Wyndgate Property

Revegetation Site Assessments 2015,

and Recommendations for Future Restoration Works





Department of Environment, Water and Natural Resources



Introduction

The Wyndgate property was purchased by the State Government, with funding support from the Federal Governments Natural Heritage Trust, National Reserves System Program, in 2001. The property is managed by Natural Resources, SA Murray Darling Basin Region, Ranges to River District.

Extensive revegetation works have been undertaken on the property since 2003. The Hindmarsh Island Landcare Group and the Department of Environment, Water and Natural Resources have been the driving force behind these revegetation works. Revegetation works funding has been sourced through several Federal Government funding initiatives including the River Murray Forest Program and the Coorong Lower Lakes and Murray Mouth Restoration Project. The community has contributed significant in-kind resources to the revegetation program.

In 2015 a cooperative project between the CLLMM Vegetation Program, and Natural Resources, SA Murray-Darling Basin Region was undertaken to develop a Wyndgate Plan. During the development process it was identified that information about the current status of the major revegetation sites on the property was incomplete.

To better understand the current status of these revegetation sites and what further revegetation planting is required at them, this assessment and report was undertaken. Funding for this project was provided by the Coorong Lower Lakes Murray Mouth (CLLMM) Vegetation Program, part of the Coorong, Lower Lakes and Murray Mouth Recovery Project, funded by the South Australian Government's Murray Futures program and the Australian Government.

The report provides details of the current status of each major revegetation site and makes recommendations for further revegetation planting and site maintenance.

The report will provide an important planning tool for Wyndgate managers and revegetation planners for the future as they continue to restore natural ecosystems on the property.

Revegetation Assessment Sites:	Slade Paddock
	Shadows Paddock
	Shadows West
	Mundoo Paddock
	Greys Paddock
	Hunters Creek above Denver Road
	Waynes World
	Homestead



Map 1. Wyndgate Property - Location Map

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Wyndgate Property Revegetation Site Assessment

Site Name: Slade Paddock

Location: Wyndgate

Site surveys completed: November 2015

Assessment submitted: November 2015

Author

Catherine Miles (Miles Environmental Consulting)



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Disclaimer

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Acknowledgements

Chris Butcher (DEWNR), Mark Phillips (DEWNR), Richard Owen (Hindmarsh Island Landcare Group), Bill New (New Environmental), Stuart Hicks (DEWNR)

Document review

DEWNR – November 2015

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2. PLAN DETAILS

Table 1: Contact details relevant to this plan

PlanID: Plan Name	Slade Paddock
SiteID: Site Name	Slade Paddock
Landholder &/or Manager	Stuart Hicks
Landholder Contact	Mobile: 0428 168 626
Size of planting area	5.21 hectares
Planning Contact	Chris Butcher: 0457 509 154 or chris.butcher@sa.gov.au
Ops Contact	Mark Phillips: 0427 192 060 or Email: Mark.Phillips4@sa.gov.au

2.1 PLAN OVERVIEW

2.1.1 Access

The site can be accessed on the eastern side from Murray Mouth Road via an unlocked gate into a raceway. The revegetation is fenced into two blocks (eastern and western, see map), each of which is dissected by the channel. Whilst there are a number of gates into the revegetation areas, the density of the vegetation and the channel prevent vehicle access into much of the site, and therefore access to the majority of the area is by foot only.

2.1.2 Landuse

The site is part of the Wyndgate property which is used for conservation and cattle grazing. The restoration site has been fenced from stock and progressively revegetated over a number of years, with the oldest plantings being the *Melaleuca halmaturorum* plantings along the perimeter of the samphire zones.

2.1.1 Site mapping

Mapping of ecosystem polygons for the site was developed from on ground mapping of landscape features and ecosystems present, both natural and planted. Further consideration of ecosystem types was developed using the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te).

3. MAP OF THE SITE SHOWING ECOSYSTEM POLYGONS



Map 1: Slade Paddock site boundary with ecosystem polygons

4. ECOSYSTEM DESCRIPTIONS

Table 2: Ecosystems found at Slade Paddock

Polygon	Total hectares	Species	Notes	
W204	0.27	Bolboschoenus caldwellii sedgeland over Distichlis	Artificial channel, all species occurring naturally	
W207	0.36	[–] distichophylla, Mimulus repens and Samolus repens	Artificial channel, all species occurring naturally	
W220	0.33	Tectocornia pergranulata, Sarcocornia sp., Threlkeldia diffusa, Frankenia pauciflora, Puccinelia stricta	Plantings of additional samphire shrubland species	
W203	0.03	Tecticornia pergranulata, Melaleuca lanceolata, Threlkeldia diffusa	Melelaleuca lanceolatas have been planted	
W208	0.25	Tectocornia pergranulata, Sarcocornia sp., Threlkeldia	Dense samphire, predominantly unplanted	
W201	1.19	diffusa, Frankenia pauciflora, Puccinelia stricta		
W214	0.04	_		
W221	0.34			
W202	0.68			
W213	0.02	Tectocornia pergranulata, Sarcocornia sp., Threlkeldia	Small areas of slightly higher ground, unplanted;	
W214	0.03	diffusa, Suada australis, introduced annual grasses	greater prevalence of introduced annual grasses	
W209	0.07	_		
W210	0.03	_		
W211	0.03	_		
W212	0.03			
W205	0.25	_ Melaleuca halmaturorum over introduced annual grasses	Established (> 5 years old) plantings	
W206	0.28	and Enchylaena tomentosa _		
W215	0.27	_		
W216	0.03	_		
W217	0.31	_		
W219	0.05		Island, inaccessible at the time of assessment	
W218	0.33	Allocasuarina verticillata, Melaleuca lanceolata, Myorporum insulare, Enchylaena tomentosa	Revegetation area, 3-5 years old	

4.1 ECOYSTEMS FOUND IN THE SITE

4.1.1 Channel - polygon W204 and W207

This ecosystem type is not described in Jellinek and Te.

Table 3: Native plant density in each Channel polygon at Slade Paddock

Polygon	Total hectares	Species	Common Name	Notes
W204	0.61	Bolboschoenus caldwellii	Salt club-rush	Naturally occurring
W207 0.36	Cotula coronopifolia	Water buttons	Naturally occurring	
	0.36	Cynodon dactylon*	Couch	Weed
		Ficinia nodosa	Knobby club-rush	May have been planted
		Juncus kraussii	Sea rush	Naturally occurring
		Mimulus repens	Creeping monkey-flower	Naturally occurring
		Isolepis sp.	Clubrush	One patch

*Introduced species



Photo 1: Channel ecosystem type at Slade Paddock

4.1.2 Samphire swamp (low lying) - polygon W201, W208, W202, W220 and W221

Note that at the time of the assessment, few of the samphires present on the site were flowering and none were found with seeds, therefore they could not be confidently identified

Table 4: Native plant density in each samphire swamp polygon at Slade Paddock	
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Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W201 W202	1.19 0.68	Disphyma crassifolium ssp. clavellatum	Round-leaf pigface	10	Natural, 10% of ecosystem density
W208 W220	0.25 0.33	Distichlis distichophylla	Emu-grass	Patches	Naturally occurring
W221	0.34	Ficinia nodosa	Knobby clubrush	<10	Naturally occurring
		Frankenia pauciflora	Southern sea-heath	100	Naturally occurring
		Gahnia filum	Thatching grass	<10	Planted in W220 and W201
		Puccinellia stricta	Saltmarsh-grass	100	Naturally occurring in patches
		Samolus repens	Creeping brookweed	100	Naturally occurring in varying densities
		Sarcocornia sp.	Samphire	>1000	Naturally occurring
		Suaeda australis	Austral seablite	100	Naturally occurring, may have been some plantings
		Tecticornia arbuscular	Shrubby samphire	<10	Planted
		Tecticornia sp.	Samphire	>1000	Naturally occurring
		Threlkeldia diffusa	Coast bonefruit	100	Naturally occurring
		Wilsonia humilis	Silky wilsonia	Patches	Naturally occurring



Photo 2: samphire shrubland at Slade Paddock (polygon W201)

4.1.3 Samphire + Melaleuca halmaturorum shrubland swamp - polygons W203, W205, W206, W215, W216, W217 and W219

These sites represent transition zones between the samphire swamp and higher terrestrial ecosystems. Note that W203 has been included here as it is more similar to this ecosystem type than any other although it has been planted to *M. lanceolata*.

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W203	0.03	Atriplex semibaccata	Berry saltbush	<10	Naturally occurring
W205	0.25	Austrostipa sp.	Speargrass	1	
W206 W215	0.28	Dianella brevicaulis	Short-stem Flax-lily	1	May be planted
W216	0.03	Distichlis distichophylla	Emu-grass	Patches	Naturally occurring
W217	0.31	Enchylaena tomentosa	Ruby saltbush	1000	Natural
W219	0.05	Frankenia pauciflora var.	Southern sea-heath	<10	Naturally occurring
		Melaleuca halmaturorum	Swamp paper-bark	3000	Planted, flowering, above ecosystem density (not planted in W203)
		Melaleuca lanceolata	Dryland tea-tree	1000	Recent planting, probably too saline for this site (W203 only)
		Myoporum insulare	Common boobialla	1	Planted
		Pimelea serpyllifolia ssp. serpyllifolia	Thyme riceflower	1	Naturally occurring
		Puccinellia stricta	Saltmarsh-grass	<10	Naturally occurring
		Sarcocornia sp.	Samphire	<10	May have been planted
		Suaeda australis	Austral seablite	<10	May have been planted
		Tecticornia sp.	Samphire	Patch	May have been planted
		Threlkeldia diffusa	Coast bonefruit	<10	Naturally occurring
		Wilsonia backhousei	Narrow-leaf wilsonia	<10	Naturally occurring

Table 5: Native plant density in each samphire + Melaleuca halmaturorum shrubland swamp polygon at Slade Paddock



Photo 3: Samphire + Melaleuca halmaturorum shrubland swamp at Slade Paddock (polygon W215, adjoining samphire zone)

4.1.4 Samphire swamp (+ annual grasses) - polygons W208, W209, W210, W211, W212, W214 and W218

These sites represent transition zones between the samphire swamp and higher terrestrial ecosystems, they are likely to be similar to what the samphire + *M. halmaturorum* shrubland would have looked like prior to being revegetated. Polygon W218 has been sparsely revegetated with a small range of species and is therefore described separately. Although the mix in W218 comprises species from an *Allocasuarina verticillata* low woodland ecosystem type, they appear to be growing well, but the area is believed to more closely match a samphire + *M. halmaturorum* shrubland.

Table 6: Native plant density in each samphire + annual grasses shrubland swamp polygons W208, W209, W210, W211, W212 and W214 at Slade Paddock

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W208	0.25	Atriplex semibaccata	Berry saltbush	<10	
W209	0.07	Distichlis distichophylla	Emu-grass	Patches	
W210 W211	0.03 0.03 0.03	Enchylaena tomentosa	Ruby saltbush	<10	
W212		Gramineae*	Introduced annual grasses	>90% cover	
W214	0.03	Sarcocornia sp.	Samphire	<10	
		Suaeda australis	Austral seablite	<10	
		Tecticornia sp.	Samphire	<10	
		Tetragonia implexicoma	Bower spinach	On fencelines	
		Threlkeldia diffusa	Coast bonefruit	<10	

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W218	0.25	Allocasuarina verticillata	Drooping sheoak	500	
		Carpobrotus rossii	Native pigface	<10	
		Enchylaena tomentosa var.	Ruby saltbush	1000	
		Gramineae*	Introduced annual grasses	>90% cover	
		Melaleuca lanceolata Dryland tea-tree 1		100	
		Myoporum insulare	Common boobialla	<10	
		Suaeda australis	Austral seablite	1000	Naturally occurring at ecosystem density

Table 7: Native plant density in polygon W218 (Allocasuarina verticillata low woodland) at Slade Paddock



Photo 4: samphire shrubland + annual grasses at Slade Paddock (polygon W211), adjoining samphire zone with channel in foreground)



Photo 5: Samphire shrubland + annual grasses and revegetation at Slade Paddock (polygon W218)

4.2 PEST ANIMALS AND WEEDS

Table 8: Pest animal and weeds present at the site

Species	Common Name	Polygon	Cover	Notes
Lycium ferocissimum	African boxthorn	W218	<1%	Scattered plants shown on map
Marrubium vulgare	Horehound	W218	<1%	Also in adjacent paddock to south of eastern block
Thynopyrum elongatum	Tall wheat-grass	W203, W201	<1%	Scattered plants shown on map
Galenia pubescens	Galenia	W218	1%	Scattered throughout polygon
	Conifers	Adjacent W214	NA	Establsihed trees, do not appear to be regenerating

In addition to the above pest plants, introduced annual grasses and broadleaf weeds are present throughout the site. These may prevent natural regeneration but are not considered high threat pest plants and should only be controlled as part of the revegetation actions outlined in the following section.

5. RECOMMENDED SITE MANAGEMENT ACTIONS

The revegetation recommendations are broken into two phases, with the first (year 1-2) focussed on enhancing the diversity and abundance of native species present on the site through active revegetation. The second phase (years 3-5) is focussed on increasing the abundance of native species through encouraging natural regeneration. The present species diversity is good for revegetation sites, and, without any further revegetation, this site could be expected to continue to improve in native species cover and diversity (on a unit area basis), albeit over a slower timeframe. The revegetation species recommendations are a guide only as there is a lack of nearby representative remnant vegetation on which to base these recommendations.

5.1 INFILL PLANTING

5.1.1 Channel

Duma florulenta, Gahnia filum, Juncus krausii and Meleleuca halmaturorum could be planted in groups of 5 plants close to the water's edge to create a more natural and diverse channel ecosystem and shade the water. D. florulenta would likely have a greater success rate near the 'island' where the water appears to be fresher.

