Blackberry, False caper, Gazania, Innocent weed, Willow (seeding)
Medium <101		Soursob			
High <192	Pin cushion daisy, Poa grass		Apple of sodom, Couch, Kikuyu	Aleppo pine, Caltrop, Prickly pear	Khaki weed, Tree of heaven
Very High >192	Bridal creeper				

Table 4.23   Vertebrate pest risk assessment results table for urban land use

URBAN	Invasiveness	Impacts	Potential Distribution	Comparative Pest Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
European rabbit	10.0	3.2	4.0	128	High	5.9	2.5	6.3	92	Low
Red fox	7.3	4.8	8.0	279	Very High	10.0	5.0	7.3	364	Negligible
Cat	10.0	4.4	10.0	440	Very High	9.3	10.0	7.3	679	Negligible
European hare	4.5	1.2	2.0	11	Low	6.7	2.5	6.4	106	Low
House mouse	7.3	4.4	10.0	320	Very High	8.0	10.0	4.5	364	Negligible
Black rat	7.3	5.6	10.0	407	Very High	8.0	8.3	4.5	303	Negligible
Brown rat	6.4	4.0	2.0	51	Medium	8.0	0.8	4.5	31	High
Wild dog/ Dingo	6.4	4.8	2.0	61	Medium	7.3	0.9	1.8	12	Very High
Common starling	6.4	2.8	10.0	178	Very High	8.7	8.3	7.3	525	Negligible
Eurasian blackbird	6.4	3.2	10.0	204	Very High	8.7	10.0	7.3	630	Negligible
Domestic pigeon	10.0	4.4	10.0	440	Very High	8.7	6.7	7.3	420	Negligible
Mallard	9.1	1.2	0.5	5	Negligible	6.7	0.8	4.5	26	High

Table 4.24   Vertebrate pest risk assessment matrix for urban land use

COMPARATIVE PEST RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >111	Low 111-55	Medium 31-54	High 13-30	Very High <13
Negligible .<11				MALLARD	
Low 11-34		HARE			
Medium 35-88				BROWN RAT	WILD DOG / DINGO
High 89-168		RABBIT			
Very High >168	BLACK RAT, MOUSE, CAT STARLING, FOX BLACKBIRD, PIGEON				

4.6.4   Summary - Urban

Pest plants

The majority of the pest plants in the urban land use are feasible to control; this is due to the accessibility to infestations and the small size of current distributions. Khaki weed was classed in the Destroy Infestations category which aims to significantly reduce the extent of the weed in the region. Caltrop is another burry weed of the urban land use, whose management action aims to contain the spread of the weed in the region. Areas where Caltrop is known to be found in the region include ovals, footpaths and other public amenity areas. Other management actions for Caltrop include control of new outbreaks to reduce spread.

Vertebrate Pests

Wild dog and Brown rat should have enforced control of all populations, aiming for a significant reduction in pest animal density through high level initial control and sustained management.

4.7 IRRIGATED CROPS AND PASTURE

4.7.1 Description

One of the unique features of the South East region is the availability of good quality underground water that is suitable for stock, domestic and agricultural use. This supports irrigated cropping and grazing across the region, with dairying, fat lambs and annual horticulture such as potatoes in the Lower South East. In the Upper South East, most irrigation is focused on lucerne and small seed production (e.g. clover). There are two main types of irrigation used for crops and pasture, spray (centre pivot) and flood irrigation, dependant largely on the quality of water available, appropriate delivery systems and external factors such as presence of large red gums (*Eucalyptus camaldulensis*). Drip irrigation is limited mainly to perennial horticulture (e.g. fruit trees and grape vines).

4.7.2 Assumptions

Pest plants

The main pest plant control occurs during pasture establishment, with knockdown sprays and cultivation used before seeding. Pre-emergence herbicides are used and some follow up sprays with selective herbicides such as 2,4D, Bromoxynil (depending on the crop). Mowing/grazing and selective and/or knockdown herbicides (e.g., paraquat) are used when needed. For flood irrigation some drain bank weed control is needed at the start of the season e.g., Glyphosate.

Vertebrate Pests

The assumption of this land use is that there is very little pest animal control conducted by landowners. The main method of control is conducting 1080 baiting programs during lambing seasons.

Figure 4.7   Map of irrigated crops and pastures land use

Landuse - Irrrigated - SE NRM Region

4.7.3 Results

In tables 4.25 and 4.26 the results are presented from the weed risk assessment for the irrigated crops and pasture land use. Tables 4.27 and 4.28 show the results for the vertebrate pest risk assessment.

Table 4.25   Weed risk assessment results table for irrigated crops and pastures land use

Irrigated Pastures and Crops	Invasiveness	Impacts	Potential Distribution	Comparative Weed Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
Alkali sida	6.0	3.2	1.0	19	Low	2.7	0.0	6.4	0	Very High
Bathurst burr	6.0	2.6	4.0	63	Medium	4.0	0.1	6.4	2	Very High
Blackberry	7.3	2.6	6.0	116	High	4.7	0.4	6.4	12	Very High
Blackberry nightshade	4.0	2.1	1.0	8	Negligible	5.3	1.8	6.4	59	Low
Bladder campion	5.3	2.6	1.0	14	Low	4.0	0.1	3.6	1	Very High
Broomrape	7.3	2.6	4.0	77	Medium	4.0	0.0	6.4	0	Very High
Buchan weed	6.7	4.2	2.0	56	Medium	5.3	2.5	6.4	85	Low
Caltrop	6.7	3.2	6.0	126	High	4.0	0.9	6.4	23	High
Capeweed	6.7	1.6	2.0	21	Low	3.3	3.3	3.6	40	Medium
Carrot	7.3	2.6	2.0	39	Low	6.0	0.1	5.5	3	Very High
Couch	6.7	2.6	10.0	175	High	6.7	3.3	6.4	141	Negligible
Creeping knapweed	3.3	3.7	6.0	74	Medium	5.3	0.1	4.5	2	Very High
Dock	4.7	2.1	8.0	79	Medium	5.3	5.0	5.5	145	Negligible
Dodder (Chilean & red)	6.0	0.5	1.0	3	Negligible	6.0	0.1	7.3	4	Very High
False caper	6.0	2.6	4.0	63	Medium	4.0	1.3	6.4	32	Medium
Fat hen	7.3	3.2	8.0	185	High	5.3	5.0	5.5	145	Negligible
Field bindweed	6.7	1.6	4.0	42	Medium	0.0	3.3	3.3	30	High
Fleabane	3.3	1.6	6.0	32	Low	3.3	6.7	5.5	121	Negligible
Golden dodder	8.7	3.7	8.0	255	Very High	4.0	0.1	5.5	2	Very High
Innocent weed	5.3	2.6	4.0	56	Medium	3.3	0.1	5.5	2	Very High
Khaki weed	5.3	2.6	8.0	112	High	3.3	0.0	5.5	0	Very High
Kikuyu	8.0	2.6	6.0	126	High	4.0	2.1	6.4	53	Medium

Lincoln weed	6.7	1.6	4.0	42	**Medium**	4.0	0.9	6.4	23	**High**
Noogoora burr complex	5.3	2.6	4.0	56	**Medium**	2.7	0.1	6.4	1	**Very High**
Ox tongue	5.3	1.1	6.0	34	**Low**	4.7	5.0	6.4	148	**Negligible**
Parramatta grass	6.7	2.6	4.0	70	**Medium**	4.0	2.5	5.5	55	**Medium**
Poa grass	6.0	4.2	4.0	101	**High**	6.7	5.0	6.4	212	**Negligible**
Salvation Jane	5.3	4.7	8.0	202	**Very High**	3.3	2.5	5.5	45	**Medium**
Skeleton weed	8.0	1.6	6.0	76	**Medium**	5.3	1.7	7.3	65	**Low**
Slender thistle	4.7	3.2	8.0	118	**High**	3.3	2.5	4.5	38	**Medium**
Silverleaf nightshade	8.0	2.6	6.0	126	**High**	6.0	0.4	7.3	18	**High**
Soldier thistle	5.3	3.7	6.0	118	**High**	3.3	2.5	4.5	38	**Medium**
Sorrell	3.3	2.1	4.0	28	**Low**	3.3	6.7	4.5	101	**Low**
Spear thistle	5.3	3.7	6.0	118	**High**	3.3	2.5	4.5	38	**Medium**
Three cornered jack	6.7	3.7	4.0	98	**Medium**	3.3	0.1	5.5	2	**Very High**
Variegated thistle	3.3	3.7	4.0	49	**Medium**	3.3	0.1	4.5	1	**Very High**
Willow herb	5.3	3.2	6.0	101	**High**	2.7	8.3	5.5	121	**Negligible**
Wireweed	4.0	2.1	6.0	51	**Medium**	3.3	5.0	4.5	76	**Low**
Yellow burrweed	5.3	4.7	6.0	152	**High**	3.3	1.3	5.5	23	**High**

Table 4.26   Weed risk assessment matrix for irrigated crops and pastures land use

WEED RISK	FEASIBILITY OF CONTAINMENT				
	Negligible *>113*	*Low* *>56*	*Medium* *>31*	*High* *>14*	*Very High* *<14*
Negligible *<13*		Blackberry nightshade			Dodder (Chilean & red)
Low *<39*	Fleabane, Ox tongue	Sorrel	Capeweed		Bladder campion, Carrot,
Medium *<101*	Dock	Buchan weed, Skeleton weed, Wireweed	False caper, Parramatta grass	Field bindweed, Lincoln weed	Bathurst burr, Creeping knapweed, Innocent weed, Noogoora burr, Three corner jack, Variegated thistle
High *<192*	Couch, Fat hen, Poa grass		Kikuyu, Slender thistle, Soldier thistle, Spear thistle	Caltrop, Silverleaf nightshade, Yellow burr weed	Blackberry, Khaki weed
Very High *>192*			Salvation Jane		Golden dodder

Table 4.27   Vertebrate pest risk assessment results table for irrigated crops and pastures land use

IRRIGATED CROPS AND PASTURES	Invasiveness	Impacts	Potential Distribution	Comparative Pest Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
European rabbit	10.0	5.2	8.0	416	Very High	7.1	5.0	6.3	221	Negligible
Red fox	7.3	6.0	10.0	436	Very High	6.7	10.0	7.3	485	Negligible
Goat	8.2	4.8	8.0	314	Very High	6.7	1.3	3.6	30	High
European hare	4.5	2.0	6.0	55	Medium	8.0	5.0	8.2	327	Negligible
House mouse	6.4	3.2	4.0	81	Medium	6.0	2.1	8.2	102	Low
Black rat	6.4	4.0	8.0	204	Very High	6.7	1.8	7.3	85	Low
Brown rat	7.3	5.2	4.0	151	High	6.0	0.8	3.6	18	High
Dingo, Wild dog	6.4	6.0	10.0	382	Very High	7.3	0.0	3.6	0	Very High
Hog deer	6.4	3.2	8.0	163	Very High	6.7	0.8	2.7	15	High
Red & Wapiti deer	7.3	3.6	10.0	262	Very High	6.0	3.3	3.6	73	Low
Rusa, Chital & Sambar deer	7.3	3.6	10.0	262	Very High	6.0	1.3	2.7	20	High
Fallow deer	7.3	3.6	10.0	262	Very High	6.0	3.3	3.6	73	Low

Table 4.28   Vertebrate pest risk assessment matrix for irrigated crops and pastures land use

COMPARATIVE PEST RISK	FEASIBILITY OF CONTAINMENT				
	Negligible *>111*	*Low* *111-55*	*Medium* *31-54*	*High* *13-30*	*Very High* *<13*
Negligible *<11*					
Low *11-34*					
Medium *35-88*	HARE	MOUSE			
High *89-168*				BROWN RAT	
Very High *>168*	RABBIT, FOX	BLACK RAT, RED, WAPITI & FALLOW DEER		HOG DEER, CHITAL, RUSA & SAMBAR DEER	GOAT, WILD DOG/ DINGO

4.7.4   Summary – Irrigation Crops and Pasture

Pest plants

Golden dodder has been identified as the highest priority for control in irrigated crops and pastures. It has come under the Eradication category which also reflects current policies for this weed. This plant is a parasitic plant that utilises a host plant to survive. The recorded infestations within the South East have been on irrigated lucerne crops.

Vertebrate Pests

In table 4.28 Goat and Wild dog/ dingo are to be eradicated from the region, while Brown rat, Hog, Sambar and Chital deer should have management actions targeted toward reducing their populations and limiting their spread.

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4.8   PERENNIAL HORTICULTURE

4.8.1   Description

Perennial horticulture in the South East region is dominated by the viticulture industry in several parcels located across the region. The main winegrowing areas are Coonawarra and Padthaway, with Wrattonbully, Cape Jaffa, Mt Benson and the Kingston area growing in popularity. This land use also includes stone fruits, pome fruit (e.g. apples) and citrus which are grown in small pockets. The total area of this land use is approximately 20,939 hectares or less than 1% of the region.

4.8.2   Assumptions

Pest plants

In some cases an annual or perennial cover crop is grown between rows of vines to prevent weed growth. A pre-emergent and knock down herbicide is also used around trees/vines. In addition a knockdown herbicide is generally used every 4-6 weeks and a pre-emergent herbicide is used twice a year. There may be some overhead sprinkler or under tree/ vine drip/micro-jet irrigation.

Vertebrate Pests

Pest animal management is through the use deterrent devices such as bird scarers and pest proof fencing, 1080 poisoned baits and shooting. An annual or perennial cover crop is grown between rows and grazing by livestock may occur.

Figure 4.8   Map of perennial horticulture land use

Landuse - Perennial Horticulture - SE NRM Region

4.8.3   Results

In tables 4.29 and 4.30 the weed risk assessment results for the perennial horticulture land use are shown. Tables 4.31 and 4.32 show the results for the vertebrate pest risk assessment.

Table 4.29   Weed risk assessment results table for perennial horticulture land use

Perennial Horticulture	Invasiveness	Impacts	Potential Distribution	Comparative Weed Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
Bathurst burr	6.7	1.1	6.0	42	Medium	0.0	3.3	0.9	0	Very High
Bridal creeper	7.3	5.3	10.0	386	Very High	5.3	6.7	6.4	226	Negligible
Caltrop	5.3	2.1	6.0	67	Medium	0.0	4.0	0.9	0	Very High
Couch	8.0	2.6	6.0	126	High	4.0	5.0	6.4	127	Negligible
Cutleaf mignonette	5.3	2.1	4.0	45	Medium	3.3	2.5	3.6	30	High
Fat hen	7.3	3.2	8.0	185	High	5.3	5.0	5.5	145	Negligible
Field bindweed	6.7	1.6	4.0	42	Medium	3.3	3.3	2.7	30	High
Fleabane	3.3	1.6	6.0	32	Low	6.7	5.5	0.0	121	Negligible
Golden dodder	8.7	3.7	8.0	255	Very High	0.1	5.5	0.0	2	Very High
Innocent weed	6.7	3.2	4.0	84	Medium	0.0	4.7	0.1	2	Very High
Khaki weed	5.3	2.6	8.0	112	High	0.1	5.5	0.0	2	Very High
Olive	6.0	3.7	4.0	88	Medium	0.9	6.4	0.0	43	Medium
Skeleton weed	8.0	1.6	6.0	76	Medium	1.7	7.3	0.0	65	Low
Silverleaf nightshade	8.0	1.6	6.0	76	Medium	0.4	7.3	0.0	18	High
Soursob	5.3	1.1	8.0	45	Medium	3.3	7.3	0.0	65	Low
Wireweed	4.7	0.5	4.0	10	Negligible	0.0	4.0	1.8	32	Medium

Table 4.30   Weed risk assessment matrix for perennial horticulture land use

WEED RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >113	**Low >56**	**Medium >31**	**High >14**	**Very High <14**
Negligible <13			Wireweed		
Low <39	Fleabane				
Medium <101		Skeleton weed, Soursob	Olive	Cutleaf mignonette, Field bindweed Silverleaf nightshade	Bathurst burr Caltrop, Innocent weed
High <192	Couch, Fat hen				Khaki weed
Very High >192	Bridal creeper				Golden dodder

Table 4.31   Vertebrate pest risk assessment results table for perennial horticulture land use

Perennial Horticulture	Invasiveness	Impacts	Potential Distribution	Comparative Pest Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
European rabbit	9.1	2.4	2.0	44	Medium	5.9	2.1	7.5	92	Low
Red fox	7.3	2.8	10.0	204	Very High	6.7	8.3	7.3	404	Negligible
Goat	7.3	3.6	0.5	13	Low	4.0	0.9	1.8	6	Very High
European hare	4.5	2.4	8.0	87	High	6.0	8.3	8.2	409	Negligible
House mouse	6.4	2.8	8.0	143	High	8.7	6.7	8.2	473	Negligible
Black rat	6.4	2.4	6.0	92	High	8.0	5.0	7.3	291	Negligible
Hog deer	6.4	2.0	0.5	6	Negligible	4.7	0.9	1.8	7	Very High
Rusa, Chital & Sambar deer	6.4	2.4	0.5	8	Negligible	4.7	0.9	1.8	7	Very High
Red & Wapiti deer	6.4	2.4	0.5	8	Negligible	4.7	1.8	1.8	15	High
Fallow deer	6.4	2.4	0.5	8	Negligible	4.7	1.8	1.8	15	High
Common starling	6.4	3.6	10.0	229	Very High	5.3	8.3	9.1	404	Negligible
Eurasian blackbird	6.4	1.6	10.0	102	High	6.7	8.3	9.1	505	Negligible

Table 4.32   Vertebrate pest risk assessment matrix for perennial horticulture land use

COMPARATIVE PEST RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >111	Low 111-55	Medium 31-54	High 13-30	Very High <13
Negligible <11				RED, WAPITI & FALLOW DEER	HOG, CHITAL, SAMBAR & RUSA DEER
Low 11-34					GOAT
Medium 35-88		RABBIT			
High 89-168	HARE, BLACK RAT, BLACKBIRD, MOUSE				
Very High >168	STARLING FOX				

4.8.4   Summary – Perennial Horticulture

Pest plants

Consistent with irrigated crops and pastures Golden dodder has been classified into the highest management category of Eradicate from region within the perennial horticulture land use. Therefore when implementing control activities a whole of region approach should be taken to ensure it does not enter into the region and ensure existing infestations are eradicated.

Burry weeds of Bathurst burr, Caltrop and Innocent weed are very prevalent in perennial horticulture and are easily spread due to the high human and vehicle traffic in plantations. Management of these weeds should be aimed at containing the spread within this land use, and controlling current infestations.

Vertebrate Pests

In table 4.32 Goat was categorised in the Protect Sites management action which aims to prevent spread of the pest animal species to key sites/assets of high economic, environmental and/or social value. Black rat, Mouse, Blackbird, Starling and Fox species are classified in the Manage Pest Populations action.

4.9 COMBINED RISK ASSESSMENT RESULTS

The attribute scores for the pest plant and pest animal threats assessed in this project have been averaged across the whole of the region and each land use outlines key assumptions that have been applied to the assessment.

The assessment of the pest plant and animals has shown species have varying control actions between each land use, i.e. one species can be categorised into multiple management actions e.g. goat is Eradicate from the region in cropping land use, Destroy Infestations in grazing land use and Protect Sites in perennial horticulture land use (refer to table 4.33 below).