5.1.2 Samphire Swamp (including Melelaleuca halmaturorum shrublands)

In low lying samphire swamp; plant shrubs and ground layer species between samphires in samphire shrublands at a density of up to 500 plants per hectare each year. In samphire with revegetated *M. halmaturorum* and *M. lanceolate* shrublands, plant groundlayer species between *M. halmaturorum* plants at a density of up to 1000 plants per hectare (in total) to increase the cover and diversity of native groundlayer species. Areas of samphire and native grasses (including the partially revegetated polygon W218) can be revegetated at a density of up to 500 plants per hectare, but care should be taken to avoid planting less than three metres from the fence to ensure the electic fence is not compromised. As these areas are small they are not a high priority for revegetation. Take care not to plant less than three metres from the fenceline so that the electric fence is not impacted.

Table 9: Revegetation species in samphire swamp ecosystem polygons

Species	W218 0.33 ha	W201 1.19 ha	W202 0.68 ha	W208 0.25 ha	W220 0.33 ha	W221 0.34 ha	W203 0.03 ha	W205 0.25 ha	W206 0.28 ha	W215 0.27 ha	W217 0.31 ha	W219 0.05 ha	W204 0.27 ha	W207 0.36 ha
Adriana klotzschii	8	0	0	0	0	0	1	6	7	7	8	1		
Atriplex paludosa ssp. paludosa	0	59	34	13	17	17	1	6	7	7	8	1	0	0
Atriplex semibaccata	16	0	0	0	0	0	2	13	14	14	16	3	0	0
Disphyma crassifolium ssp. clavellatum	33	119	68	25	33	34	2	13	14	14	16	3	0	0
Duma florulenta	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Species	W218 0.33 ha	W201 1.19 ha	W202 0.68 ha	W208 0.25 ha	W220 0.33 ha	W221 0.34 ha	W203 0.03 ha	W205 0.25 ha	W206 0.28 ha	W215 0.27 ha	W217 0.31 ha	W219 0.05 ha	W204 0.27 ha	W207 0.36 ha
Ficinia nodosa	16	0	0	0	0	0	3	25	28	27	31	5	14	18
Gahnia filum	0	59	34	13	17	17	0	0	0	0	0	0	0	0
Juncus kraussii	0	0	0	0	0	0	0	0	0	0	0	0	14	18
Lawrencia squamata	0	59	34	13	17	17	2	13	14	14	16	3	27	36
Maireana oppositifolia	0	238	136	50	66	68	0	0	0	0	0	0	0	0
Melaleuca halmaturorum	66	0	0	0	0	0	6	50	56	54	62	10	0	0
Rhagodia candolleana	8	0	0	0	0	0	1	6	7	7	8	1	14	18
Tecticornia arbuscular	0	59	34	13	17	17	0	0	0	0	0	0	0	0
Tetragonia implexicoma	16	0	0	0	0	0	1	6	7	7	8	1	0	0
Totals (2,382)	163	593	340	127	167	170	19	138	154	151	173	28	69	90

In the longer term, adopt a 'bushcare-type' management of the site, with the aim of encouraging natural regeneration of the planted and naturally occurring native species. This should focus on spot spraying annual weeds in rings up to 1m radius around plants that are setting seed / fruit in early winter. Natural regeneration for some of the planted species requires the right hydrological conditions occur. Therefore longer term management should aim to restore natural hydrological cycles, however this will need to be considered in relation to investment resources and priorities.

Continue to monitor for and control pest plants and animals as outlined below.

5.2 PEST ANIMAL AND WEED RECOMMENDATIONS

Table 10: Pest animal and weed recommendations

Туре	Task
African boxthorn	Drill and fill African boxthorn as mapped. Continue to monitor for and control any new plants; this is likely to be an on-going task that will need to be done at least every second year.
Horehound	Control small patches of horehound as mapped, monitor for and control any new plants particularly along the southern part of the western block. Can be cut and swabbed, spot sprayed or grubbed out by hand.
Tall wheat-grass	Brush-cut / snip plants and spot spray re-growth, plants are growing close to native plants so care will need to be taken to avoid off-target damage and if wet only use herbicide approved for use near watercourses.
Galenia	Work from outer perimiter of infestation towards the middle. Can be hand-pulled ensuring the tap roots are removed, therefore this is best done in wetter months. Can be spot sprayed in spring to early summer when actively growing.
Conifers	These are not currently spreading into the site and are unlikely to, however if this occurs control regeneration through hand-pulling or cut and swab.
Hare	Monitor for and control hares at the site.

Wyndgate Property Revegetation Site Assessment

Site Name: Shadows Paddock

Location: Wyndgate

Assessment completed: November 2015

Assessment submitted: November 2015

Author

Catherine Miles (Miles Environmental Consulting)



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7. PLAN DETAILS

Table 11: Contact details relevant to this plan

PlanID: Plan Name	Shadows Paddock
SiteID: Site Name	Shadows Paddock
Landholder &/or Manager	Stuart Hicks
Landholder Contact	Mobile: 0428 168 626
Size of planting area	28.86 hectares
Planning Contact	Chris Butcher: 0457 509 154 or chris.butcher@sa.gov.au
Ops Contact	Mark Phillips: 0427192060 or Email: Mark.Phillips4@sa.gov.au

7.1 PLAN OVERVIEW

7.1.1 Access

The site can be accessed from Denver Road via a locked gate on the southern boundary (Map 2). There is a main track that runs from this gate to the northern boundary as mapped, which includes one all-weather creek crossing. North of the crossing there are tracks to the north eastern corner of the site through the samphire (providing access to dredge the channel entrance to Shadows Lagoon), through the dune and one along the northern boundary. There is an older track from a gate in the south western corner marked on the DEWNR maps, however this appears to be no longer in use and has been revegetated over in at least two sections.

7.1.2 Landuse

The site is part of the Wyndgate property which is used for conservation and cattle grazing (**Error! Reference source not found.**). The restoration ite has been fenced from stock and progressively revegetated over a number of years, with the oldest plantings being the *Melaleuca* halmaturorum plantings along the perimeter of the samphire zones, however this site still contains significant areas that have not yet been planted.

7.1.3 Site mapping

Mapping of ecosystem polygons for the site was developed from on ground mapping of landscape features and ecosystems present, both natural and planted (Map 3). Further consideration of ecosystem types was developed using the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014).

7.2 SITE ACCESS MAP





8. MAP OF THE SITE SHOWING ECOSYSTEM POLYGONS



Map 3: Shadows Paddock site boundary with ecosystem polygons

9. ECOSYSTEM DESCRIPTIONS

Table 12: Ecosystems identified at Shadows Paddock

Polygon	Total hectares	Species	Notes		
W301	0.08	Tecticornia pergranulata,	The samphire shrublands; in general these consist of T. pergranulata		
W303	0.53	Sarcocornia sp., Suada australis,	and bare ground in the lower areas with an increasing proportion of		
W306	0.30	Threlkeldia diffusa, introduced	annual grasses, T. diffussa and S. autralis with increasing elevation.		
W308	0.22	annual grasses.	Most of these have not been planted into except W317 and W326		
W315	0.10		where there has been some planting of samphire ecosystem shrub		
W317	1.79		paludosa		
W321	0.93				
W326	0.10				
W330	6.17				
W332	0.11				
W302	0.11	Melaleuca halmaturorum,	Established plantings of M. halmaturorum (approximately 5 years old)		
W304	0.16	introduced annual grasses and	on perimeter of samphire swamps.		
W307	0.54	sparse lecticornia pergranulata.			
W309	0.38				
W316	0.28				
W318	0.95				
W319	0.69				
W322	2.08				
W328	1.41				
W305	0.61	Allocasuarina verticillata, Callitris	Revegetated flats containing a variety of ages of plantings and		
W311	0.50	gracilliris, Eucalyptus diversifolia, E.	varying species densities. Newer plantings appear to contain a greater		
W312	0.13	incrassate, E. porosa, Myoporum	proportion of understorey species and are planted into older plantings		
W313	0.76	Insulare, Affipiex semibaccata and	(as infili) as well as adjacent (new areas).		
W314	1.65	commonly planted adjacent to			
W323	0.29	saline influence areas.			
W324	1.99				
W327	0.82				
W329	0.12				

W325	4.98	A. verticillata, Acacia longifolia, A. dodonaeifolia, Olearia axilaris, Ehrharta calycina.	Sparse old (> 5 years) and new (<1 year) plantings and dense E. calycina over whole dune and Pennisetum clandestinum growing on lower areas of dune.
W331	0.05	Cytisus proliferus over Ehrharta calycina and Gazania sp.	North western end of sand dune has probably been planted with introduced species to prevent wind erosion, soil in this area is notably redder than the rest of the dune and the <i>E. calycina</i> are sparser.
W310	32.8	Predominantly introduced annual	Unplanted areas dominated by introduced annual grasses. Polygon
W320	0.24	grasses, Lolium sp. and Avena barbata	W310 includes the area north and south of the central wetland area (W317 and W319). Revegetation recommendations are discussed in Section 0.

9.1 ECOYSTEMS FOUND IN THE SITE

9.1.1 Samphire swamp ecosystem (low lying) - polygons W301, W303, W306, W308, W315, W317, W321, W326, W330 and W332

Note that at the time of the assessment, few of the samphires present on the site were flowering and none were found with seeds, therefore they could not be confidently identified.

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W301	0.08	Atriplex paludosa	Lagoon saltbush	<10	Planted only in W317 and W326
W303	0.53	Disphyma crassifolium ssp.	Round-leaf pigface	<10	Appears to be naturally occurring
W306	0.30	clavellatum			
W308	0.22	Enchylaena tomentosa	Ruby saltbush	<10	Naturally occurring on higher
W315	0.10				ground at low densities
W317	1 79	Frankenia pauciflora	Southern sea-heath	100	Naturally occurring in patches
W321	0.93	Gahnia filum	Thatching grass	<100	Planted in some areas
W326	0.10	Maireana oppositifolia	Heathy bluebush	<10	Planted only in W317 and W326
W330	6.17	Sarcocornia sp.	Samphire	<10	Naturally occurring
W332	0.11	Suada australis	Austral seablite	<10	Naturally occurring in higher areas
	0.11	Tecticornia pergranulata	Samphire	10,000	Naturally occurring
Total	10.35	Tecticornia arbusucular	Shrubby glasswort	<10	Planted only in W317 and W326
		Threlkeldia diffusa	Coast bonefruit	<10	Naturally occurring in higher areas

Table 13: Species present in polygons W301, W303, W306, W308, W315, W317, W321, W326, W330 and W332



Photo 6: samphire shrubland at Shadows Paddock showing gradation from samphire and bare ground in the lower areas (top right) to samphire and introduced annual grasses on higher ground (with *M. halmatuorums* planted in adjacent saline edge)

9.1.2 Samphire swamp + Melaleuca halmaturorum shrubland - polygons W302, W304, W307, W309, W316, W318, W319, W322 and W328

These sites represent transition zones between the samphire swamp and higher terrestrial ecosystems that have been planted with *M. halmatuorum* (Photo 7).

able 14: Species present in polygons W30	2, W304, W307, W309,	, W316, W318, W319, W	V322 and W328
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Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes		
W302	0.11	Distichlis distichophylla	Emu-grass	<1% cover	Naturally occurring		
W304	0.16	Enchylaena tomentosa	Ruby saltbush	<10	Naturally occurring at low densities on higher		
W307	0.54				ground		
W309	0.38	Melaleuca halmaturorum	Swamp Paper-bark	1000 - 2000	Planted, older plants flowering; at and above ecosystem density		
W316	0.28	Sugoda australis	Austral Soablito	<10	Naturally occurring at $< 10\%$ of accepton		
W318	0.95		Augural Seapline		density		
W319	0.69	Tecticornia pergranulata	Samphire	<100	Sparse		
W322	2.08	Threlkeldia diffusa	Coast Bonefruit	<10	Naturally occurring at <10% of ecosystem		
W328	1.41				density		
Total	6.60						



Photo 7: Samphire swamp + M. halmaturorum shrubland swamp at Shadows Paddock (adjoining Samphire zone)

9.1.3 Allocasuarina verticillata low woodland - polygons W305, W311, W312, W313, W314, W323, W324, W327 and W329

These areas have been previously planted with a mix of dryland species and are commonly referred to as 'other inland' zones in earlier revegetation plans. Based on the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014) and considering species planted to date and the sandy loam over clay soil type with strong coastal and saline influences, these zones best match the Allocasuarina verticillata low woodland ecosystem type (Photo 3), however the original (pre-European) vegetation may have more closely represented a Eucalyptus porosa grassy woodland. Newer plantings appear to consist of a greater proportion of understorey species. The density of species per hectare varies somewhat between areas and was difficult to determine in the field.

Polygon	Total hectares	Species	Common name	Density (plants per hectare)	Notes
W305	0.61	Acacia cupularis	Cup wattle	<10	Planted
W311	0.50	Acacia dodonaeifolia	Hop-bush wattle	<10	Planted
W312	0.13	Acacia longifolia ssp. sophorae	Coastal wattle	<10	Planted
W313	0.76	Acacia paradoxa	Kangaroo thorn	<10	<10% of ecosystem density
W323	0.29	Acacia pycnantha	Golden wattle	<10	<10% of ecosystem density
W324	1.99	Allocasuarina verticillata	Drooping sheoak	300	300% ecosystem density
W329	0.82	Atriplex semibaccata	Berry saltbush	100	Appears to be naturally occurring
Total	6.88	Austrostipa elegantissima	Feather spear- grass	<10	<10% of ecosystem density
		Bursaria spinosa ssp. spinosa	Sweet bursaria	<10	<10% of ecosystem density
		Callitris gracilis	Southern cypress pine	<10	<10% of ecosystem density
		Distichlis distichophylla	Emu-grass	<1% cover	Naturally occurring in lower areas
		Dodonaea viscosa ssp. spatulata	Sticky hop-bush	<10	<10% of ecosystem density

Table 15: Species present in polygons W305, W311, W312, W313, W314, W323, W324, W327 and W329

Polygon	Total hectares	Species	Common name	Density (plants per hectare)	Notes
		Enchylaena tomentosa var.	Ruby saltbush	<10	<10% of ecosystem density, naturally occurring
		Enneapogon nigricans	Black bottle washers	<10	Planted
		Eucalyptus porosa	Mallee box	100	20% of ecosystem density
		Eucalyptus sp.	Eucalypt	200	Small plants not easily identifiable, some of which may be E. porosas and E. diversifolias
		Ficinia nodosa	Knobby club- rush	<10	<10% ecosystem density
		Hakea mitchellii	Heath needlebush	<10	Planted
		Leucophyta brownii	Coast cushion bush	<10	Planted
		Marieana brevifolia	Short -leaf bluebush	<10	Naturally occurring
		Melaleuca lanceolata	Dryland tea-tree	50	Planted adjacent to M. halmaturorum shrublands
		Myoporum insulare	Common boobialla	200	200% of ecosystem density
		Poa poiformis var. poiformis	Coast tussock- grass	<10	Planted
		Rhagodia candolleana ssp. candolleana	Sea-berry saltbush	<10	<10% ecosystem density


Photo 8: Allocasuarina verticillata low woodland at Shadows Paddock with newer infill plantings into older areas

9.1.4 Eucalyptus diversifolia ssp. diversifolia mallee – polygons W325 and W331

This zone consists of predominantly midstorey species from the Eucalyptus diversifolia ssp. diversifolia mallee ecosystem type on a sand dune.

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W325	4.98	Acacia dodonaeifolia	Hop-bush wattle	50	Planted
W331	0.05	Acacia longifolia ssp. sophorae	Coastal wattle	50	Planted at 25% of ecosystem density
Total	5.02	Acacia pycnantha	Golden wattle	<10	Planted at < 10% ecosystem density
TOTAL	5.05	Allocasuarina verticillata	Drooping sheoak	100	Planted at 1/5 th ecosystem density
		Bursaria spinosa ssp. spinosa	Sweet bursaria	1	Planted at <1% of ecosystem density
		Callitris gracilis	Southern cypress pine	<10	Planted at < 10% ecosystem density
		Carpobrotus rossii	Native pigface	1	Planted
		Dodonaea viscosa ssp. cuneata	Wedge-leaf hop-bush	<10	Planted at < 10% ecosystem density
		Dodonaea viscosa ssp. spatulata	Sticky hop-bush	<10	Planted
		Eucalyptus incrassata	Ridge-fruited mallee	<10	Planted at < 10% ecosystem density
		Eucalyptus diversifolia ssp. diversifolia	Coastal white mallee	<10	Planted at < 10% ecosystem density
		Hakea mitchellii	Heath needlebush	<10	Planted at < 10% ecosystem density
		Myoporum insulare	Common boobialla	<10	Planted at < 10% ecosystem density
		Olearia axillaris	Coast daisy-bush	50	Planted at half ecosystem density
		Rhagodia candolleana ssp. candolleana	Sea-berry saltbush	<10	Planted at < 10% ecosystem density

Table 16: Species present in polygons Eucalyptus diversifolia ssp. diversifolia mallee



Photo 9: Eucalyptus diversifolia ssp. diversifolia mallee at Shadows Paddock site

9.2 PEST ANIMALS AND WEEDS

Table 17: Pest animal and weeds present at the site

Species	Common Name	Polygon	Cover	Notes
Lycium ferocissimum	African Boxthorn	W302, W304, W319, W324, W328, W325	<1%	Also present in adjacent paddock to the north west of the site.
Gazania sp.	Gazania	W331	1%	
Galenia pubescens	Galenia	All except samphire shrublands	<1%	Scattered throughout unplanted areas and A. verticillata low woodland polygons and M. halmaturorum shurblands
Cytisus proliferus	Lucerne tree	W331	20%	May have been planted or spread from plantings in adjacent paddock
Pennisetum clandestinum	Kikuyu	W325	20%	Present on lower slopes of the dune
Ehrharta calycina	Perennial Veldtgrass	W325, W331	80%	Likely to have been planted to prevent wind erosion of the dune
	Hares	-	-	Not sited but likely to be present on the site as common on Hindmarsh Island

In addition to the above pest plants, introduced annual grasses and broadleaf weeds are present throughout the site. These may prevent natural regeneration but are not considered high threat pest plants and should only be controlled as part of the revegetation actions outlined in the following section.

10. RECOMMENDED SITE MANAGEMENT ACTIONS

10.1 INFILL PLANTING

In the short term, focus on enhancing the diversity and abundance of native species present on the site through infill planting. There are older plants in all zones that are flowering and/or setting seed but no natural regeneration of the planted species was observed (although some of the groundcover species would be difficult to detect). In the medium and longer term, management should shift to focus on increasing the abundance of native species through encouraging natural regeneration using bushcare-type methods (e.g. spot spraying around seeding plants).

The revegetation species and planting density recommendations are a guide only as there is a lack of nearby representative remnant vegetation on which to base these recommendations. The species and numbers are based on the ecosystem types as guided by the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014).

10.1.1 Samphire swamp

A relatively low species and structural diversity is present in the Samphire Swamp ecosystems present at the Shadows Paddock Site. Infill planting is recommended to increase the site diversity. Lower target densities are recommended than in the 'Site Planners Guide' to allow for the planting to focus on the higher (grassy) areas and the existing density of samphire species. Plant seedlings of the same species in groups of 5-10 at <1 m to create structural diversity.

Table 18: Revegetation species for Samphire Swamp Ecosystem polygons

Species	W301 0.08 ha	W303 0.53 ha	W306 0.30 ha	W308 0.22 ha	W315 0.10 ha	W317 1.79 ha	W321 0.93 ha	W326 0.10	W330 6.17 ha	W332 0.11 ha
Atriplex paludosa ssp. paludosa	8	53	30	22	10	179	93	10	617	11
Disphyma crassifolium ssp. clavellatum	4	27	15	11	5	90	47	5	308	6
Lawrencia squamata	8	53	30	22	10	179	93	10	617	11
Maireana oppositifolia	8	53	30	22	10	179	93	10	617	11
Puccinellia stricta	17	107	60	44	20	359	187	20	1234	23
Samolus repens	8	53	30	22	10	179	93	10	617	11
Totals (6,721)	53	346	195	143	65	1,165	606	65	4,010	73

Ongoing management of the samphire swamp ecosystem at Shadows Paddock will be limited.

10.1.2 Samphire Swamp + Melaleuca halmaturorum Shrubland

Melaleuca halmaturorum is well established in this ecosystem type, opportunity exists to infill with understorey species in to the annual grass areas between the *M. halmaturorum* to improve the groundlayer species diversity and native species cover.

Table 19: Revegetation species for Samphire Swamp + Melaleuca halmaturorum Shrubland Ecosystem polygons

Species	W302 0.11 ha	W304 0.16 ha	W307 0.54 ha	W309 0.38 ha	W316 0.28 ha	W318 0.95 ha	W319 0.69 ha	W322 2.08 ha	W328 1.41 ha
Atriplex paludosa ssp. paludosa	5	8	27	19	14	48	34	104	71
Atriplex semibaccata	16	24	81	57	41	143	103	312	212
Disphyma crassifolium ssp. clavellatum	16	24	81	57	41	143	103	312	212
Enchylaena tomentosa var. tomentosa	11	16	54	38	28	95	69	208	141
Lawrencia squamata	5	8	27	19	14	48	34	104	71
Maireana oppositifolia	5	8	27	19	14	48	34	104	71
Suada australis	5	8	27	19	14	48	34	104	71
Threlkeldia diffusa	5	8	27	19	14	48	34	104	71
Totals (4,288)	68	104	351	247	180	621	445	1,352	920

In the longer term, adopt 'bushcare-type' management of the site, with the aim of encouraging natural regeneration of the planted and naturally occurring native species. This should focus on spot spraying annual weeds in rings up to 1m radius around plants that are setting seed / fruit in early winter.

Monitor and control Boxthorn, Galenia and other significant weeds as required.

10.1.3 Allocasuarina verticillata low woodland

Based on the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014) and considering the loam over clay soil type with coastal and saline influences, this site would best be restored to Allocasuarina verticillata low woodland with influence from Eucalyptus porosa grassy woodland and keep an open grassy structure to these areas. The canopy and medium to large shrubs layers are established in most polygons and are on a trajectory towards open low woodland structure. Opportunity exists to build on this open structure with infill of understorey species in to the annual grass areas between the shrub and canopy layers, and, in the newer planting areas, to continue the focus on groundlayer species to create a diversity of vegetation structures across the site. However, without any further revegetation, this site could be expected to continue to improve in native species cover and diversity (on a unit area basis), albeit over a slower timeframe.

Plant grass, sedge herb and smaller species in groups at 0.5-1m spacing and medium shrub and ground cover spreading plants at 2-3m spacing. Place climbing species throughout, near established tree species as structure to grow on.

Species	W305 0.61 ha	W311 0.50 ha	W312 0.13 ha	W313 0.76 ha	W314 1.65 ha	W323 0.29 ha	W324 1.99 ha	W327 0.82 ha	W329 0.12 ha
Adriana quadripartita	31	25	6	38	82	14	100	41	6
Allocasuarina verticillata	122	50	13	76	165	29	398	82	12
Austrostipa elegantissima	92	75	19	114	247	43	299	123	18
Austrostipa flavescens	92	75	19	114	247	43	299	123	18
Billardiera cymosa ssp. cymosa	122	100	26	152	330	58	398	164	24
Bursaria spinosa ssp. spinosa	61	25	6	38	82	14	199	41	6
Callitris gracilis	31	0	0	0	0	0	100	0	0
Carpobrotus rossii	61	50	13	76	165	29	199	82	12
Clematis microphylla	122	100	26	152	330	58	398	164	24
Dianella brevicaulis	305	250	65	380	825	145	995	410	60
Enchylaena tomentosa var. tomentosa	122	100	26	152	330	58	398	164	24

Table 20: Revegetation species for Allocasuarina verticillata low woodland Ecosystem polygons

Species	W305 0.61 ha	W311 0.50 ha	W312 0.13 ha	W313 0.76 ha	W314 1.65 ha	W323 0.29 ha	W324 1.99 ha	W327 0.82 ha	W329 0.12 ha
Enneapogon nigricans	31	25	6	38	82	14	100	41	6
Eucalyptus porosa	31	0	0	0	0	0	100	0	0
Ficinia nodosa	61	50	13	76	165	29	199	82	12
Kennedia prostrata	122	100	26	152	330	58	398	164	24
Kunzea pomifera	122	100	26	152	330	58	398	164	24
Lomandra effusa	153	125	32	190	412	72	498	205	30
Muehlenbeckia gunnii	61	50	13	76	165	29	199	82	12
Melaleuca lanceolata	31	0	0	0	0	0	100	0	0
Rytidosperma caespitosum	610	500	130	760	1,650	290	1,990	820	120
Tetragonia implexicoma	61	25	6	38	82	14	199	41	6
Vittadinia australasica var. australasica	61	50	13	76	165	29	199	82	12
Vittadinia cuneata var. cuneata	122	100	26	152	330	58	199	164	24
Totals (27,845)	2,627	1,975	510	3,002	6,514	1,142	8,362	3,239	474

Adopt a 'bushcare-type' management of the site, with the aim of encouraging natural regeneration of the planted and naturally occurring native species. This should focus on spot spraying annual weeds in rings up to 1m radius around plants that are setting seed / fruit in early winter.

Monitor and control Boxthorn, Galenia and other significant weeds as required.

10.1.4 Eucalyptus diversifolia ssp. diversifolia mallee

This site is currently dominated by introduced perennial grasses, mainly *E. calycina*, with *P. clandestinum* on the lower slopes. There has been some revegetation to date but the established plantings are sparse and more recent plantings appear to have had a low success rate. Total eradication of the introduced grasses over the whole site would leave the dune at high risk of wind erosion and would be very difficult to achieve. It is therefore recommended that revegetation take place in two phases:

- First phase: concentrate on establishment of overstorey and taller midstorey species to create wind shelter for the ground layer
- Second phase: undertake spraying of grassy weeds in large patches for at least two years before dense planting of lower midstorey and groundlayer species (with grasses planted in dense patches).

There will need to be a gap of at least 5 years between phase 1 and 2 to enable the taller species to establish and form a continuous canopy. The aim of this strategy is to enable herbicide weed control to be undertaken. Depending on the broader objectives, for the site it may be acceptable to never implement the second phase of planting as it will be resource intensive and the site is not ever likely to achieve a dominance of native groundlayer.

Table 21: Phase	1 revegetation speci	es for Eucalyptus di	iversifolia ssp. (diversifolia mallee polygons
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Species	W325 – 4.98 ha	W331 – 0.12 ha
Acacia longifolia var. sophorae	498	12
Acacia pycnantha	2490	60
Allocasuarina verticillata	1992	48
Bursaria spinosa ssp. spinosa	498	12
Callitris gracillis	249	6
Dodonaea viscosa ssp. spatulata	498	12
Eucalyptus diversifolia ssp. diversifolia	1992	48
Eucalyptus incrassata	498	12
Myoporum insulare	249	6
Totals (9,180)	8964	216

Species	W325 – 4.98 ha	W331 – 0.12 ha
Austrostipa spp. (e.g. A. drummondii, A. pilata, A. elegantissima)	4,980	120
Carpobotrus rossii	498	12
Dianella brevicaulis	996	24
Enchylaena tomentosa	498	12
Ficinia nodosa	,2490	60
Hakea mitchellii	498	12
Kunzea pomifera	498	12
Muehlenbeckia gunnii	498	12
Olearia axilaris	498	12
Rytidosperma caespitosum	4,980	120
Tetragonia implexicoma	498	12
Totals (17,340)	16,932	408

Table 22: Phase 2 species for Eucalyptus diversifolia ssp. diversifolia mallee polygons

Adopt a 'bushcare-type' management of the site, with the aim of encouraging natural regeneration of the planted and naturally occurring native species. This should focus on spot spraying weeds in rings up to 1m radius around plants that are setting seed / fruit in early winter.