Table 4.33   Weed species versus management actions

Landuse		Grazing	Native Vegetation	Cropping	Forestry	Aquatic	Urban	Irrigated Crop & Pastures	Perennial Horticulture	Highest Management Class
1	Eradicate from Region (Red)									
2	Destroy Infestations (Orange)									
3	Contain Spread (Yellow)									
4	Protect Sites (Green)									
5	Manage Weed (Light Blue)									
6	Manage Sites (Dark Blue)									
7	Monitor (Purple)									
8	Limited Action (Grey)									
	Not Present/ Alert Species									
WEEDS:										
Acacia cyclops	*Acacia cyclops*		5							5
African boxthorn	*Lycium ferocissimum*	4	4		7		4			4
African feathergrass	*Pennisetum macrourum*	3	3		7					3
African lovegrass	*Eragrostis curvula*	3	3							4
African rue	*Peganum harmala*									
Agave	*Agave americana*		7							7
Aleppo pine	*Pinus halepensis*		3				3			3
Alisma	*Alisma lanceolatum*									
Alkali sida	*Malvella leprosa*									
Alligator weed	*Alternanthera philoxeroides*									
Annual ryegrass	*Lolium rigidum*			5						5
Apple of sodom	*Solanum hermannii*	4	6	6			4			4
Arrowhead	*Sagittaria montevidensis*									
Arum lily	*Zantedeschia aethiopica*		7							7
Asparagus fern	*Asparagus scandans*		2							2
Athel pine	*Tamarix aphylla*		7			4	7			7
Azzarola	*Crataegus sinaica*									
Bamboo	*Arundo donax*		8							8

Landuse		Grazing	Native Vegetation	Cropping	Forestry	Aquatic	Urban	Irrigated Crop & Pastures	Perennial Horticulture	Highest Management Class
1	Eradicate from Region (Red)									
2	Destroy Infestations (Orange)									
3	Contain Spread (Yellow)									
4	Protect Sites (Green)									
5	Manage Weed (Light Blue)									
6	Manage Sites (Dark Blue)									
7	Monitor (Purple)									
8	Limited Action (Grey)									
	Not Present/ Alert Species									
Bathurst burr	*Xanthium spinosum*	3		4	3			3	3	3
Bedstraw	*Galium sp.*			4						4
Bifora	*Bifora testiculata*									
Blackberry	*Rubus fruticosus*	3	3		2	3	4	2		2
Blackberry nightshade	*Solanum nigrum*		8					8		8
Bladder campion	*Silene vulgaris*	4		4				4		4
Blue mustard	*Chorispora tenella*									
Blue periwinkle	*Vinca major*		6							6
Blue psoralea	*Psoralea pinnata*		4							4
Bluebell creeper	*Sollya heterophylla*		3		4					3
Boneseed	*Chrysanthemoides monilifera*		3		3					3
Bracken fern	*Pteridium esculentum*	8			5					5
Bridal creeper	*Asparagus asparagoides*		5		5		5		5	5
Bridal creeper (Western Cape)	*Asparagus asparagoides*		2							2
Bridal veil	*Asparagus declinatus*		1		1					1
Broadkernel espartillo	*Achnatherum caudatum*									
Broomrape	*Orobanche ramosa*			3				3		3
Buchan weed	*Hirschfeldia incana*	8		8				6		6
Buckthorn	*Rhamnus alaternus*		4							4
Bulbil watsonia	*Watsonia meriana var. bulbillifera*		8							8
Butterfly bush	*Buddleja davidii*		7							7
Cabomba	*Cabomba caroliniana*									
Calomba daisy	*Oncosiphon suffruticosum*	3		3						3
Caltrop	*Tribulus terrestris*	3		3			3	3	3	3
Cane needlegrass	*Nassella hyaline*									
Cape broom	*Genista monspessulana*		4		4					4
Cape tulip - one leaf	*Moraea flaccida*	3	6							3
Cape tulip - two leaf	*Moraea miniata*	3	6							3

	Landuse	Grazing	Native Vegetation	Cropping	Forestry	Aquatic	Urban	Irrigated Crop & Pastures	Perennial Horticulture	Highest Management Class
1	Eradicate from Region (Red)									
2	Destroy Infestations (Orange)									
3	Contain Spread (Yellow)									
4	Protect Sites (Green)									
5	Manage Weed (Light Blue)									
6	Manage Sites (Dark Blue)									
7	Monitor (Purple)									
8	Limited Action (Grey)									
	Not Present/ Alert Species									
Capeweed	*Arctotheca calendula*	5		8					8	5
Carrot	*Daucus carota*							4		4
Chilean needlegrass	*Nassella neesiana*									
Coastal tea tree	*Leptospermum laevigatum*		4							4
Coastal wattle	*Acacia sophorae*		5							5
Common lantana	*Lantana camara*									
Coolatai grass	*Hyparrhenia hirta*	2	4				4			2
Cootamundra wattle	*Acacia baileyana*		4							4
Cotoneaster	*Cotoneaster spp.*		4							6
Couch	*Cynodon dactylon*			5	4		4	5	5	4
Creeping knapweed	*Acroptilon repens*	3		3				3		3
Cutleaf mignonette	*Reseda lutea*	4		4					4	4
Desert ash	*Fraxinus angustifolia sup. angustifolia*		5							5
Dock	*Rumex crispus*			6	8			6		6
Dodder (Chilean & red)	*Cuscuta spp*	7	7			7		7		7
Dog rose	*Rosa canina*	7	6							6
Dolichos pea	*Dipogon lignosus*		3							3
Elodea	*Elodea canadensis*									
English broom	*Cytisus scoparius*		4							4
English oak	*Quercus robur*		7							7
Erica	*Erica baccans & lusitanica*		3							3
Eurasian watermilfoil	*Myriophyllum spicatum*									
False caper	*Euphorbia terracina*	6	6				4	6		4
Fat hen	*Chenopodium album*							5	5	5
Field bindweed	*Convolvulus arvensis*			4				4	7	4
Field garlic	*Allium vineale*									
Fleabane	*Conyza spp.*			6	8			8	8	4
Fountain grass	*Pennisetum setaceum*	2								2
Freesia	*Freesia hybrids*		6							6

Landuse		Grazing	Native Vegetation	Cropping	Forestry	Aquatic	Urban	Irrigated Crop & Pastures	Perennial Horticulture	Highest Management Class
1	Eradicate from Region (Red)									
2	Destroy Infestations (Orange)									
3	Contain Spread (Yellow)									
4	Protect Sites (Green)									
5	Manage Weed (Light Blue)									
6	Manage Sites (Dark Blue)									
7	Monitor (Purple)									
8	Limited Action (Grey)									
	Not Present/ Alert Species									
Gazania spp.	Gazania spp.		4				4			4
Giant reed	Arundo donax									
Golden dodder	Cuscuta campestris							1	1	1
Golden wreath wattle	Acacia saligna		5							5
Gorse/ Furze	Ulex europaeus	3	3		3					3
Hoary cress	Cardaria draba			3						3
Horehound	Marrubium vulgare	4	8	4						4
Horsetail	Equisetum hyemale									
Hydrocotyle	Hydrocotyle ranunculoides									
Innocent weed	Cenchrus incertus/longispinus	3		2	3		4	3	3	2
Ivy (Cape & English)	Hendera helix		4							4
Khaki weed	Alternanthera pungens	2					2	2	2	2
Kikuyu	Pennisetum clandestinum				6		4	4		4
Lagarosiphon	Lagarosiphon major									
Leafy elodea	Egeria densa									
Lesser loosestrife	Lythrum hyssopifolia									
Lincoln weed	Diplotaxis tenuifolia	4		4				4		4
Lippia	Phyla canescens									
Marguerite daisy	Argyranthemum frutescens		7							7
Marram grass	Ammophila arenaria		6							6
May/ Hawthorn	Crataegus monogyna		7							7
Mexican feathergrass	Nassella tenuissima									
Muskweed	Myagrum perfoliatum									
Nightstock	Matthiola longipetala									
Noogoora burr complex	Xanthium strumarium sp. agg.	4				4		4		4
Olive	Olea europaea		4						6	6
Onion grass	Romulea rosea var. australis	6								6
Onion weed	Asphodelus fistulosus	6								6

Landuse		Grazing	Native Vegetation	Cropping	Forestry	Aquatic	Urban	Irrigated Crop & Pastures	Perennial Horticulture	Highest Management Class
1	Eradicate from Region (Red)									
2	Destroy Infestations (Orange)									
3	Contain Spread (Yellow)									
4	Protect Sites (Green)									
5	Manage Weed (Light Blue)									
6	Manage Sites (Dark Blue)									
7	Monitor (Purple)									
8	Limited Action (Grey)									
	Not Present/ Alert Species									
Ox tongue	*Picris echioides*							8		7
Pampas grass	*Cortaderia spp.*		2		3					2
Parramatta grass	*Sporobolus africanus*	6						6		6
Parrots feather	*Myriophyllum aquaticum*									
Pepper tree	*Schinus molle var. areira*		8			8				4
Perennial thistle	*Cirsium arvense*	6								6
Phalaris	*Phalaris aquatica*		5		5					5
Pheasant's eye	*Adonis microcarpa*									
Pin cushion daisy	*Scabiosa atropurpurea*		5				5			5
Plumerillo	*Jarava plumose*									
Poa grass	*Poa annua*						5	5		5
Poison buttercup	*Ranunculus sceleratus*									
Polygala	*Polygala myrtifolia*		4							6
Poplars	*Populus spp.*		6							6
Prickly acacia	*Acacia nilotica subsp. Indica*									
Prickly pear	*Opuntia spp*		7				3			3
Primrose willow	*Ludwigia peruviana*									
Pyp grass	*Ehrharta villosa var maxima*		5							5
Radiata pine	*Pinus radiata*		3							3
Ragwort	*Senecio jacobaea*									
Rhus tree	*Toxicodendron succedaneum*									
Sagittaria	*Sagittaria graminea*									
Sallow wattle	*Acacia longifolia*		4		4					3
Salvation Jane	*Echium plantagineum*	4		5				3		3
Salvinia	*Salvinia molesta*									
Sea spurge	*Euphorbia paralias*		7							7
Sea wheatgrass	*Thinopyrum junceiforme*		4							4
Senegal tea plant	*Gymnocoronis spilanthoides*									

Landuse		Grazing	Native Vegetation	Cropping	Forestry	Aquatic	Urban	Irrigated Crop & Pastures	Perennial Horticulture	Highest Management Class
1	**Eradicate from Region (Red)**									
2	**Destroy Infestations (Orange)**									
3	**Contain Spread (Yellow)**									
4	**Protect Sites (Green)**									
5	**Manage Weed (Light Blue)**									
6	**Manage Sites (Dark Blue)**									
7	**Monitor (Purple)**									
8	**Limited Action (Grey)**									
	Not Present/ Alert Species									
Serrated tussock	*Nassella trichotoma*									
Shiny leaf coprosma	*Coprosma repens*		4							4
Silver grass	*Vulpia bromoides*	6								6
Skeleton weed	*Chondrilla juncea*	6	6	6				6	6	6
Slender thistle	*Carduus tenuiflorus*		6					4		4
Silverleaf nightshade	*Solanum elaeagnifolium*	2		3				3	4	2
Soldier thistle	*Picnomon acarna*	5						4		4
Sorrell	*Rumex acetosella*	8						8		8
Soursob	*Oxalis pes-caprae*	8		6			6		6	6
South African weed orchid	*Disa bracteata*		6		8					6
Spear thistle	*Cirsium vulgare*	5						4		4
Spiny rush	*Juncus acutus*	4	6			4				4
Swamp oak	*Casuarina glauca*					4				4
Sweet briar	*Rosa rubiginosa*		6							6
Sweet pittosporum	*Pittosporum undulatum*		6							6
Tagasaste	*Chamaecytisus palmensis*		6							6
Tall wheatgrass	*Thinopyrum ponticum*		5	5						5
Texas needlegrass	*Nassella leucotricha*									
Three corner jack	*Emex spp.*	3						3		3
Three horned bedstraw	*Galium tricornutum*			3						3
Tree of heaven	*Ailanthus altissima*						2			2
Variegated thistle	*Silybum marianum*	4		4				3		3
Veldt grass	*Ehrharta calycina*		5							5
Wandering jew	*Tradescantia albiflora*		7							7
Water caltrop	*Trapa natans*									
Water dropwort	*Oenanthe pimpinelloides*									
Water hyacinth	*Eichhornia crassipes*									
Water primrose	*Ludwigia peploides spp montividensis*									
Water soldier	*Stratiotes aloides*									

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	Landuse	Grazing	Native Vegetation	Cropping	Forestry	Aquatic	Urban	Irrigated Crop & Pastures	Perennial Horticulture	Highest Management Class
1	Eradicate from Region (Red)									
2	Destroy Infestations (Orange)									
3	Contain Spread (Yellow)									
4	Protect Sites (Green)									
5	Manage Weed (Light Blue)									
6	Manage Sites (Dark Blue)									
7	Monitor (Purple)									
8	Limited Action (Grey)									
	Not Present/ Alert Species									
White arctotis (African daisy)	*Arctotis stoechadifolia*		8							8
White weeping broom	*Retama raetam*		2							2
Wild artichoke	*Cynara cardunculus*	7	7							7
Wild oats	*Avena fatua*			5						5
Wild radish	*Raphanus raphanistrum*			5						5
Williams grass	*Festuca arundinacea*		6							6
Willow herb	*Epilobium billardieranum*									
Willow spp.	*Salix spp.*					4	4			4
Wireweed	*Polygonum aviculare*				6			6	8	6
Yellow burrweed	*Amsinckia spp.*	4	7	5				3		3

Table 4.34   Vertebrate pests versus management actions

Land Management Action	Land use	Grazing	Native Vegetation	Cropping	Forestry	Aquatic	Urban	Irrigated Crop & Pastures	Perennial Horticulture	Highest Management Class
1	Eradication from Region (Red)									
2	Destroy Infestations (Orange)									
3	Contain Spread (Yellow)									
4	Protect Sites (Green)									
5	Manage Weed (Light Blue)									
6	Manage Sites (Dark Blue)									
7	Monitor (Purple)									
8	No Action (Grey)									
Black rat	*Rattus rattus*		5	4		5	5	4	5	4
Brown rat	*Rattus norvegicus*					3	5	3		3
Cat	*Felis catus*		5				5			5
Carp	*Cyprinus carpio*					3				3
Carp gudgeon	*Hypseleotris compressa*					5				5
Chital (axis) deer, Rusa, Sambar	*Axis axis, Cervus timorensis, Cervus unicolor*	2	5	2	4			2	7	2
Common starling	*Sturnus vulgaris*		5				5		5	5
Dingo/ Wild Dog	*Canis lupus dingo/ Canis lupus familiaris*	1	3				3	2		1
Domestic pigeon	*Columba livia*						5			5
European rabbit	*Oryctolagus cuniculus*	5	5	3			5	5	6	3
European hare	*Lepus europaeus*	6	6	6	6		8	6	6	6
Eurasian blackbird	*Turdus merula*		6				5		5	5
Fallow deer	*Dama dama*	4	5	3	6			4	8	3
Goat	*Capra hircus*	2	2	1	2			2	4	1
Goldfish	*Carassius auratus*					4				4
Gambusia	*Gambusia holbrooki*					5				5
House mouse	*Mus musculus*		5	5			5	6	5	5
Hog deer	*Axis porcinus*	3	8	3	4			3	7	2
Marron	*Cherax cainii*					4				4
Mallard	*Anas platyrhynchos*		8			2				1
Red fox	*Vulpes vulpes*	5	5				5	5	5	5
Redfin	*Perca fluviatilis*					5				5
Trout						5				5
Tench	*Tinca tinca*					6				6
Wapiti & Red deer	*Cervus canadensis & elaphus*	4	5	2	6			4	8	2

5   ALERT LIST

Table 5.1 lists alert species which are pest plants and pest animals that may pose a threat to primary industries and biodiversity in the South East region. These species are not present in the region but from investigations into their biology and ecology they may be suited to the South East region, thus they are automatically categorised into the highest management action of the risk assessment process. The following points are guiding principles for alert species:

- Prevention of entry to region
- The removal of any pest species that may enter the region
- Investigations into reported sightings of the pest and detailed surveillance and mapping to locate all populations
- Destruction of all populations including juveniles

Table 5.1 Alert species

Management Action	Declared Species		Non declared species
	Pest plants	Pest animals	
Alert List *Species that are not known to be present in the region and which represent a significant threat. Aims to prevent the species arriving and establishing in the management area*	Alisma Alligator weed Arrowhead Azzarola Broadkernel espartillo Broomrape Cabomba Calomba daisy Cane needlegrass Chilean needlegrass Coolatai grass Elodea Eurasian watermilfoil Horsetail Hydrocotyle Lagarosiphon Leafy elodea Mexican feathergrass Nightstock Pheasant's eye Plumerillo Poison buttercup Primrose willow Ragwort Rhus tree Sagittaria Salvinia Senegal tea plant Serrated tussock Texas needlegrass Water caltrop Water dropwort Water hyacinth Water soldier	Cane toad Common myna Feral pig House crow Indian ringneck Laughing dove Red-eared slider Red-whiskered bulbul Song thrush Tree sparrow Water buffalo	Blue mustard Parrot's feather Water primrose

6 PRIORITY PEST PLANT AND PEST ANIMAL SPECIES

In a regional context the highest management action is applied to the pest plant and pest animal species to achieve the best possible outcome of control for all land uses. In table 6.1 a list of the priority agricultural and environmental pest plants and pest animals is shown.

Table 6.1   **Priority pest plant and pest animal list**

Class	Environmental		Agricultural	
	Priority pest plants	Priority pest	Priority pest plants	Priority pest
Eradicate from region	Bridal veil	Dingo/ Wild dog	Golden dodder	Dingo/ Wild dog Goat
Destroy Infestations	Asparagus fern Western Cape Bridal Creeper Pampas grass	Goat Mallard	Blackberry Innocent weed Khaki weed Silverleaf nightshade	
Contain Spread	Aleppo pine Blackberry Bluebell creeper Boneseed Dolichos pea Erica Gorse Radiata pine		African feathergrass Bathurst burr Caltrop Cape tulip Creeping knapweed Gorse Hoary Cress Salvation Jane Three corner jack Three horned bedstraw	Deer (all species) Rabbit

6.1.1 Regional priorities

It is important to remember that the resulting list of high priority pest plants and pest animals described through this assessment have been determined at the regional scale. This context may result in the exclusion of some pest plants and animals that are a high priority at the local level. Local priorities can still be addressed as policies can recognise local issues among regional priorities.

The assessment procedure compares the threat of the pest plants and pest animals to the feasibility of controlling them. This process has resulted in some species that many people consider to be a high priority or have serious impact, to not make it to the priority list. Bridal creeper is a good example of this. Whilst Bridal creeper poses a very high risk to the environment and some primary industries it is simply not feasible to undertake control at a regional scale. This can be due to a number of reasons such as the cost of control techniques, the accessibility to populations and the current high distribution across the region. Control techniques as outlined in the management actions should be aimed at protecting key assets and using integrated control techniques such as biological control agents.

Foxes are an example of a pest animal that presents a very high risk to primary industry and native vegetation, but it is simply not feasible to undertake eradication actions at the regional scale. This can be due to a number of reasons such as the cost of control techniques, the accessibility to populations, the current high distribution across the region and a foxes' ability to avoid detection.

7   DISCUSSION

7.1   CONFLICT OF INTEREST

There are a number of conflicts of interests for pest plant and pest animal species across land uses. What is grown as a production/ agricultural species in one land use may be a significant pest plant or pest animal in another land use. For example, Radiata pine is the major forestry species in the South East but is a high priority weed in native vegetation. The same applies to Veldt grass, Tall wheat grass and Phalaris. All were planted as pasture grasses but now threaten native vegetation. The feasibility to control these grasses is very low due to their extensive distribution across the region, hence resulting in a lower priority for control despite the high level of risk they present.

Bracken fern and Coastal wattle have been listed in several land uses as pest plants. The conflict here is that both species are locally-indigenous native plants, and as such are protected by the Native Vegetation Act 1991 which prevents clearance without a permit, except in certain circumstances. This report does not condone the unlimited control of Bracken fern or Coastal wattle across all land uses. Each situation must be assessed and it is recommended that land managers seek the advice of the Native Vegetation Council before undertaking any control measures.

There are a number of conflicts of interests for pest animal species across land uses. What is farmed as a livestock species, or kept as a pet may become a pest if uncontrolled. For example deer are farmed for their meat, velvet and sometimes kept as pets but if not controlled appropriately i.e. behind adequate fencing they can escape into the wild and become a pest across multiple land uses in the region.

7.2   LIMITATIONS AND INTERPRETATION OF RISK ASSESSMENT RESULTS

The outcomes of the procedure should be regarded as the *minimum* level of management that should be applied at the regional level. If a higher accuracy of priorities is required, the risk assessment process may be undertaken at a smaller scale (e.g. sub-regional NRM group level), if data permits. In this case, local level plans and policies may identify the need for higher levels of management due to specific local circumstances.

The pest plant and pest animal risk assessment distribution results reported in this plan are based on data obtained from regional Authorised Officers. From the local data collected, averages were calculated allowing each pest plant and pest animal to be assessed in a regional context.

The prioritisation of pest plant and animal species utilising the risk assessment model is limited by the lack of readily available information on distribution, species characteristics and best practice management actions. These are common knowledge gaps (not limited to the SE NRM region) and highlight the need for improvements in ongoing mapping and monitoring of pest plant and animal species, research into biological and ecological characteristics and the communication and refinement of current best practice management options.

Fresh water fish were assessed in this project, although the vertebrate pest risk assessment was not designed for their assessment. The results obtained from the assessment were seen to be creditable from various professionals, therefore have been reported in this plan.

Invertebrates are not currently included within the scope of this project. At the time of this project, risk assessments were being developed for invertebrate species.

8   RECOMMENDATIONS

The results of this project are a thoroughly assessed regional summary of pest plant and pest animal recommended management actions. All stakeholders considering targeted pest plant and animal control activities and determining priorities for on-ground works can use these results. It is anticipated that this report will provide the background information for determining the regional pest plant and animal policies of the South East Natural Resources Management Board.

Interpreting this pest plant and pest animal management information for policy development will require consideration of a much broader range of issues. For this reason it is recommended that users of this report consult an Authorised Officer for specific local context information.

The management actions recommended within the matrices should not be taken literally for every situation, however they provide solid guiding principles for the effective management of pest plant and animal species within the region. Other information to be considered when deciding on management actions should include, although not limited to, the current distribution of the pest plant and animal, local issues such as climatic conditions e.g. drought, the proximity to other land uses which may be affected and the resources available to undertake control activities.

In a native vegetation context the species based approach (that the weed risk assessment (WRA) process uses) while useful in some instances (e.g. Bridal Veil), is not commonly used by agencies to prioritise regional environmental works programs. The asset based approach (eg. E-Weed MAT) that protects biodiversity at the site or patch scale is more often used for prioritising limited resources for the protection of biodiversity assets in a highly fragmented landscape. Each method has its place - particularly as the asset based approach often means working on species to protect high priority patches against invasive weeds (e.g. Bridal creeper) that the WRA gives the impression of being a low priority for action in the region.

The pest plant and pest animals on the alert list have not been individually assessed for their risk level. As part of Chapter 4 of this strategy a regional incursion management plan will be drafted in consultation with SE NRM Board staff to determine the risk level of pest plants and animals that are currently not present in the region and develop a response strategy for potential introduction of new pest plant and animal species.

Current pest plant and animal control programs are briefly mentioned in this report. A thorough summary of such activities should be compared against the results of this pest plant and animal assessment to determine gaps in control programs for the highest priority species. The key action areas to consider during this review include:
- Education and awareness campaigns
- Investment in on-ground works
- Research into control methods
- Enforcement of pest plant and pest animal control legislation

As further knowledge concerning an individual species' attributes such as the biology, ecology, control methods, current/potential distribution and climate change influences become known, they can be easily fed into the risk assessment model and assist in strengthening and refining the management actions. It is therefore suggested that the assessment is reviewed on a minimum 3-5 yearly basis.

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SA WEED RISK MANAGEMENT GUIDE
February 2008

INTRODUCTION

The SA Weed Risk Management System was developed by the Animal and Plant Control Commission, in cooperation with Animal and Plant Control Boards, to help in prioritising weeds for control programs. A series of questions are answered to compare the relative risk and feasibility of control of different weeds. Weeds are assessed separately for various **land uses**, so that the most important weeds of different land uses can be identified.

The System was originally devised for Animal & Plant Control Boards in South Australia (now integrated into Natural Resource Management Boards). However, it can be broadly applied to many geographic scales (replace the term 'Board' with a more relevant one) and for any land use.

Use this guide when filling out the accompanying scoresheet. The questions can apply to any type of weed in any land use. There may be questions where you don't know the answer for a certain weed, especially if it is not present in your area. In such cases choose the "don't know" option, and seek opinions from others (e.g. landholders, advisers, other Boards, researchers). "Don't know" is treated as a "0" for the Comparative Weed Risk scoring and gets a maximum score for the Feasibility of Containment scoring. This avoids bias against weeds which have a score for all questions. However, weeds which have one or more questions answered as "don't know" are indicated as such at their final score. Sharing information and scores is the key to building up knowledge and getting the most out of the SA Weed Risk Management System. Answering questions as a group is better than individually. It's particularly important to get consensus on assumptions about typical weed control in the land use.

This scoring system is a tool to help in making standard, informed decisions on weed control priorities. Comments on the system are welcome for future improvements in its accuracy and ease of use.

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See the following references for example uses of the SA Weed Risk Management System:

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LAND USES

Different types of weeds are important in different land uses. For example, annual weeds are problems in grain crops, and woody weeds are problems in native vegetation. If you were to compare the risk of weeds of different land uses, then you would also need to compare the importance of the land uses themselves. This is too difficult to do (i.e. you need $/ha values for each land use). An easier approach is to compare weeds within land uses only. Animal and Plant Control/Natural Resource Management Boards can then decide for themselves the amount of time and resources devoted to protecting each land use from weeds.

The following land uses are suggested:

1. **Aquatic** (Permanent water bodies. e.g. rivers, swamps, canals, lakes, estuaries)

2. **Crop/Pasture rotation** (e.g. dryland cereals, pulses, oilseeds, legume pastures, hay)

3. **Forestry** (e.g. pines, blue gums)

4. **Irrigated crops and pastures** (e.g. vegetables, lucerne. Prone to summer weeds.)

5. **Native vegetation** (For nature conservation purposes. Public and private reserves.)

6. **Non-arable grazing** (Includes permanent pastures and rangelands.)

7. **Perennial horticulture**   (e.g. vineyards, citrus, stonefruits)

8. **Urban** (e.g. sports fields, parks, footpaths)

Within each Board, land uses will vary in terms of what is grown and how crops/pastures/vegetation are managed. However, to keep the scoring system relatively simple and to answer at a Board or regional level, it is necessary to think in averages. There are two main aspects to keep in mind:

(i)   *Where a weed is only prevalent at certain phases in a land use.* For example, the typical *crop/pasture rotation* land use in a Board may have cereals, canola, pulses and pasture phases. In answering questions, average the *invasiveness* and *impacts* of a weed amongst these four vegetation types. Thus a weed which is only a problem in cereals will score less than a similar weed which is a problem in all crops and pasture. In the *potential distribution* section these two weeds will get the same score, as they will occupy the same area.

(ii)   *Where a weed only occurs in certain parts of a land use.* For example, the *perennial horticulture* land use in a Board may contain citrus, stonefruit, olives and vines. For a weed which only occurs in citrus and vines, average the *invasiveness* and *impacts* of a weed amongst these two vegetation types only. Then in the *potential distribution* section, the weed's score may be reduced because it is not a problem in all perennial horticulture crops in the Board area.

Decide which land uses apply to your Board. Then decide which weeds cause problems in which land uses. There is no need (and it makes little sense) to assess every weed in every land use. The idea is simply to determine the important weeds of each land use.

Assumptions about a land use can be recorded on the scoresheets.

1) COMPARATIVE WEED RISK

The weed risk questions are divided into three main criteria; invasiveness, impacts and potential distribution. **Invasiveness** looks at the weed's rate of spread, faster spreading weeds being a higher priority for control. **Impacts** are the economic, environmental and social effects the weed has. **Potential distribution** indicates what total area the weed could spread to. Scores for each of these criteria are multiplied (each ranging between 0 and 10), to give a weed risk score out of 1000.

INVASIVENESS

This section indicates how fast the weed can spread within a particular land use. It takes account of how well the weed can establish, reproduce and disperse. Answer all questions with the land use in mind, except for question 5(a).

1. What is the weed's ability to establish amongst existing plants?		*SCORE*
☐ very high	"Seedlings" readily establish within dense vegetation, or amongst thick infestations of other weeds.	*3*
☐ high	"Seedlings" readily establish within more open vegetation, or amongst average infestations of other weeds.	*2*
☐ medium	"Seedlings" mainly establish when there has been moderate disturbance to existing vegetation, which substantially reduces competition. This could include intensive grazing, mowing, raking, clearing of trees, temporary floods or summer droughts.	*1*
☐ low	"Seedlings" mainly need bare ground to establish, including removal of stubble/leaf litter. This will occur after major disturbances such as cultivation, overgrazing, hot fires, grading, long-term floods or long droughts.	*0*
☐ don't know		*?*

Ignore any weed control practices for this question. Depending on the land use, "vegetation" may be crops, pastures, lawns and/or native vegetation. Weeds that invade well-managed land uses (where a dense vegetative cover over soil is maintained) are assumed to be more important. High scoring weeds would include wild radish, bridal creeper and dodder.

Assume the plant has just arrived. "Seedlings" <u>includes</u> growth from dispersed vegetative propagules (e.g. broken fragments of couchgrass stems or silverleaf nightshade roots) and spores, in addition to seeds. "Seedlings" <u>does not include</u> new vegetative growth whilst still attached to the parent plant (e.g. by stolons, rhizomes or lateral roots). This feature is accounted for in question 3(c).

Features which can help a weed establish amongst existing plants include:
* *the ability to germinate under the canopy of other plants (e.g. weeds that have staggered germination in crops)*
* *large seeds or vegetative propagules (e.g. bulbs, root fragments, tubers) provide more reserves to help the weed establish in competition with other plants*
* *the ability to tolerate or avoid competitive stresses (e.g. by rapid root growth, fixing own nitrogen, or rapid vertical shoot growth)*

2. What is the weed's tolerance to average weed management practices in the land use?		SCORE
☐ very high	Over 95% of weeds survive commonly used weed management practices.	3
☐ high	More than 50% of weeds survive.	2
☐ medium	Less than 50% of weeds survive.	1
☐ low	Less than 5% of weeds survive.	0
☐ don't know		?

Assume the weed is new to an area. This question looks at whether the new weed is killed by the weed management practices which are commonly used across the land use. If most are killed then there will be few plants to reproduce and spread. If few are killed then changes to weed management practices will eventually be needed. Weed management practices include herbicides, cultivation, cutting/slashing, grazing, and fire. The types and timing of these practices may vary within land uses (e.g. for cereals and broadleaf crops, or vineyards and citrus), but average these. If a weed grows and seeds when there is normally no weed management (e.g. summer) then it is highly tolerant of the common weed management practices. Weeds with high tolerance to routine weed management would include silverleaf nightshade (difficult to kill), caltrop (quick to seed), and broomrape. In native vegetation there may be no commonly used weed management practices at a regional level - if so then include this in your assumptions about the land use.

3. What is the reproductive ability of the weed in the land use?						Total (a+b+c)	SCORE
(a) Time to seeding		*(b) Seed set*		*(c) Vegetative reproduction*			
☐ 1 year	2	☐ high	2	☐ fast	2	☐ high	5 or 6	3
☐ 2-3 yrs	1	☐ low	1	☐ slow	1	☐ medium-high	3 or 4	2
☐ >3 yrs/never	0	☐ none	0	☐ none	0	☐ medium-low	1 or 2	1
☐ don't know	?	☐ don't know	?	☐ don't know	?	☐ low	0	0
						☐ don't know		?

This question looks at how well the weed can reproduce, to rapidly build up its numbers at a site, and to spread quickly to other sites. If a weed never gets to reproduce in a land use then it will score 0. Three factors are considered in scoring the weed:

(a) *Time to seeding is the time from establishment (from seed or vegetative propagule) to seed production.*

(b) *Consider seed set as the average number of viable seed produced per square metre of ground per year, in a patch of the weed. This may be from one large weed (e.g. a tree) or many small weeds (e.g. grasses). High would be >1000 seeds per m^2. Your answer to question 2 may influence seed set.*

(c) *Consider vegetative reproduction as the average number of new plants produced each year by such means as bulbs, bulbils, corms, tubers, rhizomes, stolons, root suckers, root fragments and shoot fragments. High would be >10 new plants per year from a mature parent plant. In certain land uses cultivation may increase vegetative reproduction (e.g. Lincoln weed). "New plants" are defined as shoots with their own root system. There may still be some connection to the parent plant (e.g. couchgrass).*

4. How likely is long-distance dispersal (>100m) by natural means?				Total (a+b+c+d)	SCORE
(a) Flying birds		**(b) Other wild animals**		6, 7 or 8	3
				3, 4 or 5	2
☐ common	2	☐ common	2	1 or 2	1
☐ occasional	1	☐ occasional	1	0	0
☐ unlikely	0	☐ unlikely	0		
☐ don't know	?	☐ don't know	?		?
(c) Water		**(d) Wind**			
☐ common	2	☐ common	2		
☐ occasional	1	☐ occasional	1		
☐ unlikely	0	☐ unlikely	0		
☐ don't know	?	☐ don't know	?		

This question looks at how well the weed can spread its propagules (seed or vegetative) by natural means, to start new weed outbreaks a long distance from the original outbreak. Weeds which have more means of dispersal tend to spread faster. Consider if a weed is adapted for long-distance dispersal by any of the above means, and how regularly these means of dispersal occur. How often do you see new outbreaks starting at least 100 metres away from an original infestation?

Features favouring long-distance dispersal by <u>flying birds</u> and <u>other wild animals</u> (e.g. foxes, kangaroos, rabbits, emus) are:
- *whole fruits are eaten, and viable seeds are then defecated or regurgitated (e.g. olives, sweet briar)*
- *propagules have hooks, barbs or sticky substances that attach to feathers, hairs or skin (e.g. horehound, brome grass)*
- *very small seeds which can lodge within feathers, hairs or feet (e.g. nutgrass)*

Features favouring long-distance <u>water</u> dispersal are:
- *propagules which float (consider wind-assisted movement as water dispersal)*
- *weeds located in or near to moving water*
- *frequent floods*

Mainly aquatic weeds such as salvinia and seeding willows would be commonly dispersed over 100m by water movement.

Research has shown that seeds of most <u>wind</u> dispersed weeds actually land close to the parent plants. Long-distance dispersal is more likely to be common for tall trees with light seeds (with wings, plumes or hairs) which are subject to frequent strong winds, and for weeds which snap off after fruiting and roll across sparsely-vegetated ground (e.g. wild turnip, serrated tussock).

5. How likely is long-distance dispersal (>100m) by human means?				Total (a+b+c+d)	SCORE
(a) Deliberate spread by people		**(b) Accidentally by people and vehicles**		6, 7 or 8	3
				3, 4 or 5	2
☐ common	2	☐ common	2	1 or 2	1
☐ occasional	1	☐ occasional	1	0	0
☐ unlikely	0	☐ unlikely	0		
☐ don't know	?	☐ don't know	?		?
(c) Contaminated produce		**(d) Domestic/farm animals**			
☐ common	2	☐ common	2		
☐ occasional	1	☐ occasional	1		
☐ unlikely	0	☐ unlikely	0		
☐ don't know	?	☐ don't know	?		

This question looks at how well the weed can spread its propagules (seed or vegetative) by human-influenced means, to start new weed outbreaks a long distance from the original outbreak. Weeds which have more means of dispersal tend to spread faster. Consider if a weed is adapted

for long-distance dispersal by any of the above means, and how regularly these means of dispersal occur. How often do you see new outbreaks starting at least 100 metres away from an original infestation?

*Deliberate human spread includes weeds which have been planted for use in agriculture, forestry, horticulture, amenity, windbreaks and/or soil protection. Those which are or have been widely planted have greater potential for dispersal due to many introduction points. **Ignore the land use for this question.** Examples include olives, African lovegrass and Aleppo pine. Deliberate human spread also includes weeds with attractive flowers which are picked and then discarded (e.g. Calomba daisy, cape tulip). A weed may be legally restricted from sale, but is it still planted?*

Features favouring accidental people and vehicle dispersal are:
- *weeds which grow in heavily trafficked areas, such that transport by footwear, clothing or vehicles (including farm machinery and boats) may occur*
- *weeds which are dragged by farm machinery (e.g. silverleaf nightshade)*
- *propagules have hooks, barbs, or sticky substances to attach to objects (e.g. caltrop)*
- *very small propagules which can lodge in cracks in footwear, clothing or vehicles (e.g. Lincoln weed)*

For contaminated produce consider crop seed, pasture seed, hay, soil, gravel, fertilisers, manures, and/or mulch. Examples of weeds which may be commonly spread by such means include bifora, salvation Jane, and soursob. Do not consider wool as this relates to the sale of farm animals between properties, which is covered in (d).

Features favouring dispersal by domestic/farm animals (e.g. sheep, cattle, horses, dogs) are:
- *whole fruits are eaten, and viable seeds are then defecated or regurgitated (e.g. cutleaf mignonette, charlock)*
- *propagules have hooks, barbs or sticky substances that attach to feathers, hairs or skin (e.g. horehound, brome grass)*
- *very small seeds which can lodge within feathers, hairs or feet (e.g. nutgrass)*

IMPACTS

This section indicates the potential impacts the weed has. Each question is answered with a land use in mind. Assume that the weed has spread across a whole paddock, orchard, plantation, nature reserve or water body, and that commonly-used weed management practices have not been changed to specifically target the weed. If the weed is well-controlled by these common practices then it will occur at a low density and will have minimal impacts. Alternatively, if the weed is poorly controlled by these common practices then it may get to a high density and have substantial impacts. If the weed has an effective biocontrol agent established which substantially reduces its growth then the weed's impacts will be reduced. ***Decide if the weed is likely to reach a low, medium or high density in the land use.***

1. Does the weed reduce the establishment of desired plants?		*SCORE*
☐ >50% reduction	The weed stops the establishment of more than 50% of desired plants (e.g. regenerating pasture, sown crops, planted trees, regenerating native vegetation), by preventing germination and/or killing seedlings.	*3*
☐ 10-50% reduction	The weed stops the establishment of between 10% and 50% of desired plants.	*2*
☐ <10% reduction	The weed stops the establishment of less than 10% of desired plants.	*1*
☐ none	The weed does not affect the germination and seedling survival of desired plants.	*0*
☐ don't know		*?*

This question looks at whether the weed prevents the establishment of desired plants, so the density of these plants is reduced. The weed may prevent germination by dense shading, or by forming physical barriers to water movement into the soil. The weed may kill seedlings by denying them access to soil moisture, sunlight and nutrients.

Note that the desired plants may mainly establish after a major disturbance (e.g. cultivation prior to planting, bushfire), so the weed itself may also be establishing. In these cases does the weed actually have a major effect?

Weeds which are likely to cause over 50% reductions in establishment are gorse and early-germinating (and unsprayed) salvation Jane in pastures, and phlaris and watsonia in native vegetation.