Monitor and control other weeds per section 10.2 below.

10.2 PEST ANIMAL AND WEED MANAGEMENT RECOMMENDATIONS

Table 23: Pest animal and weed recommendations

Туре	Task
African Boxthorn	Drill and fill African Boxthorn as mapped. Continue to monitor for and control any new plants; this is likely to be an on- going task that will need to be done at least every second year
Galenia	Spot spray or grub out. Undertake annual monitoring and control as required.
Gazania	Work from the perimeter towards the middle. Grub out small plants (ensuring all roots are removed). Cut and swab larger plants with appropriate herbicides. Take care to avoid soil disturbance as the site is ver susceptible to erosion. Monitor for and control re-growth – this is likely to be an on-going activitiy unless they are controlled in the adjacent paddock.
Kikuyu	Control as part of revegetation actions outlined in 10.1.4 above. Monitor along perimiter with other polygons and control with appropriate herbicide in late Spring as required.
Lucerne tree	Cut and swab smaller plants and drill and fill larger plants to maintain soil protection. Monitor for and control re- growth – this is likely to be an on-going activitiy unless they are controlled in the adjacent paddock.
Perrenial veldtgrass	Control as part of revegetation actions outlined in 10.1.4 above. Monitor along perimiter with other polygons and control with appropriate herbicide in late Spring as required.
Hare	Monitor for and control hares at the site.

10.3 SITE ACCESS RECOMMENDATIONS

It is recommended that some dedicated access tracks, doubling as firebreaks, be identified for the site that are clearly delineated during planting events. These should be slashed in early winter to ensure they are clearly visible during planting, and in mid to late spring as annual grasses begin to set seed. There are also multiple tracks through the samphire swamp, some of which could be 'closed down' to limit impacts on the swamp.

10.4 REVEGETATION OF POLYGON W310

The vegetation of this polygon is dominated by introduced annual grasses (mainly Avena barbata, Lolium sp.) and other introduced annual broadleaf weeds, occasional Enchylaena tomentosa and Galenia pubescens. Whilst the current focus for the Shadows Paddock site is to improve the existing areas of revegetation, it is anticipated that the unplanted areas will be revegetated in the longer term. *E. porosa* grassy woodland should be the target Ecosystem Type for this site and the corresponding planting list in the 'Site Planners Guide' should be used as the basis for the revegetation species list, with the addition of groundlayer species from the A. verticillata low woodland. However, in order to achieve an open grassy woodland structure, the overstorey and midstorey species density should be reduced to around 10% of the current recommended target density.

These areas could be slashed and potentially cut for hay (if of suitable quality) to reduce the weed seed load prior to revegetation commencing and Galenia control undertaken as outlined in section 10.2 above.

Wyndgate Property Revegetation Site Assessment

Site Name: Shadows West

Location: Wyndgate

Site Surveys completed: November 2015

Assessment submitted: December 2015

Author

Bill New – New Environmental Pty Ltd





ent Government of South Australia

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12. PLAN DETAILS

Table 24: Contact details relevant to this plan

PlanID: Plan Name	Shadows West
SiteID: Site Name	Shadows West
Landholder &/or Manager	Stuart Hicks
Landholder Contact	Mobile: 0428 168 626
Size of planting area	31.7 hectares (mapped plan area)
Planning Contact	Chris Butcher: 0457 509 154 or chris.butcher@sa.gov.au
Ops Contact	Mark Phillips: 0427192060 or Email: Mark.Phillips4@sa.gov.au

12.1 PLAN OVERVIEW

12.1.1 Access

The site is in from Denver Road, on the northern side just before the causeway (Map1). Vehicle access to the edge of the site is through a gate on the left hand side directly before the causeway. Drive north across the paddock to another set of gates at the ford crossing though to the next paddock. Site begins just to the left hand side of the ford crossing and extends north. Park near fence and walk the rest of the site. Access to all planting areas will be difficult in winter when site is wetter.

NOTE: The fence is electrified, a rubber mat placed over the fence may help with general access. Turning it off during site preparation and planting activities would be advisable.

12.1.2 Landuse

The site is part of the Wyndgate property which is used for conservation and cattle grazing (Map 2). The restoration site has been fenced from stock and progressively revegetated over a number of years, with the oldest plantings being the *Melaleuca halmaturorum* plantings along the perimeter of the samphire zones and more recent plantings on the loamy flats and sandy dune areas.

12.1.3 Site Mapping

Mapping of ecosystem polygons for the site was developed from on ground mapping of landscape features and ecosystems present, both natural and planted (Map 3). Further consideration of ecosystem types was developed using the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014).

12.2 SITE ACCESS MAP



Map 4: Access to Shadows West site

13. MAP OF THE SITE SHOWING ECOSYSTEM POLYGONS



Map 5: Shadows West site boundary with ecosystem polygons

14. ECOSYSTEM DESCRIPTIONS

Table 25: Ecosystems identified at Shadows West

Polygon	Total hectares	Species	Notes
W802 W827	0.03 4.47	Bolboschoenus caldwellii +/- Eleocharis acuta and Schoenoplectus pungens over Suaeda australis, Samolus repens, Distichlis distichophylla and Tecticornia sp. Scattered groups of Juncus kraussii	-Low lying wet flats with fresh water influence from the channel, extending to the samphire edge. -Plantings of <i>Melaleuca halmaturorum</i> in W802 and a small patch in W616 (adjacent to W804).
W801 W806 W809 W810	21.72 0.01 0.01 0.01	Tecticornia sp. +/- Suaeda australis over Frankenia pauciflora, Disphyma crassifolium ssp. clavellatum, Distichlis distichophylla, Puccinellia stricta and Samolus repens.	-Low lying naturally occurring Samphire Swamp. -Areas of dense Atriplex paludosa ssp. paludosa particularly around the South East of W801 adjacent to W814.
W807 W812 W813 W814 W815 W818 W821 W822 W824 W826	0.15 0.21 0.09 0.37 0.43 0.08 0.21 0.49 0.12 0.32	Melaleuca halmaturorum over introduced annual grasses +/- Tecticornia sp, Atriplex paludosa ssp. paludosa, Enchylaena tomentosa and Atriplex semibaccata	-Dense Melaleuca halmaturorum plantings on narrow edge around Samphire Swamp. Older plantings in W814 (>5 years) and 1-3 year old plantings in the other polygons. -W807, W821 and W826 have not previously been planted, it is however proposed to plant these areas completely to this ecosystem type. -Patches of tall wheat-grass exist as mapped along with scattered individuals. W803 and W815 have patches and individuals across the whole area.
W803 W804 W805 W816 W817 W819 W820 W823 W825	0.01 0.11 0.10 0.16 0.08 0.29 0.13 1.39 0.06	Scattered Atriplex semibaccata and Enchylaena tomentosa var. tomentosa amongst dense *Avena barbata, *Bromus diandrus, *Bromus hordeaceus, *Lolium rigidum and patches of *Thinopyrum elongatum	-These areas have not previously been revegetated. -Very open areas of dense annual weedy grasses and scattered tall wheat-grass. -Patches of tall wheat-grass exist as mapped along with scattered individuals. W804 and W816 have patches and individuals across the whole area.
W811	0.66	Eucalyptus diversifolia, Allocasuarina verticillata, Eucalyptus porosa, Eucalyptus incrassata and Callitris gracilis. Dodonaea viscosa spp. Spatulata, Myoporum insulare and Acacia paradoxa, Enchylaena tomentosa, Rhagodia candolleana ssp. candolleana and Dianella brevicaulis	-2015 plantings of mixed Eucalyptus and shrub.

Note: *Denotes weed species

14.1 ECOYSTEMS FOUND IN THE SITE

14.1.1 Duma florulenta shrubland - polygons W802, W827

Table 26: Plant density in each Duma florulenta shrubland ecosystem polygon at Shadows West site (Photo 10)

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W802	0.03	Bolboschoenus caldwellii	salt club-rush	10000	Naturally occurring
		Distichlis distichophylla	emu-grass	10000	Naturally occurring
W827	4.4/	Eleocharis acuta	common spike-rush	10000	Naturally occurring
		Juncus kraussii	sea rush	100	Naturally occurring, grouped in wetter sections
		Melaleuca halmaturorum	swamp paper-bark	200	Planted, scattered groups planted
		*Paspalum vaginatum	salt-water couch		WEED- dense
		*Plantago coronopus ssp. coronopus	bucks-horn plantain		WEED
		Puccinellia stricta	Australian saltmarsh- grass	1000s	Naturally occurring
		Samolus repens	creeping brookweed	2000	Naturally occurring
		Schoenoplectus pungens	spiky club-rush	10000	Naturally occurring, edge
		*Sonchus oleraceus	common sow-thistle		WEED
		Suaeda australis	austral seablite	200	Naturally occurring
		Tecticornia sp.	samphire	100s	Naturally occurring, edge to samphire
		*Thinopyrum elongatum	tall wheat-grass		WEED- edges

Note: *Denotes weed species



Photo 10: Duma florulenta shrubland ecosystem, note fresh water influence with edge of Melaleuca halmaturorum

(polygon W802)

14.1.2 Samphire swamp - polygons W801, W806, W809, W810

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W801	21.72	Atriplex paludosa ssp. paludosa	marsh saltbush	200	Naturally occurring
W00/	0.01	Disphyma crassifolium ssp. clavellatum	round-leaf pigface	500	Naturally occurring
W806	0.01	Distichlis distichophylla	emu-grass	1000s	Naturally occurring
W809	0.01	Frankenia pauciflora var. gunnii	southern sea-heath	200	Naturally occurring
		*Hordeum marinum	sea barley-grass		WEED
W810	0.01	Lawrencia squamata	thorny lawrencia	100	Naturally occurring
		*Lolium rigidum	Wimmera ryegrass		WEED
		*Medicago sp.			WEED
		*Parapholis incurva	curly ryegrass		WEED
		*Plantago coronopus ssp. coronopus	bucks-horn plantain		WEED
		Puccinellia stricta	Australian saltmarsh-grass	100s	Naturally occurring
		Samolus repens	creeping brookweed	100s	1000 Naturally occurring
		Suaeda australis	austral seablite	1000s	Naturally occurring
		Sporobolis virginicus	salt couch	10000	Naturally occurring
		Tecticornia sp.	samphire	2500	Naturally occurring

Table 27: Plant density in each Samphire swamp polygon at Shadows West site (Photo 11)

Note: *Denotes weed species



Photo 11: Samphire swamp at Shadows West (polygon W801)

14.1.3 Samphire Swamp + Melaleuca halmaturorum Shrubland - polygons W807, W812, W813, W814, W815, W818, W821, W822, W824, W826

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W807	0.15	Atriplex paludosa ssp. paludosa	marsh saltbush	10	Naturally occurring
W010	0.01	Atriplex semibaccata	berry saltbush	200	Naturally occurring ? Planted
W812	0.21	*Avena barbata	bearded oat		WEED
W813	0.09	*Bromus diandrus	great brome		WEED
		*Bromus hordeaceus	soft brome		WEED
W814	0.37	Disphyma crassifolium ssp. clavellatum	round-leaf pigface	10	Naturally occurring
W815	0.43	Distichlis distichophylla	emu-grass	100s	Naturally occurring
W818	0.08	Enchylaena tomentosa var. tomentosa	ruby saltbush	500	Naturally occurring and to samphire edge
W821	0.21	Frankenia pauciflora var. gunnii	southern sea- heath	100	Naturally occurring, samphire edge
W822	0.49	*Lolium rigidum	Wimmera ryegrass		WEED- dense
W824	0.12	*Medicago sp.			WEED
W824	0.12	Melaleuca halmaturorum	swamp paper- bark	1200-2000	Planted
11020	0.02	*Paspalum vaginatum	salt-water couch		WEED
		*Sonchus oleraceus	common Sow- thistle		WEED
		Suaeda australis	austral seablite	100s	Naturally occurring samphire edge
		Tecticornia sp.		100	Naturally occurring
		*Thinopyrum elongatum	tall wheat-grass		WEED- extensive patches

Table 28: Plant density in each Samphire swamp + Melaleuca halmaturorum shrubland polygon at Shadows West site (Photo 12)

Note: *Denotes weed species



Photo 12: Samphire + Melaleuca halmaturorum shrubland swamp at Shadows West.

(polygon W815)

14.1.4 Eucalyptus porosa grassy woodland - polygons W803, W804, W805, W816, W817, W819, W820, W823, W825

These polygons a have not been revegetated.

Based on the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014) and considering the heavy loam over clay soil type with coastal and saline influences, this site would best be restored to *Eucalyptus porosa* grassy woodland and keep an open grassy structure to these areas.

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W803	0.01	*Pinus halepensis	Aleppo pine		WEED
	0.11	Atriplex semibaccata	berry saltbush	200	Naturally occurring
W804	0.11	*Avena barbata	bearded oat		WEED- Dense across area
W805	0.10	*Bromus diandrus	great brome		WEED- Dense across area
		*Bromus hordeaceus	soft brome		WEED
W816	0.16	Enchylaena tomentosa var.	ruby saltbush	500	Naturally occurring and to samphire edge
W917	0.08	tomentosa			
W017	0.00	*Lolium rigidum	Wimmera ryegrass		WEED
W819	0.29	*Lycium ferocissimum	African boxthorn		WEED
W820	0.13	*Sonchus oleraceus	common sow- thistle		WEED
W823	1.39	*Thinopyrum elongatum	tall wheat-grass		WEED
W825	0.06				

Table 29: Plant density in each Eucalyptus porosa grassy woodland polygon at Shadows West site (Photo 13)

Note: *Denotes weed species



Photo 13: A. verticillata low woodland at Shadows West site (polygon W819)

14.1.5 Eucalyptus diversifolia ssp. diversifolia Mallee - polygons W811

This area has been planted in the last year. The ecosystem type that best matches the revegetation species present at this site is Eucalyptus diversifolia ssp. diversifolia Mallee (Jellinek and Te, 2014).

Based on the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014) and considering the heavy loam over clay soil type and coastal influences, this site would best be restored to *Eucalyptus porosa* grassy woodland and keep an open grassy structure to these areas.

able 30: Plant density in each Eucalyptus diversifolia ss	p. diversifolia Mallee ecosystem polygon at Homestead site (Pl	hoto 14)
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Polygon	Total	Species	Common Name	Density	Notes
	nectores			(plants per hectare)	
W811	0.66	Acacia longifolia var. sophorae	coastal wattle	100	Planted
		Acacia paradoxa	kangaroo thorn	100	Planted
		Allocasuarina verticillata	drooping sheoak	100	Planted
		Atriplex semibaccata	berry saltbush	20	Naturally occurring
		*Avena barbata	bearded oat		WEED- Dense across
					area
		*Bromus diandrus	great brome		WEED
		*Bromus diandrus	great brome		WEED- Dense across
					area
		*Bromus hordeaceus	soft brome		WEED
		Bursaria spinosa	Christmas bush	100	WEED
		Callitris gracilis	southern Cypress pine	100	Planted
		Dianella brevicaulis	short-stem flax-lily	50	Planted
		Dodonaea viscosa ssp. cuneata	wedge-leaf hop-bush	50	Planted
		Dodonaea viscosa ssp. spatulata	sticky hop-bush	100	Planted
Enchylaena tomentosa var. tomentosa ruby saltbush		50	Naturally occurring		
		Eucalyptus diversifolia ssp. diversifolia	coastal white mallee	100	Planted
		Eucalyptus incrassata	ridge-fruited mallee	100	Planted
		Eucalyptus porosa	mallee box	100	Planted
		Ficinia nodosa	knobby club-rush	50	Planted
		Hakea mitchellii	heath needlebush	50	Planted
		*Lolium rigidum	Wimmera ryegrass		WEED
		*Lycium ferocissimum	African boxthorn		WEED
		Melaleuca lanceolata	dryland tea-tree	50	Planted
		Myoporum insulare	common boobialla	50	Planted
		Rhagodia candolleana ssp.	sea-berry saltbush	50	Planted
		candolleana			

Polygon	olygon Total Species hectares		Common Name Density Notes (plants per hectare)		
		*Sonchus oleraceus	common sow-thistle		WEED
		*Thinopyrum elongatum	tall wheat-grass		WEED

Note: *Denotes weed species



Photo 14: Eucalyptus diversifolia ssp. diversifolia Mallee ecosystem (polygon W811)

14.2 PEST ANIMALS AND WEEDS

Table 31: Pest animal and weeds present at the site

Species	Common Name	Polygon	Cover	Notes
*Lycium ferocissimum	African boxthorn	W823	<1%	
*Senecio pterophorus	African daisy	W822	<1%	
*Pinus halepensis	Aleppo pine	W819	<1%	One plant
*Thinopyrum elongatum	tall wheat-grass	W803, W804 W815, W816 W818, W819 W822, W823 W821	5%	Patches of tall wheat-grass exist as mapped along with scattered individuals and groups. W803, W804, W815 and W816 have patches and individuals across the whole area.
Vulpes vulpes	fox			Many fox scat present across site

Note: *Denotes weed species

In addition to the above pest plants, introduced annual grasses and broadleaf weeds are present throughout the site. These may prevent natural regeneration but are not considered high threat pest plants and should only be controlled as part of the revegetation actions outlined in the following section.

Table 32: Waypoints for some recorded weeds

Туре	Waypoints (GDA94, UT	M Zone 54H)	Notes
African boxthorn	E-309458 N-6065925	E-309142 N-6066999 E-309089 N-6066947	
	E-309199 N-6066994	E-309081 N-6066955	
	E-309143 N-6066979	E-307133 N-6066734	
African daisy	E-309115 N-6066923		one plant here and another in channel edge (West of and adjacent W819)
Aleppo pine	E- 309311 N- 6066860		one plant, cut and swab
Tall Wheat-grass	E-309458 N-6065925 E-309288 N-6066857 E-309223 N-6066920	E-309024 N-6067034 E-309094 N-6066931	

15. RECOMMENDED SITE MANAGEMENT ACTIONS

15.1 INFILL PLANTING

Within the first 1-2 years focus on enhancing the diversity and abundance of native species present on the site through active revegetation. The second phase, years 3-5, is to focus on increasing the abundance of native species through encouraging natural regeneration. The present species diversity is good for revegetation sites and without any further revegetation this site could be expected to continue to improve in native species cover and diversity (on a unit area basis), albeit over a slower timeframe.

The revegetation species and planting density recommendations are a guide only as there is a lack of nearby representative remnant vegetation on which to base these recommendations. The species and numbers are based on the ecosystem type as guided by the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014).

15.1.1 Duma florulenta shrubland

This ecosystem best matches the Duma florulenta shrubland ecosystem described in the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014), aside from not having any Lignum present and not being suitable for Eucalyptus camaldulensis ssp. camaldulensis. The fresh water influence of this ecosystem extends from the adjacent artificial channel and is therefore similar. Little management is required for these areas with planting limited to trying a few Duma florulenta on the higher fresh areas.

Table 33: Revegetation Species for Duma florulenta shrubland Ecosystem Type at Shadows West Site (plants per polygon)

Species	Common Name	W802 0.03ha	W827 4.47ha	Total
Duma florulenta	lignum	3	447	450

The dense salt-water couch may impact on establishment, although the site is very wet and water stress for seedlings is unlikely. Brush-cut a 1m diameter spot in the salt-water couch to prepare planting site and reduce smothering.

15.1.2 Samphire swamp

A reasonable species diversity and density already exist for the Samphire Swamp ecosystems present at the Shadows West Site. As per personal communication with Richard Owen and reference to the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014) it is considered that the samphire species *Tecticornia arbuscula* is under represented for these ecosystems and is a key structural species. Plant the following species in more open areas towards the edges and higher sections of the samphire swamp.

Species	Common Name	W801 21.72ha	W806 0.01ha	W809 0.01ha	W810 0.01ha
Tecticornia arbuscula	shrubby samphire	2,172	1	1	1
Atriplex paludosa ssp. paludosa	marsh saltbush	1,086	1	1	1
Lawrencia squamata	thorny lawrencia	2,172	1	1	1
Maireana oppositifolia	salt bluebush	4,344	2	2	2
	Totals (9,789)	9,774	5	5	5

Table 34: Revegetation Species for Samphire Swamp Ecosystem Type at Shadows West Site (plants per polygon)

15.1.3 Samphire Swamp + Melaleuca halmaturorum Shrubland

Melaleuca halmaturorum is becoming well established in this ecosystem type, from 1-5 year plantings, opportunity exists to infill with understorey species in to the annual grass areas between the *M. halmaturorum*. Plant smaller species such as *Atriplex semibaccata*, *Disphyma crassifolium ssp. clavellatum*, *Threlkeldia diffusa* in groups at 1m spacing. Plant the rest of the shrub species at 3m spacing.

W814 has dense areas of Melaleuca halmaturorum cover and will be difficult to establish seedlings under. Do not plant this polygon.

W807, W821 and W826 have not previously been planted, it is however proposed to plant these areas completely to this ecosystem type.

Table 35: Revegetation Species for Samphire Swamp + Melaleuca halmaturorum Shrubland Ecosystem Type at Shadows West Site (plants per polygon)

Species	Common Name	W807 0.15ha	W812 0.21ha	W813 0.09ha	W815 0.43ha	W818 0.08ha	W821 0.21ha	W822 0.49ha	W824 0.12ha	W826 0.32ha
Atriplex paludosa ssp. paludosa	marsh saltbush	15	21	9	43	8	21	49	12	32
Atriplex semibaccata	berry saltbush	15	21	9	43	8	21	49	12	32
Disphyma crassifolium ssp. clavellatum	round-leaf pigface	15	21	9	43	8	21	49	12	32
Enchylaena tomentosa var. tomentosa	ruby saltbush	15	21	9	43	8	21	49	12	32

Species	Common Name	W807 0.15ha	W812 0.21ha	W813 0.09ha	W815 0.43ha	W818 0.08ha	W821 0.21ha	W822 0.49ha	W824 0.12ha	W826 0.32ha
Lawrencia squamata	thorny lawrencia	15	21	9	43	8	21	49	12	32
Maireana oppositifolia	salt bluebush	15	21	9	43	8	21	49	12	32
Melaleuca halmaturorum	swamp paper-bark	150	0	0	0	0	210	0	0	320
Nitraria billardierei	nitre-bush	15	21	9	43	8	21	49	12	32
Rhagodia candolleana ssp. candolleana	sea-berry saltbush	15	21	9	43	8	21	49	12	32
Threlkeldia diffusa	coast bonefruit	15	21	9	43	8	21	49	12	32
	Totals (2,570)	285	189	81	387	72	399	441	108	608

Adopt a 'bushcare-type' management of the site, with the aim of encouraging natural regeneration of the planted and naturally occurring native species. This should focus on spot spraying annual weeds in rings up to 1m radius around plants that are setting seed / fruit in early winter.

Monitor and control tall Wheat-grass occurring extensively in these areas, along with scattered individuals and patches across W803 and W815. Monitor and control other significant weeds as required.

15.1.4 Eucalyptus porosa grassy woodland

Polygons W803, W804, W805, W816, W817, W819, W820, W823, W825 have not previously been planted.

Polygon W811 has been planted in the last year. Polygon W811 should be left to establish for a couple of years to allow the tree and shrub species to establish prior to planting understorey species.

Create an open woodland structure with a grassy tussock, sedge and herb understorey. Plant grass, sedge herb and smaller species in groups at 1m spacing and medium shrub and ground cover spreading plants at 3m spacing. Place climbing species throughout, near tree species as structure to grow on.

In the first couple of years, only plant canopy and large shrub species in the areas not already established to these. Follow up with infill of understorey species.

Species	Common Name	W803 0.01ha	W804 0.11ha	W805 0.10ha	W816 0.16ha	W817 0.08ha	W819 0.29ha	W820 0.13ha	W823 1.39ha	W825 0.06ha
Acacia paradoxa	kangaroo thorn	1	11	10	16	8	29	13	139	6
Allocasuarina verticillata	drooping Sheoak	2	22	20	32	16	58	26	278	12
Austrostipa elegantissima	feather spear-grass	2	17	15	24	12	44	20	209	9
Austrostipa flavescens	coast spear-grass	2	17	15	24	12	44	20	209	9
Billardiera cymosa ssp. cymosa	sweet apple-berry	2	22	20	32	16	58	26	278	12
Bursaria spinosa ssp. spinosa	sweet bursaria	2	22	20	32	16	58	26	278	12
Callitris gracilis	southern Cypress pine	1	11	10	16	8	29	13	139	0
Carpobrotus rossii	native pigface	1	11	10	16	8	29	13	139	6
Clematis microphylla	old man's beard	2	22	20	32	16	58	26	278	12
Dianella brevicaulis	short-stem flax-lily	5	55	50	80	40	145	65	695	30
Enchylaena tomentosa var. tomentosa	ruby saltbush	2	22	20	32	16	58	26	278	12
Eucalyptus diversifolia ssp. diversifolia	coastal white mallee	1	6	5	8	4	15	7	70	0
Eucalyptus porosa	mallee box	1	6	5	8	4	15	7	70	3
Ficinia nodosa	knobby club-rush	1	11	10	16	8	29	13	139	6
Kennedia prostrata	running postman	2	22	20	32	16	58	26	278	12

Table 36: Revegetation Species for Eucalyptus porosa grassy woodland Ecosystem Type at Shadows West Site (plants per polygon)

Species	Common Name	W803 0.01ha	W804 0.11ha	W805 0.10ha	W816 0.16ha	W817 0.08ha	W819 0.29ha	W820 0.13ha	W823 1.39ha	W825 0.06ha
Kunzea pomifera	Muntries	2	22	20	32	16	58	26	278	12
Lomandra effusa	scented mat-rush	3	28	25	40	20	73	33	348	15
Muehlenbeckia gunnii	coastal climbing lignum	1	11	10	16	8	29	13	139	6
Myoporum insulare	common boobialla	1	6	5	8	4	15	7	70	3
Rhagodia candolleana ssp. candolleana	sea-berry saltbush	1	11	10	16	8	29	13	139	6
Rytidosperma caespitosum	common wallaby-grass	10	110	100	160	80	290	130	1390	60
Vittadinia australasica var. australasica	sticky New Holland daisy	1	11	10	16	8	29	13	139	6
Vittadinia cuneata var. cuneata	fuzzy new Holland daisy	2	22	20	32	16	58	26	278	12
	Totals (10,491)	48	498	450	720	360	1,308	588	6,258	261

Adopt a 'bushcare-type' management of the site, with the aim of encouraging natural regeneration of the planted and naturally occurring native species. This should focus on spot spraying annual weeds in rings up to 1m radius around plants that are setting seed / fruit in early winter.

Monitor and control tall wheat-grass occurring extensively in these areas, along with scattered individuals and patches across W803. Monitor and control other significant weeds including African boxthorn and Aleppo pine.