2. Does the weed reduce the yield or amount of desired vegetation?		*SCORE*
☐ >50% reduction	The weed reduces crop, pasture or forestry yield, or the amount of mature native vegetation by over 50%.	*4*
☐ 25-50% reduction	The weed reduces yield or amount of desired vegetation by between 25% and 50%.	*3*
☐ 10-25% reduction	The weed reduces yield or amount of desired vegetation by between 10% and 25%.	*2*
☐ <10% reduction	The weed reduces yield or amount of desired vegetation by up to 10%.	*1*
☐ none	The weed has no effect on growth of the desired vegetation. Or the weed may become desirable vegetation at certain times of year (e.g. providing useful summer feed), which balances out its reduction in the growth of other desirable plants.	*0*
☐ don't know		*?*

This question looks at the degree of yield loss (in crops, pastures, forestry) or suppression (in mature native vegetation) caused by the weed. It follows on from question 1, and looks at the growth achieved by plants which did establish despite the weed. The question is answered on a per hectare basis, in comparison to similar vegetation which is free of the weed. For native vegetation it may be useful to think in terms of percentage cover.

Weeds will reduce growth of other plants by competing for sunlight, water and nutrients. Competition is greater where a weed is larger (e.g. tall with a dense leaf canopy and an extensive

root system) and grows at the same time as the desirable plants. Some weeds also compete by forming physical barriers which stop plants growing to reach light, water and/or nutrients (e.g. tuber mat of bridal creeper). A special case are parasitic weeds which directly attack other plants. Weeds which could cause >50% reductions in the yield/amount of desired vegetation would include Allepo pines, serrated tussock and branched broomrape.

Some weeds may increase the amount of useful vegetation in a land use. For example, does a perennial weed of grazing land provide nutritious summer feed, thus increasing total pasture available throughout the year?

3. Does the weed reduce the quality of products or services obtained from the land use?		*SCORE*
☐ high	The weed severely reduces product quality such that it cannot be sold. This may be due to severe contamination, toxicity, tainting and/or abnormalities (chemical and/or physical). For **native vegetation**, the weed severely reduces biodiversity (plants and animals) such that it is not suitable for nature conservation and/or nature-based tourism. For **urban** areas, the weed causes severe structural damage to physical infrastructure such as buildings, roads and footpaths.	*3*
☐ medium	The weed substantially reduces product quality such that it is sold at a much lower price for a low grade use. For **native vegetation**, the weed substantially reduces biodiversity such that it is given lower priority for nature conservation and/or nature-based tourism. For **urban** areas, the weed causes some structural damage to physical infrastructure such as buildings, roads and footpaths.	*2*
☐ low	The weed slightly reduces product quality, lowering its price but still passing as first grade product. For **native vegetation**, the weed has only marginal effects on biodiversity but is visually obvious and degrades the natural appearance of the landscape. For **urban** areas, the weed causes negligible structural damage, but reduces the aesthetics of an area through untidy visual appearance and/or unpleasant odour.	*1*
☐ none	The weed does not effect the quality of products or services.	*0*
☐ don't know		*?*

This question looks at whether the weed effects the quality of products or services obtained from a land use. Products affected by the weed may include meat, grain/seed, milk, wool, timber, fruit, hay, and/or water. For native vegetation, consider services such as nature conservation and tourism. An example of a high effect on quality is dodder preventing the sale of seed crops. Reduction in stock condition/liveweight should not be considered here - this is due to either a reduction in available feed (question 2) or animal health effects caused by eating the weed (question 5).

For this question, ignore a weed's proclamation status with regard to moving contaminated produce in South Australia, but do consider noxious weed lists and seed quality standards of other states or countries. This prevents bias against non-proclaimed weeds when comparing them to existing proclaimed plants.

4. Does the weed restrict the physical movement of people, animals, vehicles, machinery and/or water?		SCORE
☐ high	Weed infestations are impenetrable throughout the year, preventing the physical movement of people, animals, vehicles, machinery and/or water.	3
☐ medium	Weed infestations are rarely impenetrable, but do significantly slow the physical movement of people, animals, vehicles, machinery and/or water throughout the year.	2
☐ low	Weed infestations are never impenetrable, but do significantly slow the physical movement of people, animals, vehicles, machinery and/or water at certain times of the year or provide a minor obstruction throughout the year.	1
☐ none	The weed has no effect on physical movement.	0
☐ don't know		?

This question looks at the degree to which a dense infestation of the weed physically restricts movement. Weeds may restrict movement by being tall, thorny, tangled and/or dense. For this question, ignore any deliberate restrictions on movement aimed solely at limiting the spread of weed propagules.

Examples of weed limits on movement include:
- *slowing of stock mustering*
- *blockages of farm machinery at crop sowing and/or harvesting*
- *tyre punctures*
- *slowing of water flow in irrigation systems*
- *interference with boat access*
- *interference with thinning operations in forestry*
- *preventing stock access to pasture and/or water*
- *preventing animal access to nesting sites*

Weeds which would score highly include blackberry and gorse at high densities, forming impenetrable thickets.

5. Does the weed affect the health of animals and/or people?		SCORE
☐ high	The weed is highly toxic and frequently causes death and/or severe illness in people, stock, and/or native animals.	3
☐ medium	The weed occasionally causes significant physical injuries (due to spines or barbs) and/or significant illness (chronic poisoning, strong allergies) in people, stock, and/or native animals, occasionally resulting in death.	2
☐ low	The weed can cause slight physical injuries or mild illness in people, stock, and/or native animals, with no lasting effects.	1
☐ none	The weed does not affect the health of animals or people.	0
☐ don't know		?

This question looks at how the weed affects the health of animals (domestic stock and native) and people. Note that if a weed is toxic but is not palatable then it may not actually be grazed. Ignore any starvation effects from reduced growth of pasture or reduced access to pasture, as these have been covered in questions 2 and 4. A weed with high effects on health would be poison ivy.

6. Does the weed have major, positive or negative effects on environmental health?				
	☐ major positive effect	☐ major negative effect	☐ minor or no effect	☐ don't know
scoring for (a) - (f):	−1	1	0	?
(a) food/shelter ?	Examples of negative effects are blackberry harbouring rabbits and grass weeds hosting wheat root diseases. An example positive effect is boxthorn providing stock shelter. Ignore pasture for livestock as this was covered in question 2.			
(b) fire regime?	This includes changes to the normal frequency, intensity, and/or timing of fires. Examples of weeds having major effects include exotic grasses invading shrubby native vegetation.			
(c) increase nutrient levels?	For example, legumes can increase soil nitrogen. This may make native vegetation more prone to invasion by other weeds, but would be beneficial in agriculture. Ignore competition for nutrients (decreased nutrient levels) as this was covered indirectly in question 2.			
(d) soil salinity?	Are the leaves of the weed high in salt? Leaf decomposition may increase salinity at the soil surface. Example plants are iceplant and tamarix.			
(e) soil stability?	Does the weed increase soil erosion, or silting of waterways?			
(f) soil water table?	Does the weed substantially raise or lower the soil water table compared to other plants present? Is this positive or negative? Ignore competition for water as this was covered in question 2.			
Total (a + b + c + d + e + f)	>3	2 or 3	1	0 or less
SCORE FOR 6.	3	2	1	0

This question looks at whether the weed has major, long-term effects on a land use's environment. These effects may be beneficial or detrimental. Effects are more likely where the weed substantially changes the vegetation structure, such as woody weed invasion of grassland. Decisions on major effects should be well-known (e.g. backed up by scientific studies or expert opinion).

POTENTIAL DISTRIBUTION

This section looks at what proportion of a land use is at risk from the weed in question. This will depend on the climate and soil preferences of the weed. For example, some weeds may only be suited to higher rainfall areas of a Board, or only be a problem on alkaline soils. Differences within the land use also need to be considered. For example in the perennial horticulture land use, a weed may be a problem in citrus but not occur in vineyards. This score should also be based on where the weed will grow at the density you assumed in scoring Impacts. That is, if you assumed a high density in scoring impacts then ignore areas where the weed would only persist at a low density when determining potential distribution

This question is best answered with topographic, land use and soil maps for the Board area. These can be analysed electronically using a GIS system such as ArcView, or done on paper maps. Data and maps can be obtained from PIRSA. If using maps the following steps will help in estimating the percentage area of a land use that is suitable for the weed:

1. Map the land use in your Board. If you do not have a land use map, you could shade areas on clear plastic laid over topographic maps.

2. Consider the climatic and soil preferences of the weed, and the vegetation/crop/pasture types within the land use to which the weed is suited. Lay a sheet of plastic over the land use map, and shade the areas of the land use which are suitable for the weed.

3. Compare the weed's map to the land use map to estimate the percentage of the land use which is suitable for the weed. Answer as follows:

In the Board, what percentage area of the land use is suitable for the weed?		SCORE
☐ > 80% of land use	The weed has a potential to spread to more than 80% of the land use in the Board.	10
☐ 60-80% of land use	The weed has a potential to spread to between 60% and 80% of the land use in the Board.	8
☐ 40-60% of land use	The weed has a potential to spread to between 40% and 60% of the land use in the Board.	6
☐ 20-40% of land use	The weed has a potential to spread to between 20% and 40% of the land use in the Board.	4
☐ 10-20% of land use	The weed has a potential to spread to between 10% and 20% of the land use in the Board.	2
☐ 5-10% of land use	The weed has a potential to spread to between 5% and 10% of the land use in the Board.	1
☐ 1-5% of land use	The weed has a potential to spread to between 1% and 5% of the land use in the Board.	0.5
☐ unsuited to land use	The weed is not suited to growing in any part of the land use in the Board.	0
☐ don't know		?

COMPARATIVE WEED RISK SCORE

The score for weed risk is calculated by adjusting the invasiveness, impacts and potential distribution scores to range from 0 to 10, and then multiplying these. Weed risk will have a maximum of 1000, and a minimum of 0. The spreadsheet does this for you.

To calculate manually, adjust the raw scores as follows:

Invasiveness: Divide by 15 and multiply by 10. Round off to one decimal place.

Impacts: Divide by 19, and multiply by 10. Round off to one decimal place.

Potential distribution: Leave unchanged.

Comparative Weed Risk = Invasiveness × Impacts × Potential distribution

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Splitting up these possible scores into bands of 20% gives cutoffs for classes of weed risk:

Frequency Band		Weed Risk Score	Weed Risk
80 - 100%	(top 20% of possible scores)	192+	*Very high*
60 - 80%		< 192	*High*
40 - 60%		< 101	*Medium*
20 - 40%		< 39	*Low*
0 - 20%	(bottom 20% of possible scores)	< 13	*Negligible*

Do not compare scores between land uses. Land uses differ in their value and this is hard to measure. Also, average weed risk scores may be lower in agricultural land uses compared to other land uses. This is simply because of the greater level of weed management in agriculture. It does not mean that agricultural weeds are less important.

Why multiply the invasiveness, impacts and potential distribution scores?

- Multiplying gives a greater spread in the scores than adding (i.e. range from 0-1000 compared to 0-30).

- Multiplying is logical, as it recognises the interactions between the criteria. Say the impacts of a weed can be measured in dollars per hectare per year, the potential distribution is known in hectares, and the invasiveness (i.e. rate of spread) is measured in terms of the increase in hectares compared to the previous year:

Impact   ×   Potential Distribution   ×   Invasiveness

$ / hectares / year   hectares   hectares(current year) / hectares (previous year)

When multiplying, all of the hectares units cancel so that weed importance is measured in total dollars per year. In multiplying the invasiveness, impacts and potential distribution criteria scores, we are mimicking the above calculation, without having the actual dollar and hectare figures.

2) FEASIBILITY OF CONTAINMENT

The feasibility of containment questions are divided into three main criteria; control costs, current distribution and persistence. **Control costs** considers the weed management costs of detection, on-ground control and enforcement/education needs. **Current distribution** considers how widespread the weed is. **Persistence** refers to the expected duration of control works. Scores for each of these criteria are multiplied (each ranging between 0 and 10), to give a feasibility score out of 1000.

Assess feasibility for the land use at risk, so that its score can be directly compared to the weed risk score from the same land use to set control priorities.

In the following questions higher scores indicate lower feasibility of containment.

CONTROL COSTS

This section indicates the control cost per hectare in the first year of targeted control, for an infestation of the weed that has reached its maximum density in the land use at risk. The four main cost factors associated with coordinated control programs are searching for the weed, accessing and treating infestations, and achieving landholder commitment.

1. How detectable is the weed?					Total (a+b+c+d)	SCORE
(a) Height at maturity		**(b) Shoot growth present**			7 or 8	3
☐ <0.5 m	2	☐ <4 months	2		5 or 6	2
☐ 0.5-2 m	1	☐ 4-8 months	1		3 or 4	1
☐ >2 m	0	☐ >8 months	0		0, 1 or 2	0
☐ don't know	?	☐ don't know	?			?
(c) Distinguishing features		**(d) Pre-reproductive height in relation to other vegetation**				
☐ non-descript	2	☐ below canopy	2			
☐ sometimes distinct	1	☐ similar height	1			
☐ always distinct	0	☐ above canopy	0			
☐ don't know	?	☐ don't know	?			

This question indicates the cost of finding infestations of the weed. Parts (a), (b) and (c) relate to finding new infestations. Part (d) relates to finding and treating plants prior to reproduction.

(a) Taller plants can be spotted from greater distances.

(b) Shoot growth considers when shoots are visible (live or dead). Annuals and some perennials (e.g., bridal creeper, bulbil watsonia) have shoots present for a limited period of the year.

(c) Distinguishing features include appearance and smell of foliage, flowers and fruits. This indicates how conspicuous the weed is amongst other vegetation. For example, the shape and foliage of a pine tree is quite obvious amongst native vegetation.

(d) Pre-reproductive height refers to locating the weed for control prior to seed set or bulb formation. Control must occur before reproduction if local eradication is to occur. The pre-reproductive height will mostly be less than at maturity and the weed will also probably be growing amongst other vegetation. Hence the weed's height is described relative to the canopy height of this other vegetation. For example, if considering a weed of the Crop/Pasture Rotation land use then the canopy will be the height of the crop.

What is general accessibility of known infestations?		*SCORE*
☐ low	Most infestation sites difficult to access	*2*
☐ medium	Most infestation sites readily accessible	*1*
☐ high	All infestation sites readily accessible	*0*
☐ not present	Not known to be present in Board	*0*
☐ don't know		*?*

Sites may be difficult to traverse due to slope, rockiness, dense vegetation and/or surface water. This will slow down searching and control activities. There may be seasonal differences in accessibility (e.g. winter waterlogging), but answer in terms of the optimal search and control times for the weed.

2. How expensive is control of the weed, using techniques which both maximise efficacy and minimise off-target damage?			SCORE
(a) Chemicals, fuel and equipment operating costs	*(b) Labour costs*	Total (a+b)	Range between 0 and 8
☐ very high *4* ☐ high *3* ☐ medium *2* ☐ low *1* ☐ not applicable *0* ☐ don't know *?*	☐ very high *4* ☐ high *3* ☐ medium *2* ☐ low *1* ☐ not applicable *0* ☐ don't know *?*	☐ don't know	*?*

Select a cost category (A, B or C) for the land use being considered. This allows for more realistic control cost estimates.

	Cost Categories			SCORE
	A	*B*	*C*	
Very high	*>$1000/ha*	*>$500/ha*	*>$100/ha*	*4*
High	*$500-1000/ha*	*$250-500/ha*	*$50-100/ha*	*3*
Medium	*$250-500/ha*	*$100-250/ha*	*$25-50/ha*	*2*
Low	*<$250/ha*	*<$100/ha*	*<$25/ha*	*1*

Herbicides are the main means by which weeds are controlled. Physical control methods may be cultivation, cutting/slashing stems or extraction (e.g., boxthorn plucker). Do not consider capital costs for purchasing application equipment in this question.

What is the likely level of cooperation from landholders within the land use at risk?		*SCORE*
☐ low	Weed control is rarely undertaken in the land use. Cost of control is beyond the financial and technical capacity of landholders.	*2*
☐ medium	Control of the weed will require a significant change in existing weed management practices, but this will be within the financial and technical capacity of landholders.	*1*
☐ high	Control of the weed will require minimal change in existing weed management practices.	*0*
☐ don't know		*?*

Aside from the "on-ground" costs of searching and control, a coordinated control program will have overarching costs of extension/education, enforcement, project management and administration. The ease of motivating and coordinating landholders in an ongoing program will vary between land uses, particularly in relation to their financial capacity to support a control program.

CURRENT DISTRIBUTION

This section indicates how widespread the weed currently is within the land use. It considers the proportion of the land use infested, and the overall pattern of infestations.

What percentage area of the land use is currently infested by the weed?		SCORE
☐ >80% of land use	The weed infests more than 80% of the land use in the Board.	10
☐ 60-80% of land use	The weed infests between 60% and 80% of the land use.	8
☐ 40-60% of land use	The weed infests between 40% and 60% of the land use.	6
☐ 20-40% of land use	The weed infests between 20% and 40% of the land use.	4
☐ 10-20% of land use	The weed infests between 10% and 20% of the land use.	2
☐ 5-10% of land use	The weed infests between 5% and 10% of the land use.	1
☐ 1-5% of land use	The weed infests between 1% and 5% of the land use.	0.5
☐ <1% of land use	The weed is present in the land use but infests less than 1%.	0.1
☐ 0% of land use but in 20-40% of Board	The weed is not known to be present in the land use but does infest between 20% and 40% of the Board area.	2
☐ 0% of land use but in 10-20% of Board	The weed is not known to be present in the land use but does infest between 10% and 20% of the Board area.	1
☐ 0% of land use but in 5-10% Board	The weed is not known to be present in the land use, but does infest between 5% and 10% of the Board.	0.5
☐ 0% of land use but in 1-5% Board	The weed is not known to be present in the land use, but does infest 1-5% of Board.	0.1
☐ 0% of land use but <1% of Board	The weed is not known to be present in the land use, but does infest <1% of Board. Or the species is not naturalised in the Board but is cultivated (e.g. olives).	0.05
☐ 0% of Board	The species is not known to be present in the Board.	0
☐ don't know		?

The aim of containment is to prevent weed spread to a susceptible land use. The greater the area of land use that is already occupied, then the less feasible is containment. In the above table it is assumed to be highly unlikely that a weed could infest >40% of the Board area and not also be present in the land use.

What is the pattern of the weed's distribution across the Board area?		SCORE
☐ widespread	The weed occurs in large and small infestations across most of the Board area.	2
☐ evenly scattered	The weed occurs as discrete, mainly small infestations across much of the Board area.	1
☐ restricted	The weed is localised to 1-2 hundreds of the Board area. Or the weed is not known to be naturalised in the Board area.	0
☐ not present	The species is not known to be present in the Board.	0
☐ don't know		?

A weed which is widespread will be more difficult to contain than one which is restricted to a small section of the Board. The former will have more landholders potentially exposed to spread of the weed.

PERSISTENCE

This section indicates how long it takes to eradicate the weed. It considers the efficacy of targeted control treatments, reproductive age, seedbank longevity and the likelihood of ongoing dispersal.

How effective are targeted control treatments applied to infestations of the weed?		SCORE
☐ low	More than 25% of weeds survive annual targeted treatment/s.	3
☐ medium	Up to 25% of weeds survive annual targeted treatment/s.	2
☐ high	Up to 5% of weeds survive annual targeted treatment/s.	1
☐ very high	Up to 1% of weeds survive annual targeted treatment/s.	0
☐ don't know		?

Do the herbicide and physical control treatments costed above kill all plants in an infestation?
Efficacy can be reduced due to:

- *tolerance to or recovery from treatment*
- *incomplete application of a treatment (e.g., some plants receive a sub-lethal dose of herbicide, missed plants)*
- *vegetative regeneration (e.g. silverleaf nightshade)*
- *"out of season" growth (e.g. early or late germination of annuals)*

What is the minimum time period for reproduction of sexual or vegetative propagules?		SCORE
☐ <1 month	Minimum generation time <1 month.	3
☐ <1 year	Minimum generation time 1-12 months.	2
☐ <2 years	Minimum generation time 12-24 months.	1
☐ >2 years	Minimum generation time >24 months.	0
☐ don't know		?

The shorter the time period to reproduction, the greater the frequency of control treatments required and the greater the chance of plants being missed prior to reproduction. Aquatic plants such as salvinia can have rapid vegetative reproduction.

What is the maximum longevity of sexual or vegetative propagules?		SCORE
☐ >5 years	Sexual or vegetative propagules can remain dormant for at least 5 years.	2
☐ 2-5 years	Sexual or vegetative propagules can remain dormant for 2-5 years.	1
☐ <2 years	Sexual or vegetative propagules remain dormant for less than 2 years.	0
☐ don't know		?

Soil seedbank longevity is the primary determinant of how long an infestation must be treated to achieve eradication.

How likely are new propagules to continue to arrive at control sites, or start new infestations?		Total (a+b)	SCORE
(a) Long-distance dispersal by natural means	*(b) Grown*	4	3
☐ frequent 2	☐ commonly planted 2	2-3	2
☐ occasional 1	☐ occasionally planted 1	1	1
☐ rare 0	☐ not planted 0	0	0
☐ don't know ?	☐ don't know ?	☐ don't know	?

FEASIBILITY OF CONTAINMENT SCORE

The score for feasibility of containment is calculated by adjusting the control costs, current distribution and persistence scores to range from 0 to 10, and then multiplying these. Feasibility of containment will have a maximum of 1000, and a minimum of 0. The spreadsheet does this for you.

To calculate manually, adjust the raw scores as follows:

Control costs: Divide by 15 and multiply by 10. Round off to one decimal place.

Current distribution: Divide by 12, and multiply by 10. Round off to one decimal place.

Persistence: Divide by 11, and multiply by 10. Round off to one decimal place.

Feasibility of Containment = Control Costs × Current Distribution × Persistence

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Splitting up these possible scores into bands of 20% gives cutoffs for classes of feasibility of containment:

Frequency Band		Feasibility Score	Feasibility of Containment
80 - 100%	(top 20% of possible scores)	113+	*Negligible*
60 - 80%		< 113	*Low*
40 - 60%		< 56	*Medium*
20 - 40%		< 31	*High*
0 - 20%	(bottom 20% of possible scores)	< 14	*Very High*

Why multiply the Control Costs, Current Distribution and Duration of Control scores?

- Multiplying gives a greater spread in the scores than adding (i.e. range from 0-1000 compared to 0-30).

- Multiplying is logical, as it recognises the interactions between the criteria. Say the control costs of a weed can be measured in dollars per hectare per year, the current distribution is known in hectares, and the duration of control is known in years:

Control Costs   ×   **Current Distribution**   ×   **Duration of Control**

$ / hectares / year   *hectares*   *years*

When multiplying, all of the hectares units cancel so that feasibility of control is measured in total dollars. In multiplying the control costs, current distribution and duration of control criteria scores, we are mimicking the above calculation, without having the actual dollar and hectare figures.

3) DETERMINING PRIORITIES

The following matrix gives guidance on appropriate strategic, weed management actions. Different weed species will appear in different positions on the matrix, based on their risk and feasibility of containment scoring. Each land use will have a separate matrix.

WEED RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >113	Low >56	Medium >31	High >14	Very High <14
Negligible <13	LIMITED ACTION	LIMITED ACTION	LIMITED ACTION	LIMITED ACTION	MONITOR
Low <39	LIMITED ACTION	LIMITED ACTION	LIMITED ACTION	MONITOR	MONITOR
Medium <101	MANAGE SITES	MANAGE SITES	MANAGE SITES	PROTECT SITES	CONTAIN SPREAD
High <192	MANAGE WEED	MANAGE WEED	PROTECT SITES	CONTAIN SPREAD	DESTROY INFESTATIONS
Very High >192	MANAGE WEED	PROTECT SITES & MANAGE WEED	CONTAIN SPREAD	DESTROY INFESTATIONS	ERADICATE

ALERT

112

Following are guiding principles for each of the management categories in the matrix. At a landscape scale these principles need to be interpreted in terms of different outcomes per land use for different weeds. For example, a weed may rank as "destroy infestations" in one land use and "limited action" in others. In this case coordinated control may still be required in the latter land uses to enable protection of the former land use.

The term "management area" can be used below to apply to a range of spatial scales (e.g. NRM Board, sub-regional, land use)

ALERT
Species that are not known to be present in the management area and which represent a significant threat. Such species would score "0" in Feasibility of Containment due to their absence. Aims to prevent the species arriving and establishing in the management area
- Prevention of entry to management area
- Ongoing surveillance for incursions of the species (e.g. nursery inspections)
- Training and awareness activities for the community to enable early detection

ERADICATE
Aims to remove the weed species from the management area
- Detailed surveillance and mapping to locate all infestations
- Destruction of all infestations including seedbanks
- Prevention of entry to management area and movement and sale within
- Must not grow and all cultivated plants to be removed
- Monitor progress towards eradication

DESTROY INFESTATIONS
Aims to significantly reduce the extent of the weed species in the management area
- Detailed surveillance and mapping to locate all infestations
- Destruction of all infestations, aiming for local eradication at feasible sites
- Prevention of entry to management area and movement and sale within
- Must not grow
- Monitor progress towards reduction

CONTAIN SPREAD
Aims to prevent the ongoing spread of the weed species in the management area
- Surveillance and mapping to locate all infested properties
- Control of all infestations, aiming for a significant reduction in weed density
- Prevention of entry to management area and movement and sale within
- Must not allow to spread from cultivated plants (if grown)
- Monitor change in current distribution

PROTECT SITES
Aims to prevent spread of the weed species to key sites/assets of high economic, environmental and/or social value
- Weed may be of limited current distribution but only threatens limited industries/habitats (lower weed risk). Or the weed may be more widespread but is yet to invade/impact upon many key industries/habitats (higher weed risk).
- Surveillance and mapping to locate all infested areas
- Identification of key sites/assets in the management area
- Control of infestations in close proximity to key sites/assets, aiming for a significant reduction in weed density
- Limits on movement and sale of species within management area
- Must not allow to spread from cultivated plants (if grown) in close proximity to key sites/assets
- Monitor change in current distribution within and in close proximity to key sites/assets

MANAGE WEED
Aims to reduce the overall economic, environmental and/or social impacts of the weed species through targeted management
- Research and develop integrated weed management (IWM) packages for the species, including herbicides and biological control where feasible
- Promote IWM packages to landholders
- Monitor decrease in weed impacts with improved management

- Identify key sites/assets in the management area and ensure adequate resourcing to manage the weed species

MANAGE SITES

Aims to maintain the overall economic, environmental and/or social value of key sites/assets through improved general weed management

- Promote general IWM principles to landholders, including the range of control techniques, maintaining competitive vegetation/crops/pastures, hygiene and property management plans.
- Identify key sites/assets in the management area and ensure adequate resourcing to manage these to maintain their values
- Broaden focus beyond weeds to all threatening processes

MONITOR

Aims to detect any significant changes in the species' weed risk

- Monitor the spread of the species and review any perceived changes in weediness

LIMITED ACTION

The weed species would only be targeted for coordinated control in the management area if its local presence makes it likely to spread to land uses where it ranks as a higher priority.

- Undertake control measures if required for the benefit of other land uses at risk
- Otherwise limited advice to land managers if required

South East Pest Management Strategy

A regional biosecurity plan for the control of invasive species

Part 2: Pest Management Plan

Containment Zones

Government of South Australia
South East Natural Resources
Management Board

CONTENTS

1. CONTAINMENT ZONES

If it is not feasible to eradicate a particular weed, the best option is to contain it and prevent expansion or new infestations. This can be done by minimising dispersal outside existing infestations, and by treating new infestations as early as possible.

Containment involves defining the boundary of the existing weed infestation and preventing any spread beyond that line. Within the infested area the weed may not be treated; it may even become more dominant. This goal is most suitable when there are severe difficulties in attempting to treat the main part of the infestation. It may simply be too large for the resources available, the weed may be very difficult to kill or some obstacle such as steep banks may prevent access.

However, there is also a role for containment at finer scales. This would involve actions at NRM group, property and paddock levels that depend on the fact that weeds are unevenly distributed at these scales. The value of attempting to contain weeds at these finer scales depends upon modes and rates of spread and rates of population increase.

Large areas of land can easily be protected by taking care in moving animals, machinery, and produce (fodder, seed etc) from infested areas to clean areas. Machinery such as slashers should always be cleaned before being moved into weed-free areas. Feeding produce to stock in a confined area ensures that any weeds present are restricted to that area and not spread throughout the property. Stock brought onto a property for the first time should be placed in a confined area for a week or so; this ensures any viable weed seeds in their digestive tracts are expelled, minimising the spread of weed seeds. (See weed spread pathways section for more information)

A critical factor in any containment program is the location of containment lines or boundaries. Land managers must consider where the weed species is present or absent, abundant or uncommon, and exploit features of the landscape that form natural barriers.

1.1 HOW WILL THEY BE MANAGED?

The containment lines identified in this report will be used as part of the South East Natural Resources Management Board program to limit the spread of weed species. This program will be implemented as part of the inspection and control program of the board and as part of the implementation of the Pest Management Strategy, this document is part of. This program is dependent on the cooperation of land managers in the control of declared pest plants on their properties and the enforcement of the SE NRM board weed policies.
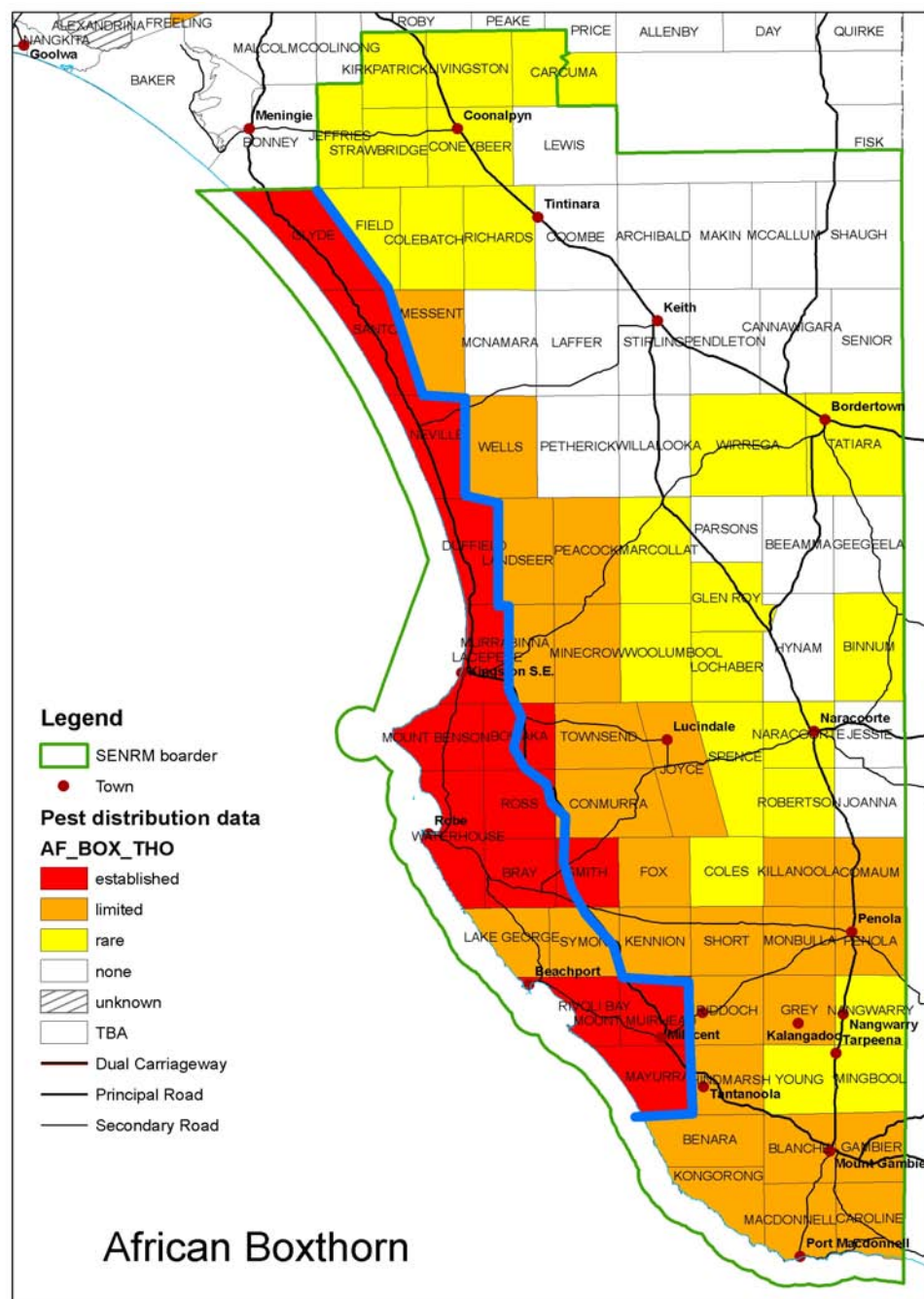
CONTAINMENT ZONES OF THE SOUTH EAST

This section shows containment lines for a number of weed species found in the south east. These weeds are
- African boxthorn,
- African lovegrass,
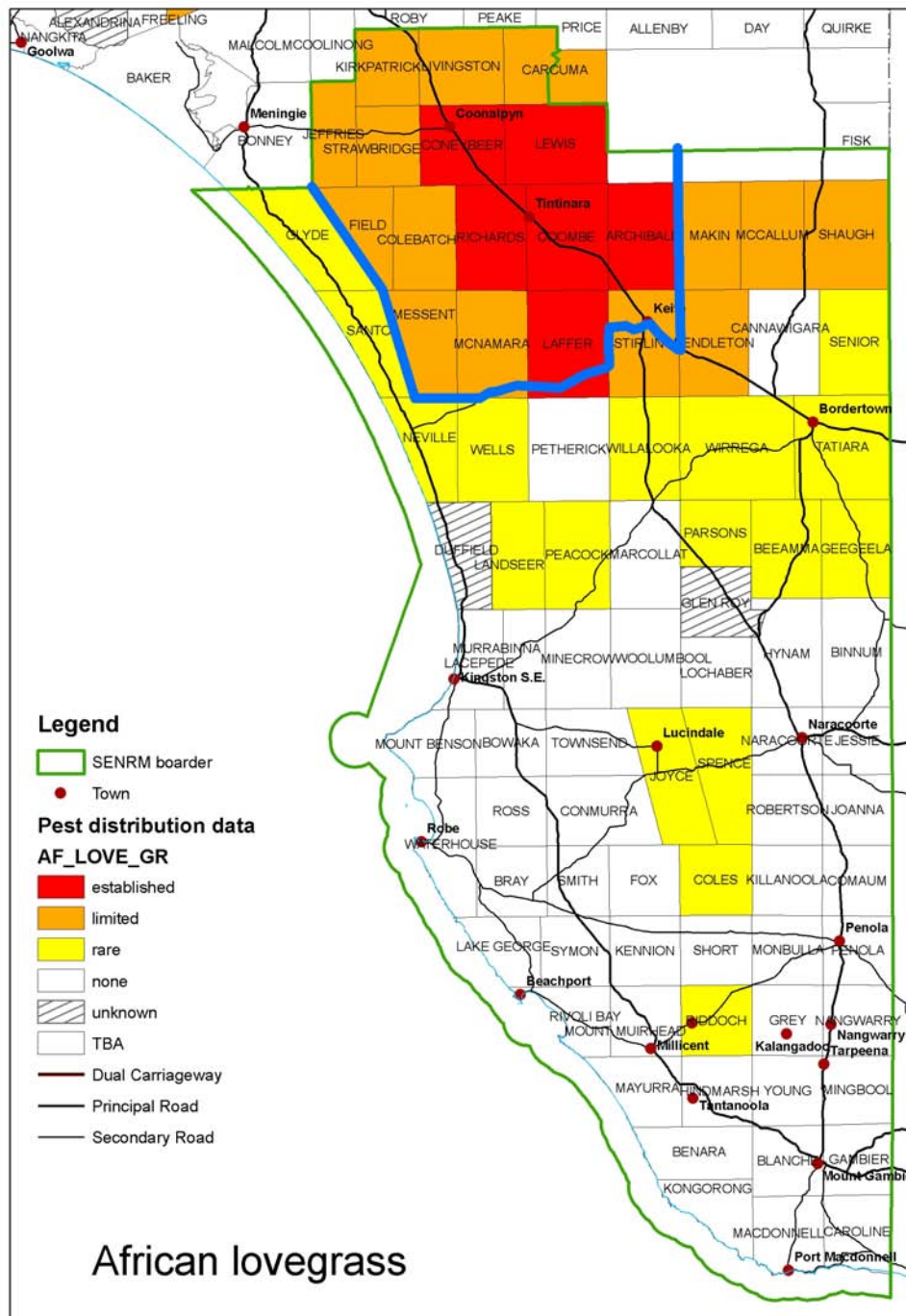- False caper,
- Salvation Jane and
- Yellow burrweed.

1.2   AFRICAN BOXTHORN *(LYCIUM FEROCISSIMUM)*

Containment of African boxthorn is to the east of the blue line.

African Boxthorn

1.3   AFRICAN LOVEGRASS (*ERAGROSTIS CURVULA*)

African lovegrass is to be contained in the hundreds of Messent, Field, McNamara, Laffer, Stirling, Archibald, Coombe, Colebactch, Jefries, Strawbridge, Coneybeer, Lewis, Carcuma, Livingston, Kirkpatrick. All outbreaks outside of this containment zones are to be controlled.

African lovegrass

1.4   FALSE CAPER (*EUPHORBIA TERRACINA*)

False caper containment line is to be limited to the coastal highway in the hundreds of Glyde, Santo, Nevillem Duffield, Lacepede, Mount Benson, Waterhouse, Lake George and Rivoli Bay. All other infestations of False caper are to be controlled outside of this containment zone. Areas of high assets are to be protected from the adverse impacts of False Caper

False caper
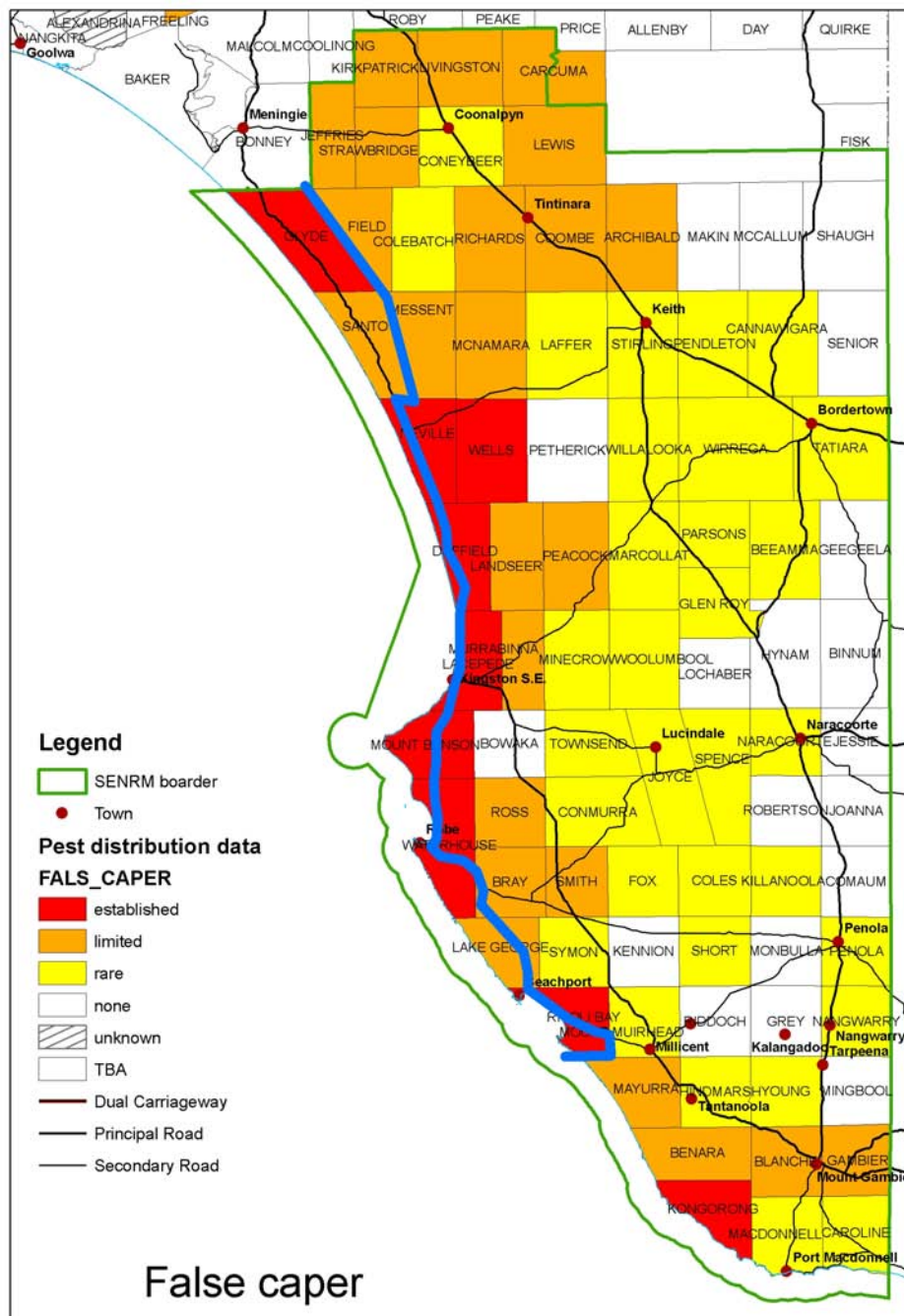
1.5   SALVATION JANE (*ECHIUM PLANTAGINEUM*)

Salvation Jane is to be contained in the northern area of the region (north of the blue line). Within the containment zone buffer zones are to be implemented to protect clean neighbours.