15.2 PEST ANIMAL AND WEED RECOMMENDATIONS

Table 37: Pest animal and weed recommendations

Туре	Task
African boxthorn	Cut and swab African boxthorn and monitor and control for further occurances.
African daisy	One plant recorded in polygons another seen edge of channel. Cut and swab to remove. Ongoing monitoring for others.
Aleppo pine	One plant recorded. Cut and swab to remove. Ongoing monitoring for others.
Tall wheat-grass	Spray when actively growing. Brush-cut plants and spot spray re-growth, care will need to be taken to avoid off-target damage where weeds are growing close to native plants.
	Tall wheat-grass is showing up as a problem on a number of the sites on Wyndgate. A broader plan (with onground action) should be developed to manage Tall Wheat-grass at Wyndgate, in both existing revegetation sites and at areas to be revegetated. Tall Wheat-grass will pose a significant future issue for both biodiversity and fire risk on Wyngate if it is not managed in revegetation areas.
Fox	Monitor for and control fox at the site and across Wyndgate. A number of signs of fox were observed.

Wyndgate Property Revegetation Site Assessment

Site Name: Mundoo Paddock

Location: Wyndgate

Site Surveys completed: November 2015

Assessment submitted: November 2015

Author

Bill New – New Environmental Pty Ltd




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17. PLAN DETAILS

Table 38: Contact details relevant to this plan

PlanID: Plan Name	Mundoo Paddock
SiteID: Site Name	Mundoo Paddock
Landholder &/or Manager	Stuart Hicks
Landholder Contact	Mobile: 0428 168 626
Size of planting area	23 hectares (mapped plan area)
Planning Contact	Chris Butcher: 0457 509 154 or chris.butcher@sa.gov.au
Ops Contact	Mark Phillips: 0427 192 060 or Email: Mark.Phillips4@sa.gov.au

17.1 PLAN OVERVIEW

17.1.1 Access

The site can be accessed from the western side of the site off Murray Mouth Road via a locked gate (DEWNR key) (Map 6). There is also access from the eastern side off Mundoo Channel Drive through a narrow unlocked gate that enters the site from the dirt carpark opposite the boat ramp, this may have limited access as the track has been planted across. Another gate, further south off Mundoo Channel Drive follows the power lines in across the samphire wetland, this gate is locked. Vehicle access within the site is good with a network of tracks that provide all weather access throughout the flat part of the site.

17.1.2 Land use

The site is part of the Wyndgate property (**Error! Reference source not found.**) which is used for conservation and cattle grazing. The restoration ite has been fenced from stock and progressively revegetated over a number of years, with the oldest plantings being the *Melaleuca* halmaturorum plantings along the perimeter of the samphire zones and more recent plantings on the loamy flats and sandy dune areas.

17.1.3 Site Mapping

Mapping of ecosystem polygons for the site was developed from on-ground mapping of landscape features and ecosystems present, both natural and planted (Map 7). Further consideration of ecosystem types was developed using the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014).

17.2 ACCESS MAP



Map 6: Mundoo Paddock site access





Map 7: Mundoo Paddock and Greys Paddock sites boundary with ecosystem polygons

19. ECOSYSTEM DESCRIPTIONS

Table 39: Ecosystems identified at Mundoo Paddock

Polygon	Total hectares	Species	Notes
W401 W402 W407	3.36 1.66 2.24	Tecticornia sp. +/- Suaeda australis, Frankenia pauciflora Disphyma crassifolium ssp. clavellatum, Distichlis distichophylla.	Low lying naturally occurring samphire swamp. Some revegetation has occurred on the edges of these polygons and slightly higher areas.
W403 W408 W412	0.09 0.35 1.93	Melaleuca halmaturorum over introduced annual grasses +/- Tecticornia sp., Atriplex paludosa ssp. paludosa, Threlkeldia diffusa, Suaeda australis, Maireana oppositifolia, Lawrencia squamata.	Dense Melaleuca halmaturorum plantings on narrow edge around samphire swamp. Melaleuca halmaturorum plantings established >5yrs, understorey species planted since then.
W405 W409	5.96 0.31	Allocasuarina verticillata +/- Eucalyptus porosa, Eucalyptus diversifolia ssp. diversifolia, Eucalyptus incrassata, Callitris gracilis. With Acacia longifolia var. sophorae, Dodonaea viscosa spp., Myoporum insulare and Bursaria spinosa.	Broad scale revegetation of ex-paddock area with middle and overstorey plantings established >5yrs with newer understorey and infill plantings.
W404	4.20	Acacia longifolia sophorae var. sophorae, Leucopogon parviflorus, Olearia axillaris coastal shrubland.	Occurring on low dunes to the southeast of Mundoo Paddock. Key dune species occurring naturally. Some revegetation with tube stock has been carried out over the last couple of years 2014 – 2015.
W406 W410 W411	0.52 0.17 2.12	Introduced annual grasses. Scattered Enchylaena tomentosa.	Unplanted patch.

19.1 ECOYSTEMS FOUND IN THE SITE

19.1.1 Samphire swamp - polygons W401, W402, W407

Table 40: Plant density in each samphire swamp polygon at Mundoo Paddock site (Photo 15)

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W401	3.36	Atriplex paludosa ssp. paludosa	Marsh saltbush	<10	Planted on edges
W402	1.66	Atriplex semibaccata	Berry saltbush	<10	Naturally occurring on higher ground and edges
W407	2.24	Disphyma crassifolium ssp. clavellatum	Round-leaf pigface	100	Naturally occurring on higher ground and edges
		Distichlis distichophylla	Emu-grass	1000	Naturally occurring on higher ground and edges
		Frankenia pauciflora	Southern sea-heath	1000	Naturally occurring
		Juncus kraussii	Sea rush	100	Couple of patches
		Lawrencia squamata	Thorny lawrencia	20	Planted on edges
		*Limonium companyonis	Sea-lavender		WEED
		Maireana oppositifolia	Salt bluebush	100	Naturally occurring and planted on edges
		Melaleuca halmaturorum	Swamp paper-bark	<10	Planted sparsely
		*Parapholis incurva	Curly ryegrass		WEED
		Puccinellia stricta	Australian saltmarsh- grass	5000- 10,000	Naturally occurring, scattered across lower lying areas
		Samolus repens	Creeping brookweed	1000	Naturally occurring
		Sarcocornia quinqueflora	Samphire	10,000	Naturally occurring
		Suaeda australis	Austral seablite	1000	Naturally occurring
		Tecticornia arbuscula	Shrubby samphire	10	Planted on edges
		Tecticornia indica ssp. leiostachya	Brown-head samphire	10,000	Naturally occurring
		Wilsonia backhousei	Narrow-leaf wilsonia	1000	Naturally occurring

* introduced species



Photo 15: Samphire Shrubland at Mundoo Paddock (polygon W401)

19.1.2 Samphire swamp + Melaleuca halmaturorum Shrubland - polygons W403, W408, W412

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W403	0.09	*Aeonium arboreum	Tree aeonium		WEED
		Atriplex paludosa ssp. paludosa	Marsh saltbush	20	Planted, scatterred patches
W408	0.35	Atriplex semibaccata	Berry saltbush	<10	Naturally occurring
W412	1.93	Austrostipa stipoides	Coast spear-grass	1000	Naturally occurring, dense patches
		*Brassica tournefortii	Wild turnip		WEED
		*Bromus diandrus	Great brome		WEED
		Carpobrotus rossii	Native pigface	<10	Planted
		Disphyma crassifolium ssp. clavellatum	Round-leaf pigface	10	Naturally occurring
		Distichlis distichophylla	Emu-grass	100	Naturally occurring in patches
		Enchylaena tomentosa var. tomentosa	Ruby saltbush	100	Naturally occurring
		Frankenia pauciflora var. gunnii	Southern sea-heath	10	Naturally occurring
		Gahnia filum	Chaffy saw-sedge	20	Planted in patches in lower areas
		*Hordeum marinum	Sea barley-grass		WEED
		*Lagurus ovatus	Hare's tail grass		WEED
		Lawrencia squamata	Thorny lawrencia	10	Planted, scattered
		*Limonium companyonis	Sea-lavender		WEED
		*Lolium rigidum	Wimmera ryegrass		WEED
		*Lycium ferocissimum	African boxthorn		WEED
		Maireana oppositifolia	Salt bluebush	20	Planted, few patches
		*Marrubium vulgare	Horehound		WEED
		*Medicago sp.			WEED
		Melaleuca halmaturorum	Swamp paper-bark	2000	Planted
		*Melilotus indicus	King Island melilot		WEED
		Myoporum insulare	Common boobialla	<10	Planted

Table 41: Plant density in each samphire swamp + Melaleuca halmaturorum Shrubland polygon (Photo 16) at Mundoo Paddock site

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
		*Plantago coronopus ssp. coronopus	Bucks-horn plantain		WEED
		Rhagodia candolleana ssp. candolleana	Sea-berry saltbush	<10	Naturally occurring
		*Sonchus oleraceus	Common sow-thistle		WEED
		Spergularia marina	Salt sand-spurrey		
		Suaeda australis	Austral seablite	100	Naturally occurring
		Tecticornia arbuscula	Shrubby samphire	50	Planted
		Tecticornia indica ssp. leiostachya	Brown-head samphire		See Tecticornia sp.
		Tecticornia pergranulata ssp. pergranulata	Black-seed samphire		See Tecticornia sp.
		Tecticornia sp.		500	Naturally occurring
		Threlkeldia diffusa	Coast bonefruit	100	Naturally occurring
		Wilsonia humilis	Silky wilsonia	<10	Naturally occurring in lower lying areas

* introduced species



Photo 16: Samphire + Melaleuca halmaturorum Shrubland swamp at Mundoo Paddock (polygon W412)

19.1.3 Eucalyptus diversifolia ssp. diversifolia Mallee - polygons W405, W409

The ecosystem type that best matches the revegetation species present at this site is *Eucalyptus diversifolia* ssp. *diversifolia* Mallee (Photo 17). Based on the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014) and considering the sandy loam over clay soil type with strong coastal and saline influences, this site would best be restored to a *Allocasuarina verticillata* woodland / *Eucalyptus porosa* grassy woodland with strong Coastal Shrubland vegetation influence.

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W405	5.96	Acacia cupularis	Cup wattle	100	Planted
14400	0.01	Acacia dodonaeifolia	Hop-bush wattle	100	Planted
W409	0.31	Acacia longifolia ssp. sophorae	Coastal wattle	100	Planted in groups
		Acacia paradoxa	Kangaroo thorn	50	Planted
		Acacia pycnantha	Golden wattle	20	Planted generally salt burnt
		Allocasuarina verticillata	Drooping sheoak	500	Planted
		Atriplex semibaccata	Berry saltbush	<10	Planted
		Austrostipa sp.		100	Planted in groups of 30-40
		Billardiera cymosa ssp. cymosa	Sweet apple-berry	<10	Planted
		*Brassica tournefortii	Wild turnip		WEED
		*Bromus diandrus	Great brome		WEED
		Bursaria spinosa ssp. spinosa	Sweet bursaria	50	Planted
		Callitris gracilis	Southern cypress pine	100	Planted in groups
		Carpobrotus rossii	Native pigface	<10	Planted few individuals
		*Chenopodium murale	Nettle-leaf goosefoot		WEED
		*Cynodon dactylon var. dactylon	Couch		WEED patches
		Dianella brevicaulis	Short-stem flax-lily	<10	Planted
		Dodonaea baueri	Crinkled hop-bush	<10	Planted
		Enchylaena tomentosa var. tomentosa	Ruby saltbush	10	Planted
		Eucalyptus diversifolia ssp. diversifolia	Coastal white mallee	200	Planted

Table 42: Plant density in each Allocasuarina verticillata woodland / Eucalyptus porosa grassy woodland polygon at Mundoo Paddock site

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
		Eucalyptus fasciculosa	Pink gum	<10	Planted
		Eucalyptus incrassata	Ridge-fruited mallee	100	Planted
		Eucalyptus porosa	Mallee box	500	Planted
		*Euphorbia terracina	False caper		WEED
		Ficinia nodosa	Knobby club-rush	20	Planted small groups
		*Galenia pubescens var. pubescens	Coastal galenia		WEED
		Hakea mitchellii	Heath needlebush	50	Planted
		*Hordeum leporinum	Wall barley-grass		WEED
		*Hypochaeris radicata	Rough cat's ear		WEED
		*Lagurus ovatus	Hare's tail grass		WEED
		*Leptospermum laevigatum	Coast tea-tree		WEED
		Leucophyta brownii	Coast cushion bush	20	Planted
		Leucopogon parviflorus	Coast beard-heath	<10	Planted
		*Lolium rigidum	Wimmera ryegrass		WEED
		*Medicago sp.			WEED
		Melaleuca lanceolata	Dryland tea-tree	100	Planted in groups, younger ones salt burnt. Patches and band adjacent to M. halmaturorum zone
		Myoporum insulare	Common boobialla	100	Planted
		Myoporum parvifolium	Creeping boobialla	<10	Planted
		Pomaderris paniculosa ssp. paniculosa	Mallee pomaderris	10	Planted
		Olearia axillaris	Coast daisy-bush	50	Planted
		Pimelea serpyllifolia ssp. serpyllifolia	Thyme riceflower	100	Naturally occurring deeper sand areas
		*Plantago coronopus ssp. coronopus	Bucks-horn plantain		
		Poa poiformis var. poiformis	Coast tussock-grass	50	Planted close groups of 20-30
		*Reichardia tingitana	False sowthistle		WEED

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
		Rhagodia candolleana ssp. candolleana	Sea-berry saltbush	10	Planted
		Rytidosperma caespitosum	Common wallaby-grass	100	Naturally occurring
		Salsola australis	Buckbush	<10	Naturally occurring
		*Scabiosa atropurpurea	Pincushion		WEED
		*Sonchus oleraceus	Common sow-thistle		WEED
		Threlkeldia diffusa	Coast bonefruit	<10	Planted few individuals
		Vittadinia sp.		10	Planted small groups

* introduced species



Photo 17: Allocasuarina verticillata low woodland at Mundoo Paddock site (polygon W405)

19.1.4 Acacia longifolia sophorae var. sophorae, Leucopogon parviflorus, Olearia axillaris Coastal Shrubland - polygon W404

Table 43: Plant density in each Acacia longifolia sophorae var. sophorae, Leucopogon parviflorus, Olearia axillaris Coastal Shrubland polygon (Photo 18) at Mundoo Paddock site

Polygon	Total hectares	Species	Common Name	Density (plants / hectare)	Notes
W404	4.20	Acacia cupularis	Cup wattle	100	Planted
		*Acacia cyclops	Western coastal wattle		WEED Regenerating, monitor and follow up control. Has had previous control.
		Acacia longifolia ssp. sophorae	Coastal wattle	200	Planted and naturally occurring
		Acacia paradoxa	Kangaroo thorn	100	Naturally occurring
		Acacia pycnantha	Golden wattle	100	Planted
		*Acacia saligna	Golden wreath wattle		WEED, regenerating near dead adults. Monitor and follow up control.
		Acaena sp.		10	Naturally occurring
		Allocasuarina verticillata	Drooping sheoak	200	Planted
		Austrostipa drummondii	Cottony spear-grass	10	Naturally occurring
		*Avena barbata	Bearded oat		WEED, scattered across whole area
		*Bromus diandrus	Great brome		WEED spread across whole area
		Bursaria spinosa ssp. spinosa	Sweet bursaria	100	Planted
		Callitris gracilis	Southern cypress pine	100	Planted
		Carpobrotus rossii	Native pigface	10	Planted
		Dianella brevicaulis	Short-stem flax-lily	20	Naturally occurring
		Dodonaea viscosa ssp. spatulata	Sticky hop-bush	100	Planted
		*Ehrharta villosa var. maxima	Pyp grass		WEED spread across whole area
		Eucalyptus diversifolia ssp. diversifolia	Coastal white mallee	100	Planted
		Eucalyptus incrassata	Ridge-fruited mallee	100	Planted
		*Euphorbia terracina	False caper		WEED

Polygon	Total hectares	Species	Common Name	Density (plants / hectare)	Notes
		Exocarpos syrticola	Coast cherry	10	Naturally occurring
		Ficinia nodosa	Knobby club-rush	100	Planted and naturally occurrring and regenerating vegetatively
		*Gazania linearis	Gazania	1	WEED. Only one observed
		Geranium potentilloides var. potentilloides	Downy geranium	1000	Naturally occuring
		Kunzea pomifera	Muntries	10	Planted
		*Lagurus ovatus	Hare's tail grass		WEED spread across whole area
		Leucophyta brownii	Coast cushion bush	10	Planted
		Leucopogon parviflorus	Coast beard-heath	50	Naturally occurring, regenerating
		Lomandra effusa	Scented mat-rush	100	Naturally occurring, scattered groups on dunes
		Lomandra sp.		1	Naturally occurring
		*Medicago sp.		1	Weed spread across whole area
		Melaleuca lanceolata	Dryland tea-tree	200	Planted
		*Melilotus indicus	King Island melilot		WEED spread across whole area
		Myoporum insulare	Common boobialla	200	Planted and naturally occurring
		*Oenothera stricta ssp. stricta	Common evening primrose		WEED scatterred across whole area
		Olearia axillaris	Coast daisy-bush	100	Planted and naturally occurring
		Pimelea serpyllifolia ssp. serpyllifolia	Thyme riceflower	500	Naturally occurring
		*Plantago coronopus ssp.	Bucks-horn plantain		WEED patches across whole area
		*Reichardia tingitana	False sowthistle		WEED spread across whole area
		Rhagodia candolleana ssp. candolleana	Sea-berry saltbush	100	Planted and naturally occurring
		*Scabiosa atropurpurea	Pincushion		WEED spread across whole area
		Scaevola crassifolia	Cushion fan flower	10	Planted
		*Sonchus oleraceus	Common sow-thistle		WEED scattered throughout
		Spinifex hirsutus	Rolling spinifex	50	Planted

Polygon	Total hectares	Species	Common Name	Density (plants / hectare)	Notes
		Threlkeldia diffusa	Coast bonefruit	100	Naturally occurring
		Xanthorrhoea sp.		5	Planted

* introduced species



Photo 18: Acacia longifolia sophorae var. sophorae, Leucopogon parviflorus, Olearia axillaris Coastal Shrubland at Mundoo Paddock site (polygon W404)

19.2 PEST ANIMALS AND WEEDS

Table 44: Pest animal and weeds present at the site

Species	Common Name	Polygon	Cover	Notes
Acacia cyclops	Western coastal wattle	W404	<1%	Regenerating near dead adults.
Acacia saligna	Golden wreath wattle	W404	<1%	Regenerating near dead adults, also present on roadside.
Aeonium arboreum	Tree aeonium	W408	<1%	Only a couple extending in from Mundoo Channel Drive
Ehrharta villosa	Pyp grass	W404	<1%	Slashed and managed through edge and denser to the south into the dunes, also dense in dunes south of W405
Galenia pubescens var. pubescens	Coastal galenia	W405	<1%	
Gazania linearis	Gazania	W404	<1%	Only one recorded. Likely others.
Leptospermum laevigatum	Coast tea-tree	W405	<1%	
Lycium ferocissimum	African boxthorn	W408	<1%	
Marrubium vulgare	Horehound	W408	<1%	Only one recorded. Likely others.
Lepus europaeus	Hare		2 observed	

In addition to the above pest plants, introduced annual grasses and broadleaf weeds were present throughout the site. These may prevent natural regeneration but are not considered high threat pest plants and should only be controlled as part of the revegetation actions outlined in the following section.

20. RECOMMENDED SITE MANAGEMENT ACTIONS

20.1 INFILL PLANTING

Within the first 1-2 years focus on enhancing the diversity and abundance of native species present on the site through active revegetation. The second phase, years 3-5, is to focus on increasing the abundance of native species through encouraging natural regeneration. The present species diversity is good for revegetation sites and without any further revegetation this site could be expected to continue to improve in native species cover and diversity (on a unit area basis), albeit over a slower timeframe.

The revegetation species and planting density recommendations are a guide only as there is a lack of nearby representative remnant vegetation on which to base these recommendations. The species and numbers are based on the ecosystem type asguided by the ('Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014).

20.1.1 Samphire swamp

A relatively high species diversity and density already exist for the samphire swamp ecosystems present at the Mundoo Paddock Site. As per personal communication with Richard Owen and reference to the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014) it is considered that the samphire species *Tecticornia arbuscula* is under represented on the site and is a key structural species for these ecosystems.

Table 45: Revegetation species for samphire swamp polygons

Species	Common Name	W401 3.36ha	W402 1.66ha	W407 2.24ha	Total
Tecticornia arbuscula	Shrubby samphire	1 680	830	1 120	3,630

Ongoing management of the samphire swamp ecosystem at Mundoo Paddock will be limited. Monitor and control African boxthorn and tree aeonium (both occurring in adjacent ecosystem) and other significant weed as required.

The northern patches of samphire swamp in this site, W409 and W407 appear to be cut off from natural inundation from the Mundoo Channel by the Mundoo Channel Drive. Assessing this and reinstating though suitable structures could assist in further natural recovery of this ecosystem.

20.1.2 Samphire Swamp + Melaleuca halmaturorum Shrubland

Melaleuca halmaturorum is well established in this ecosystem type, opportunity exists to infill with understorey species in to the annual grass areas between the M. halmaturorum. Plant smaller species such as Atriplex semibaccata, Disphyma crassifolium ssp. clavellatum and

Threlkeldia diffusa in groups at 0.5-1 m spacing. Plant the rest of the shrub species 2-3 m spacing and scatter individuals of Myoporum insulare across the area.

Table 46: Revegetation species for Samphir	Swamp + Melaleuca halmaturorum polygons
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Species	Common Name	W403 0.09 ha	W408 0.35 ha	W412 1.93 ha
Atriplex paludosa ssp. paludosa	Marsh saltbush	0	35	193
Atriplex semibaccata	Berry saltbush	0	70	386
Disphyma crassifolium ssp. clavellatum	Round-leaf pigface	0	70	386
Enchylaena tomentosa var. tomentosa	Ruby saltbush	0	35	193
Lawrencia squamata	Thorny lawrencia	0	35	193
Maireana oppositifolia	Salt bluebush	0	70	386
Myoporum insulare	Common boobialla	0	35	193
Rhagodia candolleana ssp. candolleana	Sea-berry saltbush	0	35	193
Suaeda australis	Austral seablite	0	70	386
Tecticornia arbuscula	Shrubby samphire	0	175	965
Threlkeldia diffusa	Coast bonefruit	0	35	193
	Totals (4,332)	0	665	3667

Adopt a 'bushcare-type' management of the site, with the aim of encouraging natural regeneration of the planted and naturally occuring native species. This should focus on spot spraying annual weeds in rings up to 1 m radius around plants that are setting seed / fruit in early winter.

Monitor and control African boxthorn and tree aeonium and other significant weeds as required.

As with the northern patches of samphire swamp being cut off from natural inundation from the Mundoo Channel by the Mundoo Channel Drive. The samphire swamp + Melaleuca halmaturorum Shrubland would also benefit from reinstating natural hydrological process to assist in further natural recovery of this ecosystem.

20.1.3 Allocasuarina verticillata woodland / Eucalyptus porosa grassy woodland

The canopy and medium to large shrubs layers are well established in the older revegetation areas and are establishing well, where more recently planted. Opportunity exists to infill with understorey species in to the annual grass areas between the shrub and canopy layers.

Plant grass, sedge herb and smaller species in groups at 0.5-1 m spacing and medium shrub and ground cover spreading plants at 2-3 m spacing. Place climbing species throughout, near established tree species as structure to grow on.

Note: W409 has Melaleuca lanceolata establishing at reasonable density so only recommending understorey species to be planted.

W406, W411 and W410 have not been previously planted, recommendations are in place for if and when they are to be planted. Leave W410 as an open area, have only recommended ground cover, sedge and grass species.

Table 47: Revegetation species fo	Allocasuarina verticillata woodland	/ Eucalyptus porosa 🤉	grassy woodland polygons
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Species	Common Name	W405 5.96 ha	W409 0.31 ha	W406 0.52 ha	W410 0.17 ha	W411 2.12 ha
Allocasuarina verticillata	Drooping sheoak	0	0	104	0	1060
Austrostipa elegantissima	Feather spear-grass	894	0	78	25.5	318
Austrostipa drummondii	Coast spear-grass	1192	0	104	34	424
Billardiera cymosa ssp. cymosa	Sweet apple-berry	1192	0	104	34	424
Bursaria spinosa ssp. spinosa	Sweet bursaria	0	0	52	0	424
Callitris gracilis	Southern Cypress pine	0	0	0	0	424
Carpobrotus rossii	Native pigface	1192	62	104	34	424
Clematis microphylla	Old man's beard	1192	62	104	34	424
Dianella brevicaulis	Short-stem flax-lily	2980	155	260	85	1060
Enchylaena tomentosa var. tomentosa	Ruby saltbush	1192	62	104	34	424
Eucalyptus diversifolia ssp. diversifolia	Coastal white mallee	0	0	26	0	212

Species	Common Name	W405 5.96 ha	W409 0.31 ha	W406 0.52 ha	W410 0.17 ha	W411 2.12 ha
Eucalyptus porosa	Mallee box	0	0	104	0	1060
Ficinia nodosa	Knobby club-rush	596	0	52	17	212
Kennedia prostrata	Running post-man	1192	0	0	34	424
Kunzea pomifera	Muntries	1192	0	0	34	424
Lomandra effusa	Scented mat-rush	1490	0	130	42.5	530
Melaleuca lanceolata	Dryland tea-tree	0	0	104	0	212
Muehlenbeckia gunnii	Coastal climbing lignum	596	31	52	0	212
Myoporum insulare	Common boobialla	0	0	104	0	1060
Poa poiformis var. poiformis	Coast tussock-grass	1192	62	104	34	424
Rhagodia candolleana ssp. candolleana	Sea-berry saltbush	596	31	52	17	212
Rytidosperma caespitosum	Common wallaby-grass	5960	0	520	170	2120
Threlkeldia diffusa	Coast bonefruit	0	31	52	0	0
Vittadinia australasica var. australasica	Sticky New Holland daisy	1192	0	104	34	424
Vittadinia cuneata var. cuneata	Fuzzy New Holland daisy	1192	0	104	34	424
	Totals (42,103)	25,032	496	2,522	697	13,356

Adopt a 'bushcare-type' management of the site, with the aim of encouraging natural regeneration of the planted and naturally occuring native species. This should focus on spot spraying annual weeds in rings up to 1 m radius around plants that are setting seed / fruit in early winter.

Monitor and control African boxthorn, false caper, coastal galenia and coast tea-tree and other significant weeds as required.

20.1.4 Acacia longifolia sophorae var. sophorae, Leucopogon parviflorus, Olearia axillaris Coastal Shrubland

This ecosystem type is a Coastal Shrubland as described in the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014). It has been partly planted with a mix of coastal dune tree, shrub and understorey species. The Hindmarsh Island Landcare Group (as per Richard Owen) wants to recreate a Coastal Shrubland Ecosystem on this area, whilst also providing a wind break to the neighbouring shacks.

The species recommended for revegetating this area reflect those suitable for Coastal Shrubland Ecosystem with addition of extra tree species to assist with providing the windbreak component for this site.