Salvation Jane
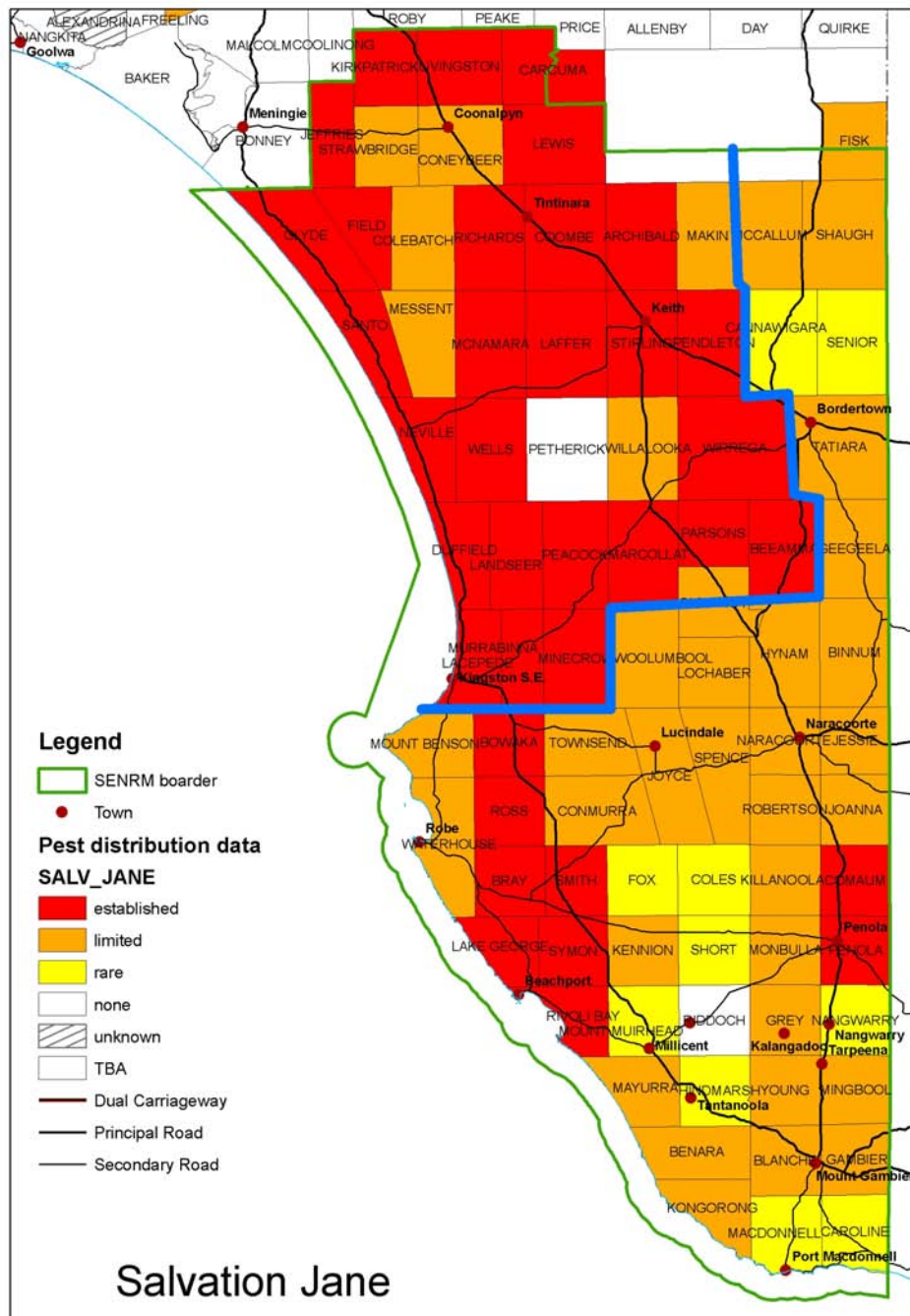
1.6   YELLOW BURRWEED (*AMSINCKIA SPP.*)

Yellow burrweed is to be contained to the northern part of the region. All infestations south of the blue line are to be controlled.
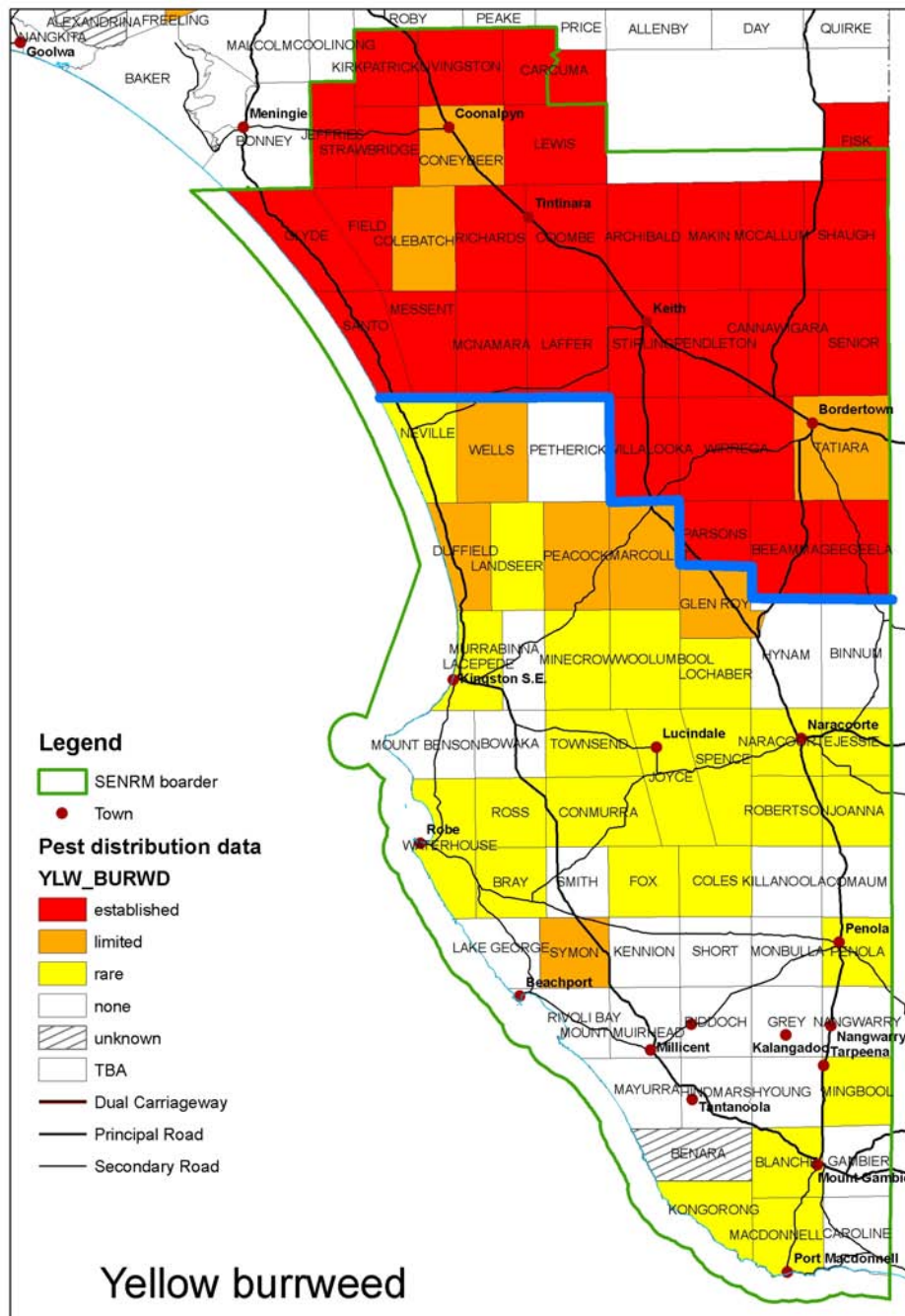
Yellow burrweed

South East Pest Management Strategy

A regional biosecurity plan for the control of invasive species

Part 2: Pest Management Plan

Pathways Of Weed Spread

Government of South Australia
South East Natural Resources
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TABLES AND FIGURES

1. IDENTIFIED ENTRY PATHWAYS FOR PEST PLANTS AND ANIMALS INTO THE SE

There exist a number of plants and animals which are found in neighbouring regions and have the potential to cause significant environmental, economic and social impact if they became established in the South East NRM Region. The SE NRM Board is identifying these pests and conducting a risk assessment of their potential impact. When this risk assessment is combined with the identification of the most likely vectors and pathways of spread, the entry and establishment of these pests will be minimised.

Management of new and existing incursions can only be achieved through the collaboration and cooperation of all people at all levels, be they individuals, industry (both public and private) or government agencies, "Biosecurity is everyone's' business".

Incursions can be reduced and managed through the implementation of a combination of measures which include;
- Surveillance,
- Education and awareness and
- Legislation/ policies/ protocols/ reporting.

All actions which are undertaken to manage incursions must be applied fairly and equitably.

The establishment success of a new incursion will be dependent of factors such as frequency of event, likelihood of establishment, individual species adaptability, and the vector for movement.

Incursions via environmental factors such as wind and water are likely to be short distance and localised e.g. along a creek or river, or across a paddock. Whereas incursions via human aided movement have the potential to be much greater, with movement occurring at intrastate, interstate and also international scales.

Limitations to incursion management include;
- Knowledge of location and distribution of pest plant and animals both within and outside the region,
- Resources (including financial and operational) required to undertake surveillance and extension,
- Achieving support and implementation at all levels.

2. PATHWAY VS. VECTORS

Vectors are considered the transport mechanism for the pest plant or animal, while the pathway can be considered the actual route along which the vector enters the region. Assessing the pathways and the potential vectors will give us an indication for a potential entry sites for new incursions.

For example, a vehicle passing through the SE NRM region along defined roads or highways without stopping has less potential for introduction of a new pest, than a vehicle which makes regular stops unloading/ loading cargo eg sheep or cattle at depots, farms yards throughout the Southeast.

The primary (anthropogenic) vectors for movement are identified by King 2007.
- Deliberate introduction via community,
- Deliberate introduction via business,
- Human movement,
- Controlled livestock movement,
- Contaminated vehicles,
- Contaminated equipment,

- Contaminated aquatic equipment,
- Contaminated goods and produce,
- Waste disposal,
- Animal movement other than livestock.

The potential points of entry into the SE NRM Board region are numerous.
To identify general priority pathways we examined where convergent pathways occurred within the region.

2.1 VEHICULAR TRAFFIC AS VECTORS FOR MOVEMENT

On average 11,630 vehicles enter and exit the SE region every day along the major thoroughfares outlined in Table 1. This does not include secondary routes like farm and industry tracks or traffic and cargo via air and sea.

Table 1: Indicative average daily traffic flows for the SE region, figures derived from DTEI 2008

Indicative traffic flows: sourced from Transport Information Management section DTEI			
Annual Average Daily Traffic Estimates, Aug 2008			
Routes	All traffic (two way flow)	Commercial Vehicles (two way flow)	
Princes Hwy to Meningie	1400	170	
Dukes Hwy to Keith	3600	1300	
Victoria to Bordertown via Dukes Hwy	2400	900	
Pinnaroo to Bordertown	220	70	
Wimmera Hwy from Vic	490	49	
Comaun Forest Rd from Vic	270	39	
Penola -Casterton rd	300	50	
Vic border to Glenburnie	800	100	
Princes hwy from Vic	1200	370	
Punt Rd from Vic	950	260	
Total traffic	**11630**	**3308**	Total traffic entering & leaving SE from the major roads on daily average basis

While the movement of traffic may pose only a minimal threat to new incursions, it is when and where these vehicles stop, decontaminate, unload etc, that poses the greater threat for the introduction of a propagules or animal being introduced.

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2.2   TRANSPORT ORIENTATED PATHWAYS

Road, Rail, Yards ,Parking Bays, Weighbridges, Marinas, Ports, Airfields and associated activities eg road construction, slashing etc all pose a potential entry point for an incursion from contaminated vehicles. Restricting movement along these pathways is extremely difficult. Actions for these pathways are centred around strategic inspection and awareness raising.

2.3   ENVIRONMENTAL PATHWAYS

Long distance movement by wind and water along creeks / drains or across paddocks is limited, while the prevention of natural dispersal of animals eg pest birds if difficult. New incursion will only be identified through strategic inspections and by raising the awareness of key industry personnel, community groups and public members.

2.4   TOURISM AIDED PATHWAYS

Potential incursions particularly grassy and burr pest plants can be picked up on clothing and vehicles, in tyres and shoes and then be deposited around the region as we move between places like caravan parks, tourist sites, and camping areas in national and state parks and conservation areas. Vigilant site managers will identify and manage new incursion quickly, but traveller should also be aware of what they could be potentially carrying. Educational materials like pamphlets and signage can aid in prompting their awareness.

2.5   INDUSTRY AND TRADE PATHWAYS

The movement of equipment and produce into, out of and around the region, is extremely difficult to manage and control. This pathways is centred around the movement of produce, materials and equipment by the transport industry eg livestock carriers, bulk material suppliers, quarries, seed and hay suppliers, contractors for haymaking, harvesting, spraying, crop inspectors.
Simple steps like decontaminating and maintenance of travel records can aid in preventing and managing incursions should they occur.

2.6   CONSUMER ORIENTATED PATHWAYS

Public can aid in transport and establishment of new incursion through the consumption from outlets like town markets, nurseries and plant sellers, landscape suppliers, pet shops etc. Actions which can limit the establishment of new incursions via this pathway are centred on awareness raising of both the supplier and the consumer.

## 3.   SPATIAL REPRESENTATION OF BIOSECURITY PATHWAYS

In order to understand and map where weeds are most likely to enter the South East from human-aided pathways, a number of potential high risk vectors (i.e. roads, railways, and high traffic areas) and land uses (for example, those that may import stock, plants, feed, or soil) were represented in a geographic information system (GIS) by readily available spatial layers. Where higher numbers of these potential pathways coincided in the landscape, it was assumed that there may be an increased likelihood of weeds being introduced at that location.
The highest number of coinciding pathways was four, and all of these locations were clustered in the mid-lower region of the South East. The following table describes the general location of likely weed incursion areas, and these areas are represented by red dots on Map #. Please refer to Appendix # for a detailed description of the GIS analysis.

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Table 2 - Description of sites with significantly clustered pest incursion values of 4 (four intersecting pathways) in the mid-lower South East.

SITE DESCRIPTION	INTERSECTING PATHWAYS
Populated place:	
Naracoorte	Intersection of rail, roads and built-up areas
Kybybolite	Intersection of rail, roads and built-up areas
South End	Intersection of drains, roads and built-up areas
Millicent	Intersection of landuse/built-up areas, railway, roads and drains
Mount Gambier	Intersection of landuse/built-up areas, railway, and roads
Other:	
8km W of Penola	Intersection of powerlines and roads
6km N of Furner on the Robe-Penola Road	Intersection of powerlines, roads, and drains
1km NW and 4km SW of Tantanoola	Intersection of powerlines, roads, rail, and drains

Figure 1: Map of pest incursion analysis of the South East region
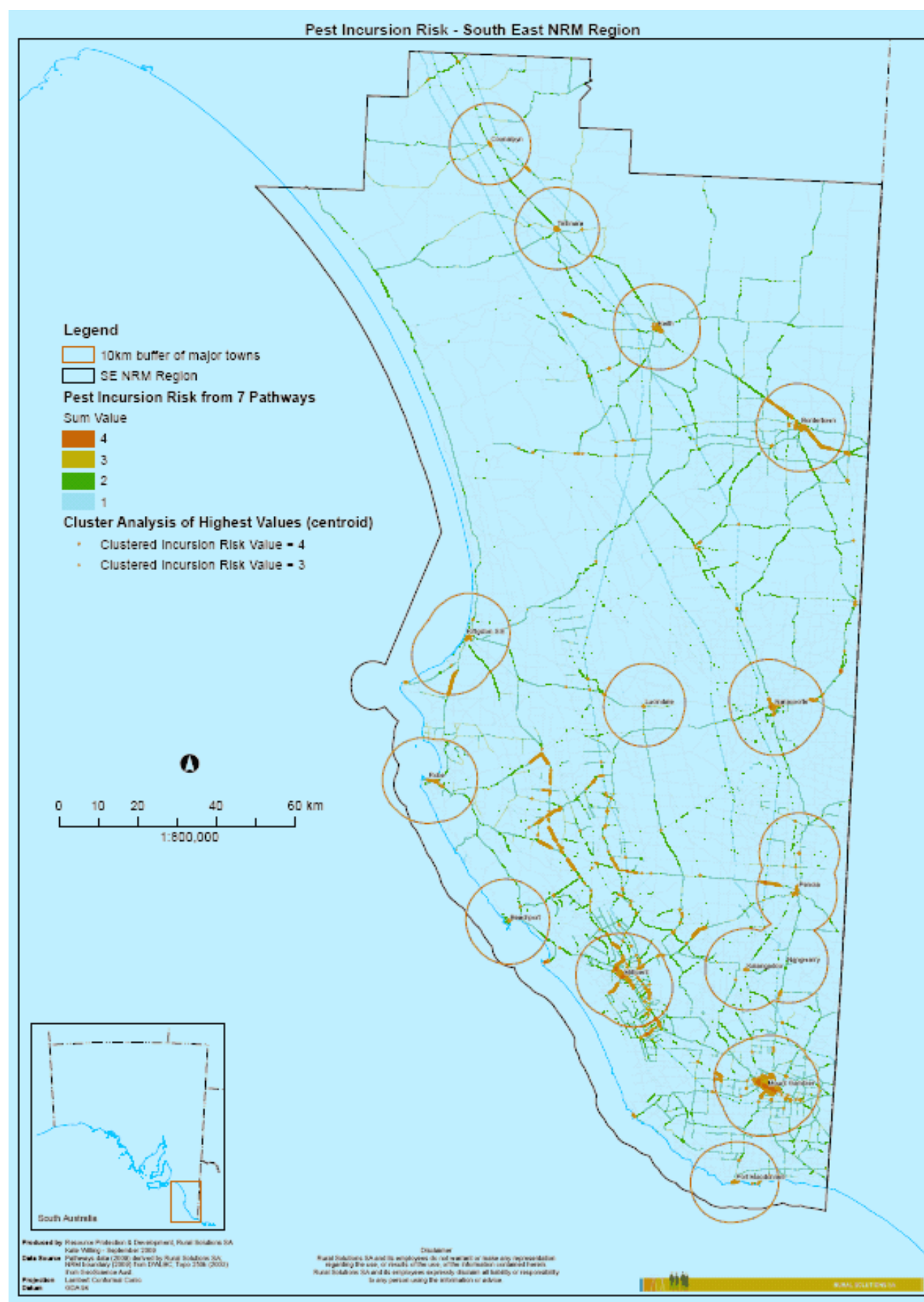
4. PATHWAYS

Table 3: Pathways identified in the South East region

Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
Transport						
Roads	All formed roads, dirt and bitumen that bisect the SE. Primary focus should be on the major highways e.g. Dukes, Riddoch, Princes and Wimmera highways. Secondary transport routes to/from towns and agribusiness centres eg silos, saleyards, stock and goods holding areas.	Roadside awareness signage e.g. "Cover your load", "here have you been, what have you brought with you?" Pest reporting procedure Location of pest plants.	Roadside weed control and slashing conducted by local government Spilt grain and produce Uncovered loads	Grass weeds on verges eg Chilean needle grass, Serrated tussock Burr weeds eg Caltrop , Three corner jack, Khaki weed, Innocent weed, Horehound Numerous existing declared pest plants associated with agricultural production eg Salvation jane, Yellow burr weed, Horehound.	Inspection of road verges least twice per year (summer and winter) for main roads and rail corridors At least once per year for secondary roads Liaise with LGA and DTEI regarding timing of control works eg slashing, spraying and decontamination protocols Education & awareness with DTEI and LGA and associated contractors about timing of control eg herbicide and slashing to prevent seed set.	Industry Compliance with load covering requirements DTEI/ LGA/Contractors Ensure slashing prior to seed set and undertaking machinery hygiene procedures. SE NRMB Inspection or road verges Awareness material preparation and liaison with DTEI and LGA

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Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
					Ensure loads are covered – DTEI and transport companies liaison. Establishment of wash-down, blow down protocols and points at depots	
Road construction	Many road construction companies operate nationally and may bring in new pest plants while local government may spread existing weed problem to a new area Key operators include local government, DTEI and associated contractors.	Pre construction survey for weeds, preferably in summer and winter Location of existing pests	Decontamination points and procedures Defined tracks and turn points Record origin of materials. Maintain pest plant free stockpile heaps Permanent and temporary stockpile sites Pest locality information	All pest plants	SENRM assist with recommendation and identification of existing pest areas. Pre inspection and liaison with work crews re location of pest plant and remediation to prevent movement eg defined turn points, location of stockpiles. Inspection of stockpiles to ensure they remain pest plant	Industry / LGA Best practice road construction and site rehabilitations. Ensure decontamination protocols are implemented. SE NRMB Liaise with LGA and contractors regarding declared plant locations Pest reporting procedure developed and communicated to relevant parties.

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Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
					free.	
					Material, sourced from near site or maintain log of where come from, link to local government quarries (pre-inspection, removal of topsoil etc).	
					Construction equipment should be decontaminated prior to arrival on site and upon leaving.	
					Awareness material of primary pest plants of concern and how to minimise spread should be developed.	
					Pest reporting procedure should be developed.	

Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
Rail and other corridors	The major interstate rail corridor bisects the SE NRM Board area. These corridors provide habitat for pest animals and plants Early detection of new pests within the defined corridor can be quickly detected and eradicated. Included are the Melbourne to Adelaide line corridor and the disused SE rail corridor. Numerous companies and service providers ARTC, GSR, Transfield. Other corridors include pipelines, drains, and power lines	Location of existing pest populations Factsheets or ute guide of primary pest plants. Pest reporting procedure	Access to rail yards and other corridors possible training for SENRM staff Wash down/ decontamination points Container loading/ unloading/ holding areas Awareness material, key species to watch out for Education – container traffic from interstate, cane toads, who to report finds to. Pest reporting procedure	Grass weeds eg Chilean needle grass, Serrated tussock. Existing declared plants eg Caltrop, Horehound, Salvation jane Potential pest animals include cane toads.	Inspection of rail corridors for summer and winter weeds, inspection should include sidings, station yards etc. Liaise with corridor management authorities eg ARTC, SA Water, ETSA and contractors on the most suitable time to conduct control works and the location of existing pest plants. Awareness material of primary pest plants and pest animals developed. Pest reporting procedure should be developed.	Industry Inspection Reporting of pest sightings. Undertake control. Ensure decontamination protocols and implemented. SE NRMB Inspection. Awareness material preparation. Pest reporting procedure developed and communicated to relevant parties.

Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
Loading and Unloading points.	This category include trucking yards, paring bays, Weigh stations Movement of livestock, machinery, containers and other goods from intra and interstate yards could contain new pest plants and animals. Examples of Trucking depots include Scotts, Kalari, We Us & Co, Bordertown Haulage, Webb Haulage, Trans Australian, Toll as well as numerous other stock and cargo carriers. Parking bays and Weigh stations Most are located along major roads and highways, include tourist stops and points of interest, ad hoc and permanent parking areas, these are should be inspected in conjunction with road	Availability of wash down/ decontamination points Access to container loading/ unloading/ holding areas Pest reporting procedure to be developed Awareness and educations material where have you been, what are you carrying, disposal Awareness materials and signage Education where have you been? DTEI awareness	Supply of Disposal bins Closing opportunistic parking areas Ensure parking areas and depots are free of pest plants Flagging of machinery from suspect areas. Pest reporting procedure to be developed.	Burr weeds eg Noogoora burr, Bathurst burr, Caltrop , Three corner jack, Khaki weed Grass weeds on sites eg Chilean needle grass, Serrated tussock Pest eg cane toads, Indian myna	SE NRM inspection of parking sites along main thoroughfares twice (Summer/ Winter) per year. SE NRMB inspection of weigh stations and surrounds once per year combine with road verge inspections. Other depot as and yards areas should be inspected on annual basis by the landholder or contractors as a part of site management. Liaison between NRM authority and landholder / managers should occur on a regular basis, minimum of once	Industry Report of any pests eg cane toads Undertake control Maintain records. reduce opportunistic parking areas Decontamination protocols implemented Maintain pest plant free depots and yards. SE NRMB Inspection Follow-up on machinery from suspect areas if required. Awareness material preparation and identification and decontamination workshops delivered. Pest reporting procedure developed and communicated to relevant parties.

Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
	inspections.				every three years. Awareness material of primary pest plants and pest animals should be produced. Pest reporting procedure should be developed. Decontamination protocol should be developed if applicable. Decontamination workshops Plant identification workshops	
Marinas	Introduction of new plants from boat trailers Marinas both commercial and private are located at Robe, Beachport, and Kingston.	Awareness materials and signage Education what could they be moving Wash down/ decontamination	Pest reporting procedure to be developed Disposal bins Disposal of bilge water	Aquatic weeds eg Cabomba Salvinia. Aquatic pests eg carp, oriental weather loach	SE NRM Inspection of wash down/ decontamination catchment cages / bins as required Awareness	Industry & Public Reporting Comply with disposal and decontamination protocols. SE NRMB

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Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
		Pest reporting procedure			material of primary pest plants and pest animals be produced. Pest reporting procedure developed and implemented.. Decontamination / waste disposal protocol and facilities developed and implemented if applicable.	Inspection Awareness material preparation Pest reporting procedure developed and communicated to relevant parties.
Ports	Portland	Wash down/ decontamination points Container loading/ unloading/ holding areas Awareness material Education what could they be moving AQIS/ SENRM liaison	Pest reporting procedure Access to container loading/ unloading/ holding areas, may require training Disposal of bilge water and waste	Burr weeds eg Noogoora burr, Bathurst burr, Caltrop , Three corner jack, Khaki weed Grass weeds on sites eg Chilean needle grass, Serrated tussock Pest eg Cane toads, Indian	As above Liaise with AQIS, industry regarding potential pest incursion and reporting.	Industry Reporting of pest sighting Undertake control SE NRMB Awareness material preparation Pest reporting procedure developed and communicated to relevant parties.

Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
				myna		
Recreational boating industry	Numerous boat ramps are accessible to the public	Awareness materials and signage

Adequate wash down/ decontamination sites and information

Pest reporting procedure | Pest reporting procedure

Disposal bins

Large number of defined and undefined (private) boat ramps

Disposal of waste, live baits, mussels, cockles, live bait etc | Aquatic weeds eg Cabomba Salvinia.

Aquatic pests eg carp, oriental weather loach, Tilapia | Inspection of wash down/ decontamination catchment cages / bins as required

Awareness material of primary pest plants and pest animals is produced.

Pest reporting procedure developed and implemented.

Decontamination / waste disposal protocol and facilities developed and implemented if applicable. | Industry & Public Reporting Comply with decontamination and waste disposal protocol.

SE NRMB Inspection Awareness material preparation Pest reporting procedure developed and communicated to relevant parties. |
| Airports & airfields | Commercial, private and public airfields can be found at Mount Gambier, Bordertown, Naracoorte and Tintinara. | Awareness materials and signage AQIS liaison | Restricted access to airfields, training required

Pest reporting procedure | All vertebrate and plant pests | Awareness material of primary pest plants and pest animals be developed and distributed. | Industry Reporting Undertake control

SE NRMB Liaison with appropriate |

Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
			Disposal bins		Liaise with other government agencies eg AQIS, Biosecurity SA. Pest reporting procedure developed and implemented. Decontamination / waste disposal protocol developed and implemented if applicable.	authorities Awareness material preparation Pest reporting procedure developed and communicated to relevant parties
Environmental pathways						
Natural plant and animal dispersal	The movement of deer, feral pigs, wild dog/ dingo, Indian myna etc is difficult to prevent. Pest plant propagules are	Awareness materials and signage Education – which weeds, fish Tilapia ?, Pest reporting procedure	Access to all areas, limited resources large areas Known pest	Aquatic weeds: Cabomba, Glush weed, Salvinia, Water hyacinth.	Inspection once per year or after heavy rainfall events, water watch volunteers may aid in	Industry Reporting Undertake control Public Reporting

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Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
	transported via rivers, creeks , drains usually through flood and heavy rainfall events. Cooperation between public and private land mangers is required to implement an effective management plan to minimise the spread of these animals and plants.	Pest locations Natural dispersal	locations Spotters networks	Aquatic vertebrate pests eg Cane toad, Oriental weather loach, Gambusia, Red eared slider, Tilapia.	inspection. Pest management along corridors, baiting, traps etc. Liaise with landholders managers and public about what they should be alert for. Awareness material of primary pest plants and pest animals be developed and distributed. Pest reporting procedure developed and implemented. Weed id training for volunteers eg water watch, "Friends" groups	SENRMB Inspection Awareness material preparation Pest reporting procedure developed and communicated to relevant parties Identification and information sessions about biosecurity issues.
Tourism pathways						
Tourist sites	Locations include	Awareness material	Decontamination	Pest plants,	Inspection of	Industry

Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
	National parks eg Coorong, Ngarkat, Conservation parks Mt Monster, Little Dip, Canunda, Blue lake reserve , Picaninee ponds, public access forestry areas and other heritage/cultural sites.	and signage

Decontamination sites and procedures

Pest reporting procedure | site established at main entry and exit points.

Weed id training for DEH, Friends groups, Bush care

Adequate disposal and decontamination facilities

Unrestricted camping areas | grass weeds, environmental weeds, burr weeds

Pest animals eg deer, wild dogs, rabbits

Viruses eg phytophera | camping ground on regular basis

Liaise with landholders and managers to develop awareness material of primary pest plants and pest animals.

Decontamination / waste disposal protocol developed and facilities implemented if applicable.

Pest reporting procedure developed and implemented. | Reporting, inspection, undertake control. Ensure facilities for disposal and decontamination are available.

Public Follow procedures, reporting.

SENRMB Inspection Awareness material preparation Pest reporting procedure developed and communicated to relevant parties |
| Open access camping sites | Caravan parks, tourist parks Numerous sites are located throughout the region. | Awareness material and signage

Decontamination and wash down procedures

Pest reporting | Disposal bins

Decontamination / wash down site established | Burr weeds eg Noogoora burr, Bathurst burr, Caltrop, Three corner jack, Khaki weed, Innocent weed | Inspection and control should be undertaken by the site manager

Liaise with landholders and managers about | Industry Reporting , undertake control

Public Follow procedures, reporting |

Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
		procedure		Grass weeds on sites eg Chilean needle grass, Serrated tussock,	what they should be alert for. Awareness material of primary pest plants and pest animals be developed and distributed. Decontamination / waste disposal protocol developed and facilities implemented if applicable. Pest reporting procedure developed and implemented.	SENRMB Inspection Awareness material preparation Pest reporting procedure developed and communicated to relevant parties
Industry & Trade pathways						
Produce processors, wholesalers		Awareness material Disposal procedures Disposal of material, waste water Decontamination and wash down procedures Wash down of equipment bins etc	Availability of disposal and decontamination equipment and procedures	Pest animals, Cane toads, other non endemic species Invertebrates	Inspection by SENRM upon request, random spot Inspection of disposal bins/sites. . Records/log kept	Industry Reporting , Undertake control when required Maintain records to enable tracing of products SE NRMB Inspection

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Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
					of goods received and dispatched, areas travelled, etc this aids in tracing should a new incursion occur. Decontamination / waste disposal protocol developed and facilities implemented if applicable. Pest reporting procedure developed and implemented. Development a vendor declaration system.	Awareness material preparation Pest reporting procedure developed and communicated to relevant parties
Saleyards	Saleyards are located at Naracoorte, Keith and Mount Gambier, suggested actions are described above.	Awareness and signage Where have they come from, where are they going to What should we be looking for	Availability of disposal and decontamination equipment and procedures Weed	Burr weeds eg Noogoora burr, Bathurst burr, Caltrop , Three corner jack, Khaki weed	SENRM annual site inspection. Follow-up on stock containing pest plants Maintenance	Industry Reporting, Undertake site control to ensure pest plant free. Comply with decontamination

Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
		Decontamination and wash down procedures Vendor declaration process Industry standard for process for purchase and selling of stock Pest reporting procedure	identification training for stock agents and vendors	Grass weeds on sites eg Chilean needle grass, Serrated tussock	weed free area Pest reporting procedure developed and communicated to relevant parties Identification and information sessions about biosecurity issues	and disposal protocols Vendors Declaration of stock , emptying out prior to transport, holding paddocks after purchase, reporting SE NRMB Awareness material preparation Pest reporting procedure developed and communicated to relevant parties Identification and information sessions about biosecurity issues Training course provider
Wash down sites	Numerous commercial and private facilities exist across the region.	Awareness and signage Decontamination and wash down procedures Where	If public utilised facility then difficult to track users.	All pest plants	Decontamination / waste disposal protocol developed and facilities implemented if	Industry Correct disposal of catchment cage material SE NRMB

Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
		does the material go? How disposed of.?			applicable. Pest reporting procedure developed and implemented.	Awareness material preparation Pest reporting procedure developed and communicated to relevant parties
Quarries and waste depots and transfer stations	Includes local government and private quarries as well as bulk material suppliers eg landscape supplies, compost.	Awareness material Decontamination and wash down procedures Pest reporting procedure Existing pest plant locations	Quick reference material in lunch rooms Decontamination policy enforced by company Wash down sites established at main entrance/exit points Buffers to prevent entry and escape of wind borne seed	All pest plants	SENRM assist with pre & post inspections and annual site inspection if required Should maintain logs/records of where goods came from and going to. Pre quarry open inspection, When opening a new quarry, the top 100 mm of soil should be removed and placed aside for site rehabilitation and minimise pest plant seeds in quarried	Industry Adhere to decontamination protocol Undertake control, maintain buffers Reporting Site maintenance Defined traffic areas Decontaminate before entering site Site restoration Wash down points monitored Removal and storage of topsoil SE NRMB Inspection and tracing Awareness material preparation

Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
					material Site management should ensure no pest plants are seeding on site Awareness material should be provided on a yearly basis. Pest reporting procedure should be developed and implemented. Decontamination / waste disposal protocol developed and facilities implemented if applicable.	Pest reporting procedure developed and communicated to relevant parties
Earthmoving contractors		Number of operators in SE Awareness material Decontamination and	Wash down sites established at main entrance/exit points GPS marked for future	All pest plants	As required Suggested Actions Awareness material should be provided on a	Industry Adhere to decontamination protocol Maintain records of areas travelled

Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
		wash down procedures Pest reporting procedure	reference Decontamination procedures, decontamination log		yearly basis. Pest reporting procedure should be developed and implemented. Decontamination / waste disposal protocol developed and facilities implemented if applicable.	Covering loads SE NRMB Awareness material preparation Pest reporting procedure developed and communicated to relevant parties Identification and information sessions about biosecurity issues.
Agronomists/ crop inspectors / Livestock agents	Companies include Elders, Landmark, S.A.L, Cunninghams, PPHS	Large number of operators in the SE Awareness material Decontamination and wash down procedures for person and vehicle Pest reporting procedure Vendor declaration	Wash down sites established at main entrance/exit points GPS marked for future reference Travel on defined roadways and tracks	All pest plants	Awareness material should be provided on a yearly basis. Pest reporting procedure should be developed and implemented. Decontamination / waste disposal protocol developed and facilities implemented if applicable.	Industry Ensure vendor adhere to industry best practice for sale of machinery / stock eg wash down / empty out prior to movement of property and into holding are a Decontaminate before enter properties. SE NRMB Awareness material preparation Pest reporting

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Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
					Liaise with industry to establish a vendor declaration system.	procedure developed and communicated to relevant parties Identification and information sessions about biosecurity issues.
Contractors	hay making, harvesting spraying	Large number of contractors in SE Decontamination and wash down procedures before entry and before leave Location of existing pest plant populations Pest reporting procedure Disposal of waste material Maintain log of movement	Utilise wash/ blow down sites established at main entrance/exit points GPS marked for future reference Disposal of waste material Travel on defined roadways and tracks	All pest plants	Awareness material should be provided on a yearly basis. Maintain records of areas travelled for tracing purposes Pest reporting procedure should be developed and implemented. Decontamination / waste disposal protocol developed and facilities implemented if applicable.	Industry Reporting Adhere to decontamination protocol Maintain records SE NRMB Preparation of awareness material Pest reporting procedure developed and communicated to relevant parties
Shearers		Large number of contractors in SE	Quick reference guide to pest	Burr weeds eg Noogoora burr,	Awareness material should	Industry Reporting

Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
		Awareness material to be developed	plant seeds/ burrs Decontamination and wash down procedures personal, vehicle, dog, equipment Pest reporting procedure Disposal of waste material	Bathurst burr, Caltrop , Three corner jack, Khaki weed, Horehound Grass weeds on sites eg Chilean needle grass, Serrated tussock	be provided on a yearly basis. Pest reporting procedure should be developed and implemented. Decontamination / waste disposal protocol developed and facilities implemented if applicable.	Decontamination between properties SE NRMB Follow up of reports Preparation of extension material Pest reporting procedure developed and communicated to relevant parties
Apiarists	SA Apiarists Association (SAAA) – SE Branch	Awareness material Decontamination and wash down procedures Pest reporting procedure Disposal of material Maintain logs of movements	Intra and interstate movements often conducted at night. Utilise wash/ blow down sites established at main entrance/exit points GPS marked for future reference Utilise defined tracks and	All pest plants Soil borne diseases Apiary diseases eg Small hive beetle from Vic Certificates required	Liaison with the South Australian Apiarist Association (SAAA) re weed and disease movement. Travel to/from commercial and non commercial properties including native vegetation areas. Clean off dirt on bottom of pallets/	Industry Adhere to decontamination protocol Report any new incursions Maintain log of movement SE NRMB Liaise with industry regarding biosecurity issues. Preparation of awareness material Pest reporting

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Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
			roadways Decontamination before leave or enter a new site dirt/ burrs etc on underside of pallets, on tyres		bee boxes/ water drums, brush off before leave site. Disinfecting water drums, pallets and bee boxes to stop spread of diseases eg phytophera, use of plastic pallets to aid in cleaning. Decontamination / waste disposal protocol developed and facilities implemented if applicable. Pest reporting procedure developed and communicated to relevant parties	procedure developed and communicated to relevant parties Vic DPI and PIRSA Hive & equipment inspections and certificates
Distributors of seed hay and fodder products	Processors include Keith Seeds, Tatiara Seeds, Grosser Pty Ltd		Responsible disposal of waste/ offal. Numerous source of	All pest plants	Liaise with relevant company regarding records, decontamination	Industry Reporting Responsible disposal of offal/ waste Vendor

Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
			material including international.		and disposal of waste material. Awareness material should be provided on a yearly basis. Pest reporting procedure should be developed and implemented. Decontamination / waste disposal protocol developed and facilities implemented if applicable.	declarations Maintain records for tracing purposes SE NRMB Follow up on reports Trace forward and back if required Pest reporting procedure developed and communicated to relevant parties
Consumer pathways						
Town markets, field days, shows	Lucindale field day Horsham field day Local shows and markets Garage sales, Clearance sales	Awareness material What does your garden grow Plant this instead Education are you selling something you shouldn't, reporting who to Pest reporting procedure	Disposal bins Markets often outside of normal working hours making inspection difficult.	All pest plants including aquatics pests Pest animals including, gambusia, oriental weather loach, rabbits, Barbary doves,	Random inspection of markets Educational displays Display's at key local events eg Lucindale field days, Horsham field days	Public Awareness & reporting SE NRMB Inspection Preparation of awareness material

Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
				red eared sliders, mallards	Awareness material should be provided each year Pest reporting procedure should be developed and implemented.	
Plant sellers	Nurseries	Awareness material Education – plant me instead, reporting of sightings Pest reporting procedure Disposal procedure Maintain logs of suppliers and customers	Training for industry in plant id Promotion of grow me instead brochures Disposal of waste	All pest plants including aquatics Pest animals –reptiles, invertebrates	Random inspection on annual basis Pest reporting procedure should be developed and implemented. Liaise with nurseries and plant sellers on regular basis	Nursery& plant seller/ distributor grower/ importer Reporting Awareness of what they are selling. Maintain record of suppliers SE NRMB Inspection Liaise with nursery industry on regular basis. Preparation of awareness material Pest reporting procedure developed and communicated to

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Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
						relevant parties
Landscape supplies		Awareness material Pest reporting procedure Maintain logs of supplier Where are you getting material from, Supplier declarations for hay/soil/ mulch etc	Supplier declarations	All pest plants including aquatics Pest animals –reptiles, invertebrates	Random site inspection on annual basis Maintain logs of suppliers Pest reporting procedure should be developed and implemented.	Industry Maintain logs, covering loads, wash down protocol, reporting SE NRMB Inspection Preparation of awareness material Pest reporting procedure developed and communicated to relevant parties
Pet shops		Awareness material Pest reporting procedure Disposal procedure	Training for industry in plant id and pest id High turn over of product	Aquatic pest plants eg Salvinia, Cabomba, Arrowhead Aquatic pests eg red eared slider, cane toads Other declared vertebrate pests eg wild	Random site inspection on annual basis Maintain logs of suppliers Pest reporting procedure should be developed and implemented.	Industry Maintain logs, reporting. Accredited suppliers SE NRMB Inspection Preparation of awareness material Pest reporting procedure developed and

Pathway	Description	Gaps/ information	Operational Issues	What pests are likely to be found?	Actions	Who's role for action
				rabbits, Indian myna, mallards.		communicated to relevant parties

5. PATHWAYS MANAGEMENT ACTIONS

Actions described for each the pathways fall into 7 common categories;
- Inspection/surveillance
- Pest reporting
- Decontamination protocol and procedures
- Disposal protocol and procedures
- Maintaining accurate logs/records
- Vendor declaration
- Education.

Each action may be utilised in the formation of regional work plans targeting specific pests e.g. rabbits, foxes, Mexican feather grass, groups of pests e.g. burry weeds, grass weeds, terrestrial vertebrates, aquatic vertebrates, or a specific issue e.g. decontamination, inspection.

5.1 INSPECTIONS/ SURVEILLANCE

Inspections wether conducted by NRM authorised officer, industry workers eg agronomists, contractors, landholder and members of the public will aid in the early detection of new pest plants and pests.
Biannual inspections (summer and winter) enable most pest plants and animal incursions to be detected in their early stages.

5.2 PEST REPORTING PROCEDURE

Any reporting procedure which is developed should be accessible via a variety of avenues eg face to face, phone, web, and mail. Initial reporting of an incursion may be experienced by numerous agencies or industries eg local veterinary practice, local agronomist, local stock agents, Regional Natural Resource Management Boards, Groups and staff, PIRSA, DWLBC, Local government or even by the new farm biosecurity initiative http://www.farmbiosecurity.com.au/ developed by the federal government.

The principal contacts for biosecurity concerns or reporting of incursions, should be made known at multiple levels, a series of actions should be undertaken at each level dependent on the incursion. The SE NRMB is the appropriate body to receive the initial reporting of pest plant and animals incursions. However their networks allow collaboration with other government agencies and industry bodies which could see them take on a wider incursion response role.

National Biosecurity plan and response, Plant Health Plan, Animal Health Plan (AUSVET Plan), State incursion response plans all need to be considered if a new incursion is reported.

5.3 DECONTAMINATION PROCEDURE AND PROTOCOL

Decontamination equipment can be mobile or permanent sites, cost recovery (coin operated) or supported/sponsored by industry or organisation.
The frequency of required decontamination is dependent on numerous variable including locations travelled, type of cargo, type of equipment or product eg slasher, earthmoving or vehicles.
Each piece of equipment or product has its own specific decontamination requirements including;
- type of decontamination required (water, air, steam, heat).
- accumulation points generally there is a focus upon radiators, grills, ledges, wheels and wheel arches, behind guards eg sump guards, pto guards, dirt accumulation on tynes/rippers/buckets, Interior of vehicles including floor mats, carpets etc.
- in some instance the use of chemicals, disinfectants is required to destroy seed and diseases eg Niproquat®, bleach, methylated spirits, methyl bromide, phospine gas etc
- Confinement of livestock to one paddock upon receiving

All decontamination points should be recorded and monitored for the presence of pest plants

5.4   DISPOSAL

Disposal of waste material can be achieved by many means;

- Deep burial - Sighting, lining, depth and holding quantity of disposal pit will be dependent on the biosecurity incursion. May need to liaise with EPA
- Burning – Type of burning method (simple heap, specific temp, fast/ slow burn, pyres) will be dependent on the biosecurity incursion. Liaison with agencies like CFS, EPA and Bureau of Meteorology will aid in addressing issues like size, sighting, burn type.
- Heat treatment.- may be utilised where a viable product can be retained eg heat treatment of grain for turning into fodder products may destroy the incursion will still being able to recoup some financial output,
- Irradiation/solarisation.

5.5   LOGS/ RECORDS

The maintenance of logs and records aids in tracing movement of machinery and materials, in some instances it maybe a legislative requirement.
There is a wide variety of forms are available, examples can be viewed at
http://www.farmbiosecurity.com.au/

5.6   VENDOR DECLARATION

The development of a voluntary vendor declaration system has been discussed for many years and achieving consensus on a way forward is difficult. Ultimately it will need to be consumer driven and will have advantages and disadvantages for every industry but it must have industry wide support and uptake to be viable. NRM Act and regulations do allow, vendor declaration process to be established, but as yet no viable process has been developed.
Examples of vendor declaration forms be sourced from http://www.farmbiosecurity.com.au/
The system can be applied to almost any product or service including hay/ fodder, livestock, seed, soil, mulch, and machinery.

5.7   EDUCATION

The development and distribution of educational and awareness material is crucial to help all aspects of society understanding why biosecurity should and does concern them. There is a variety of media and delivery mechanism for material including printed material, displays, face to face communication, radio, television internet. The material should aid in answering question like;
What should we be looking for?
What have we already got and where is it?
I've found something, who do I report it to?

APPENDIX 1

1.   Spatial Representation of Biosecurity Pathways

In order to spatially describe and analyse biosecurity pathways in the South East, a number of potential high risk vectors and land uses were represented in a geographic information system (GIS) by readily available spatial layers. Seven spatial layers were derived, and their details and intermediate analysis are described in Table 1.

Table 1 – Spatial layers representing biosecurity pathways used in GIS analysis.

	LAYER	DESCRIPTION	SOURCE	ANALYSIS
Point Features (Transport / Recreation)				
1.	se_point_features_merge	Point features representing boat ramps and an intermodal transport site in Bordertown (rail/road transfer)	Boat ramps extracted from 1:50,000 topographic data (TOPIS 50K, 2006, DEH) Intermodal sites (2009) from DTEI	Point feature buffered by 20 metres
Line Features (Transport / Utilities)				
2.	se_rd_centrelines	Road centrelines data	Extracted from 1:50,000 data (current, DEH)	Buffered by 20 metres
3.	se_rd_gazetted	Gazetted routes for restricted access vehicles; BDouble, Higher Mass Limits (Single Semi Trailer), and Road Trains	Extracted from DTEI data (2009)	Buffered by 20 metres There is spatial overlap between road centreline features and gazetted road train features
4.	se_railways_50k		Extracted from 1:50,000 topographic data (TOPIS 50K, 2006, DEH)	Buffered by 20 metres

5.	se_powerlines_250k 	Major powerlines	Extracted from 1:250,000 topographic data (TOPO 250K, 2003, GeoScience Australia)	Buffered by 10 metres
6.	se_drains_enrims 	Drains in the South East	e-NRIMS (DWLBC)	Buffered by 20 metres
Polygon Features (Landuse)				
7.	se_poly_features_merge 	Polygon features representing high risk landuses (see Table 3), marinas, and built-up areas	Landuse parcels extracted from DCDB (2008, DEH) Built-up areas and marinas extracted from 1:50,000 topographic data (TOPIS 50K, 2006, DEH)	

2. Potential Cumulative Influence of Pathways & Cluster Analysis

In an effort to highlight areas of greater pest incursion risk compared with the rest of the surrounding landscape, an overlay analysis was used to find where biosecurity pathways spatial data layers intersected.

The seven pathway datasets (point, line and polygon) were converted into raster[1] layers with a grid size of 20 metres. Cells representing polygon features were given a value of one. The seven layers were overlaid in a sum calculation; the resultant raster layer's cell values equalling the sum of overlapping cell values. The raster was then converted into a polygon feature class, *pathways_sum7_poly*, each polygon possessing a value between 0 and 7 representing the number of overlapping biosecurity pathways in that location. The highest polygon value was 4 (four overlapping pathways), which was attributed to 49 polygons in the mid-lower South East.

A spatial statistics tool, cluster analysis, was used to identify where high values cluster spatially. The analysis output is a Local Moran's I index value, Z score, P-value and cluster type code for each feature.

The Z scores and p-values are measures of statistical significance indicating whether the similarity or dissimilarity in values for a feature and its neighbours is greater than one would expect in a random distribution. A high positive Z score for a feature indicates that the surrounding features have similar values. Finally, the cluster type code indicates HH for a statistically significant (0.05 level) cluster of high values.

The output confirmed that 49 polygons with the highest value of 4 (where there are four intersecting pathways, see Table 2), and 2,397 polygons with the second highest value of 3 were significantly clustered (cluster type code = HH). These polygons are represented as polygon centroids[2] in the following map.

Table 2 – Description of sites with significantly clustered pest incursion values of 4 (four intersecting pathways) in the mid-lower South East.

SITE DESCRIPTION	INTERSECTING PATHWAYS
Populated place:	
Naracoorte	Intersection of rail, roads and built-up areas
Kybybolite	Intersection of rail, roads and built-up areas
South End	Intersection of drains, roads and built-up areas
Millicent	Intersection of landuse/built-up areas, railway, roads and drains
Mount Gambier	Intersection of landuse/built-up areas, railway, and roads
Other:	
8km W of Penola	Intersection of powerlines and roads
6km N of Furner on the Robe-Penola Road	Intersection of powerlines, roads, and drains
1km NW and 4km SW of Tantanoola	Intersection of powerlines, roads, rail, and drains

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[1] Raster datasets represent geographic features as cells laid out in a grid. Each cell has a value that is used to represent some characteristic of that location.
[2] Centre point of polygon.

Table 3 – Landuse codes extracted from 2008 DCDB representing high incursion risk landuse.

LANDUSE CODE	LANDUSE DESCRIPTION	VG_LAND_US	LG_LAND_US
2000	Light Industry	Wholesale Trade	Commercial - Other
2030	Residential	Wholesale Trade - Timber And Other Building Materials	Commercial - Other
2650	Commercial	Farm Products, Warehousing Storage And Silos (Excl. Stockyards)	Commercial - Other
2650	Community Use	Farm Products, Warehousing Storage And Silos (Excl. Stockyards)	Commercial - Other
2650	District Centre	Farm Products, Warehousing Storage And Silos (Excl. Stockyards)	Commercial - Other
2650	Excluded From Zoning	Farm Products, Warehousing Storage And Silos (Excl. Stockyards)	Commercial - Other
2650	General Farming	Farm Products, Warehousing Storage And Silos (Excl. Stockyards)	Commercial - Other
2650	Industrial	Farm Products, Warehousing Storage And Silos (Excl. Stockyards)	Commercial - Other
2650	Light Industry	Farm Products, Warehousing Storage And Silos (Excl. Stockyards)	Commercial - Other
2650	Residential	Farm Products, Warehousing Storage And Silos (Excl. Stockyards)	Commercial - Other
2651	General Farming	Silo - Concrete Cells	Commercial - Other
2652	General Farming	Silo - Steel Cells	Commercial - Other
2653	General Farming	Silo - Horizontal Bins	Commercial - Other
2654	Conservation	Silo - Temporary Storage	Commercial - Other
2654	General Industry	Silo - Temporary Storage	Commercial - Other
2660	District Centre	Stockyard Services	Commercial - Other
2660	General Farming	Stockyard Services	Commercial - Other
2660	General Industry	Stockyard Services	Commercial - Other
2660	Light Industry	Stockyard Services	Commercial - Other
2660	Residential	Stockyard Services	Commercial - Other
2660	Rural	Stockyard Services	Commercial - Other
2661	Conservation	Stockyard Services - Horses	Commercial - Other
2662	Horticulture	Stockyard Services - Stables	Commercial - Other
2665	Business	Stock Agent's Office	Commercial - Other
2665	District Centre	Stock Agent's Office	Commercial - Other
2665	Residential 1	Stock Agent's Office	Commercial - Other
2665	Tourist Commercial	Stock Agent's Office	Commercial - Other
2669	Residential	Saddlery, Riding Outfitters	Commercial - Other
3110	General Farming	Food Manufacturing	Industry - Other
6210	Coastal	Water Pipeline Right Of Way (Exclusive Use Of Land)	Other
6210	Country Township	Water Pipeline Right Of Way (Exclusive Use Of Land)	Other
6210	General Farming	Water Pipeline Right Of Way (Exclusive Use Of Land)	Other
6430	Business	Railway Terminal Facilities (Passenger)	Other
6440	General Farming	Railway Terminal Facilities (Freight)	Other
6450	Horticulture	Railway Equipment And Maintenance	Other
6540	Commercial	Truck Freight Terminal	Industry - Other
6540	Home Industry	Truck Freight Terminal	Industry - Other
6540	Industrial	Truck Freight Terminal	Industry - Other
6540	Light Industry	Truck Freight Terminal	Industry - Other
6540	Residential	Truck Freight Terminal	Industry - Other
6550	Commercial	Truck Freight Garaging And Equipment Maintenance	Industry - Other
6550	General Industry	Truck Freight Garaging And Equipment Maintenance	Industry - Other
6550	Industrial	Truck Freight Garaging And Equipment Maintenance	Industry - Other
6550	Light Industry	Truck Freight Garaging And Equipment Maintenance	Industry - Other

		Maintenance	
6550	Residential	Truck Freight Garaging And Equipment Maintenance	Industry - Other
6550	Tourist Commercial	Truck Freight Garaging And Equipment Maintenance	Industry - Other
6560	Commercial	Removal, Haulage, Carting And Carrying	Industry - Other
6560	Residential	Removal, Haulage, Carting And Carrying	Industry - Other
6610	Coastal	Airport	Industry - Other
6610	Community Use	Airport	Industry - Other
6610	Country Township	Airport	Industry - Other
6610	District Centre	Airport	Industry - Other
6610	General Farming	Airport	Industry - Other
6660	Residential	Wharves (Including Storage)	Industry - Other
6660	Rural	Wharves (Including Storage)	Industry - Other
6662	Residential	Boat Ramp	Industry - Other
7510	Coastal	Camping And/Or Caravaning	Commercial - Other
7510	Commercial	Camping And/Or Caravaning	Commercial - Other
7510	Community Use	Camping And/Or Caravaning	Commercial - Other
7510	Conservation	Camping And/Or Caravaning	Commercial - Other
7510	Country Living	Camping And/Or Caravaning	Commercial - Other
7510	Country Township	Camping And/Or Caravaning	Commercial - Other
7510	General Farming	Camping And/Or Caravaning	Commercial - Other
7510	Horticulture	Camping And/Or Caravaning	Commercial - Other
7510	Landscape	Camping And/Or Caravaning	Commercial - Other
7510	Residential	Camping And/Or Caravaning	Commercial - Other
7510	Tourist Commercial	Camping And/Or Caravaning	Commercial - Other
8100	Horticulture	Metals	Industry - Other
8114	General Farming	Base Metals - Abandoned Workings	Industry - Other
8230	General Farming	Dimension Stone	Industry - Other
8230	Horticulture	Dimension Stone	Industry - Other
8232	General Farming	Dimension Stone - Open Workings	Industry - Other
8232	Horticulture	Dimension Stone - Open Workings	Industry - Other
8240	General Farming	Crushed Stone	Industry - Other
8240	Residential	Crushed Stone	Industry - Other
8242	General Farming	Crushed Stone - Open Workings	Industry - Other
8242	Horticulture	Crushed Stone - Open Workings	Industry - Other
8242	Rural	Crushed Stone - Open Workings	Industry - Other
8250	Coastal	Sand And Gravel	Industry - Other
8250	Commercial	Sand And Gravel	Industry - Other
8250	General Farming	Sand And Gravel	Industry - Other
8250	Residential	Sand And Gravel	Industry - Other
8252	Country Township	Sand And Gravel - Open Workings	Industry - Other
8252	Residential	Sand And Gravel - Open Workings	Industry - Other
8252	Rural	Sand And Gravel - Open Workings	Industry - Other
8259	Industrial	Sand And Gravel - Secondary Industry Is Primary Production And Is Viable In Itself Or With Other Landowned And Used By The Same Owner	Industry - Other
8292	Coastal	Non-Metals N.E.C. - Open Workings	Industry - Other
8320	Country Township	Gas	Industry - Other
9930	Coastal	Nursery (Plants)	Primary Production
9930	Commercial	Nursery (Plants)	Primary Production
9930	General Industry	Nursery (Plants)	Primary Production
9930	Residential	Nursery (Plants)	Primary Production