Plant grass, sedge herb and smaller species in groups at 0.5-1 m spacing and medium shrub and ground cover spreading plants at 2-3 m spacing. Place climbing species throughout, near established tree species as structure to grow on. Place tree species in single species groves of 10 plants at 3-5 m spacing.

Table 48: Revegetation species for Acacia longifolia sophorae var. sophorae, Leucopogon parviflorus, Olearia axillaris Coastal Shrubland polygons

Species	Common Name	W404 4.2ha
Acacia cupularis	Cup wattle	420
Acacia longifolia ssp. sophorae	Coastal wattle	840
Acacia pycnantha	Golden wattle	420
Allocasuarina verticillata	Drooping sheoak	840
Austrostipa drummondii	Cottony spear-grass	420
Billardiera cymosa ssp. cymosa	Sweet apple-berry	2,100
Callitris gracilis	Southern cypress pine	420
Carpobrotus rossii	Native pigface	840
Clematis microphylla	Old man's beard	840
Dianella brevicaulis	Short-stem flax-lily	4,200
Enchylaena tomentosa var. tomentosa	Ruby saltbush	420
Eucalyptus diversifolia ssp. diversifolia	Coastal white mallee	840
Eucalyptus incrassata	Ridge-fruited mallee	420
Ficinia nodosa	Knobby club-rush	4,200
Kennedia prostrata	Running post-man	840
Kunzea pomifera	Muntries	840
Leucophyta brownii	Coast cushion bush	1,260
Leucopogon parviflorus	Coast beard-heath	420
Lomandra effusa	Scented mat-rush	840
Melaleuca lanceolata	Dryland tea-tree	420
Myoporum insulare	Common boobialla	840
Olearia axillaris	Coast daisy-bush	840
Rhagodia candolleana ssp. candolleana	Sea-berry saltbush	840
Spinifex hirsutus	Rolling spinifex	840
Tetragonia implexicoma	Bower spinach	840
Threlkeldia diffusa	Coast bonefruit	840
	Total	26,880

Adopt a 'bushcare-type' management of the site, with the aim of encouraging natural regeneration of the planted and naturally occuring native species. This should focus on spot spraying annual weeds in rings up to 1 m radius around plants that are setting seed / fruit in early winter.

Monitor and control African boxthorn, golden wreath wattle, false caper, pyp grass, gazania and western coastal wattle and other significant weeds as required.

20.2 PEST ANIMAL AND WEED RECOMMENDATIONS

Table 49: Pest animal and weed recommendations

Туре	Task
Golden wreath wattle	Have been controlled in the past, ongoing monitoring and removal of recruits. Work towards removing plants in Mundoo Channel roadside adjacent shacks. See waypoints for recored plants. Drill and fill Golden Weath Wattle, hand pull or cut and swab smaller ones. Continue to monitor for and control any new plants. This is likely to be an on-going task that will need to be done at least every second year.
Western coastal wattle	Have been controlled in the past, ongoing monitoring and removal of recruits. Work towards removing plants in dune area. Cut, drill and fill larger plants, hand pull or cut and swab smaller ones. This is likely to be an on-going task that will need to be done at least every second year.
Tree aeonium	Manually remove and monitor for any regeneration adjacent to roadside. See waypoints for recored plants.
Pyp grass	Brush-cut plants and spot spray re-growth, plants are growing close to native plants so care will need to be taken to avoid off-target damage. Over time control the pyp grass edge southwards.
Gazania	Only one recorded, manually remove. Monitor for others and for any regeneration and spot spray. See waypoints for recored plant.
African boxthorn	Drill and fill African boxthorn, cut and swab smaller ones. Monitor for others present and continue to monitor for and control any new plants. This is likely to be an on-going task that will need to be done at least every second year. See waypoints for recored plants.
Horehound	Control isolated and small patches of horehound. Can be cut and swabbed, spot sprayed or grubbed out by hand. See waypoints points for recorded patch.
Hare	Monitor for and control hares at the site. A number of individuals were observed and damage to some seedlings was evident.

Wyndgate Property Revegetation Site Assessment

Site Name: Greys Paddock

Location: Wyndgate

Site Surveys completed: November 2015

Assessment submitted: November 2015

Author

Catherine Miles (Miles Environmental Consulting)







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22. PLAN DETAILS

Table 50: Contact details relevant to this plan

PlanID: Plan Name	Greys Paddock
SiteID: Site Name	Greys Paddock
Landholder &/or Manager	Stuart Hicks
Landholder Contact	Mobile: 0428 168 626
Size of planting area	20 hectares
Planning Contact	Chris Butcher: 0457 509 154 or chris.butcher@sa.gov.au
Ops Contact	Mark Phillips: 0427192060 or Email: Mark.Phillips4@sa.gov.au

22.1 PLAN OVERVIEW

22.1.1 Access

The site can be accessed on the eastern side from Murray Mouth Road via a locked gate (Map 8). There is also access from the paddock on the north side via an unlocked gate, however the track linking this to the other track systems has been planted over and a pile of mulch dumped. Within the site there is a network of tracks that are slashed as fire breaks and provide all weather access throughout the flat part of the site. An artificial channel limits access to and from the western and northern boundaries.

22.1.2 Landuse

The site is part of the Wyndgate property which is used for conservation and cattle grazing (**Error! Reference source not found.**). The restoration ite has been fenced from stock and progressively revegetated over a number of years, with the oldest plantings being the *Melaleuca* halmaturorum plantings along the perimeter of the samphire zones (Map 9).

22.2 SITE ACCESS MAP









Map 9: Greys Paddock and Mundoo Paddock sites boundary with ecosystem polygons

24. ECOSYSTEM DESCRIPTIONS

Table 51: Ecosystems identified at Greys Paddock

Polygon	Total hectares	Species	Notes
W100	0.61	Bolboschoenus caldwellii sedgeland over Distichlis distichophylla, Mimulus repens and Samolus repens	Artificial channel, all species occurring naturally
W101	0.60	Sarcocornia quinqueflora +/- Threlkeldia diffusa, Suaeda australis, Disphyma crassifolium ssp. clavellatum, Distichlis	Some revegetation has occurred in this polygon but width is narrow
W103	0.57	distichophylla	Not assessed
W104	2.34	_	Some revegetation has occurred in this polygon
W108	0.21	Melaleuca halmaturorum over introduced annual grasses	Sparse plantings, narrow zone
W112	1.09	and Sarcocornia quinqueflora	Established (>5yrs) plantings of M. halmaturorum
W110	1.37	_	Established (>5yrs) plantings of M. halmaturorum
W102	10.76	Eucalyptus diversifolia ssp. diversifolia, E. porosa, E. incrassata, Allocasuarina verticillata, Acacia longifolia var. sophorae, Dodonaea viscosa spp., Myoporum insulare	Established (>5yrs) middle and overstorey plantings with newer understorey and infill planting. Could also be E. porosa or A. verticillata woodlands. Dianella brevicaulis and Ficinia nodosa spreading and Pimelea serpyllifolia
W107	0.03	Introduced annual grasses	Unplanted patch
W111	0.07	Introduced annual grasses	Unplanted patch
W105	0.11	Introduced annual grasses	Unplanted patch
W109	0.02	Introduced annual grasses	Unplanted patch
W106	1.79	Allocasuarina verticillata +/- C. gracilis, E. incrassata, Eucalyptus sp., Acacia pycnantha, A. paradoxa, Dodonaea viscosa ssp. cuneata	More recent planting (2011 / 2012)

24.1 ECOYSTEMS FOUND IN THE SITE

24.1.1 Channel Ecosystem - polygon W100

This ecosystem type (Photo 19) is not described in Jellinek and Te, 2014.

Table 52: Species present in polygon W 100

Polygon	Total hectares	Species	Common Name	Notes
W100	0.61	Bolboschoenus caldwellii	Salt club-rush	Naturally occurring
		Pennisetum clandestinum*	Kikuyu grass	Naturally occurring
		Phragmites australis	Common reed	Naturally occurring
		Mimulus repens	Creeping monkey-flower	Naturally occurring
		Schoenoplectus pungens	Spiky club-rush	Naturally occurring
		Suaeda australis	Austral seablite	Naturally occurring
		Distichlis distichophylla	Emu-grass	Naturally occurring
		Juncus kraussii	Sea rush	Naturally occurring
		Samolus repens	Creeping brookweed	Naturally occurring

*Introduced species



Photo 19: Channel ecosystem type

24.1.2 Samphire Swamp - polygons W101, W103 and W104

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W101	0.60	Atriplex paludosa ssp. paludosa	Marsh saltbush	<10	Planted on margins in W101 and W103, 10% of ecosystem density
W103	0.57	Atriplex semibaccata	Berry saltbush	<10	Naturally occurring?
W104	2.34	Cotula vulgaris var. australasica	Slender cotula	<10 (in patches)	Naturally occurring
		Disphyma crassifolium ssp. clavellatum	Round-leaf pigface	100	Planted in W103, 10% of ecosystem density
		Distichlis distichophylla	Emu-grass	Patches	Naturally occurring
		Enchylaena tomentosa	Ruby saltbush	<10	Naturally occurring
		Frankenia pauciflora	Southern sea-heath	1000	Naturally occurring
		Gahnia filum	Thatching grass	<10, patches	Planted in W103
		Maireana oppositifolia	Salt bluebush	<10	Planted in W103 in patches at approx. 1000/ha
		Melaleuca halmaturorum	Swamp paper-bark	<10	Planted sparsely in W101 and W103
		Puccinellia stricta	Saltmarsh-grass	Patches	Naturally occurring
		Samolus repens	Creeping brookweed	1000	Naturally occurring
		Sarcocornia quinqueflora	Samphire	10,000	Naturally occurring
		Suaeda australis	Austral seablite	1000	Naturally occurring
		Tecticornia arbuscula	shrubby samphire	<10	Planted and naturally occurring
		Threlkeldia diffusa	Coast bonefruit	<10	Naturally occurring
		Wilsonia backhousei	Narrow-leaf wilsonia	Patches	Naturally occurring
		Wilsonia humilis	Silky wilsonia	Patches	Naturally occurring

Table 53: Native plant density in each samphire swamp polygon (Photo 20) at Greys Paddock site



Photo 20: samphire shrubland at Greys Paddock (polygon W104)

24.1.3 Samphire + Melaleuca halmaturorum shrubland swamp - polygons W108, W110 and W112

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W108	0.21	Atriplex paludosa ssp. paludosa	Marsh saltbush	<10	Patchy planting
W110	1.37	Atriplex semibaccata	Berry saltbush	<10	Planted?
		Carpobrotus rossii	Native pigface	<10	Planted?
W112	1.09	Cynodon dactylon var. dactylon*	Couch	Sparse	Weed
		Dianella brevicaulis	Short-stem flax-lily	<10	Planted?
		Distichlis distichophylla	Emu-grass	Patches	Naturally occurring
		Enchylaena tomentosa	Ruby saltbush	<10	Planted with natural regeneration
		Exocarpos sparteus	Slender cherry	1	
		Frankenia pauciflora var.	Southern sea-heath	<10	Naturally occurring
		Kennedia prostrata	Scarlet runner	Patch	Planted? Occurs in eastern 110
		Kunzea pomifera	Muntries	Patch	Planted? Occurs in eastern 110
		Lawrencia squamata	Thorny lawrencia	1	Natural
		Melaleuca halmaturorum	Swamp paper-bark	3000	Planted, flowering
		Myoporum insulare	Common boobialla	1	Planted
		Pennisetum clandestinum*	Kikuyu grass	Patches	Weed
		Pimelea serpyllifolia ssp. serpyllifolia	Thyme riceflower	<10	Naturally occurring
		Rhagodia candolleana ssp. candolleana	Sea-berry saltbush	<10	Planted
		Sarcocornia quinqueflora	Samphire	Patches	N
		Suaeda australis	Austral seablite	<10	Ν
		Threlkeldia diffusa	Coast bonefruit	<100	Edges

Table 54: Plant density in each samphire + Melaleuca halmaturorum shrubland swamp polygon (Photo 21) at Greys Paddock site



Photo 21: samphire + Melaleuca halmaturorum shrubland swamp at Greys Paddock (polygon W110, adjoining western channel zone)
24.1.4 Eucalyptus diversifolia mallee - polygons W102

The ecosystem type that best matches the revegetation species present at this polygon is *E. diversifolia* mallee (Photo 22). Based on the 'Site Planners Guide' (Jellinek and Te, 2014) Ecosystem Types, soil types (sand over clay with saline influence) and proximity to the coast, this site would best be restored to an A. verticillata woodland with influences from *E. porosa* grassy woodland and coastal shrubland.

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W102	10.76	Acacia dodonaeifolia	Hop-bush wattle	100	Southern plants salt and/or wind affected
		Acacia longifolia ssp. sophorae	Coastal wattle	<10	
		Acacia paradoxa	Kangaroo thorn	50	
		Acacia pycnantha	Golden wattle	50	Southern plants salt and/or wind affected
		Allocasuarina verticillata	Drooping sheoak	1000	
		Atriplex semibaccata	Berry saltbush	<10	Patches
		Austrostipa sp.	Spear-grass	1	Patches
		Billardiera cymosa ssp. cymosa	Sweet appleberry	20	
		Bursaria spinosa ssp. spinosa	Sweet bursaria	10	
		Callitris gracilis	Southern Cypress pine	50	Planted in patches, south-western side of trees dead
		Carpobrotus rossii	Native pigface	<10	
		Dianella brevicaulis	Short-stem flax-lily	<10	Planted in patches, spreading from rhizomes
		Disphyma crassifolium ssp. clavellatum	Round-leaf pigface	<10	
		Dodonaea viscosa ssp. cuneata	Wedge-leaf hop- bush	100	
		Dodonaea viscosa ssp. spatulata	Sticky hop-bush	100	
		Enchylaena tomentosa var.	Ruby saltbush	<10	Planted and/or naturally occurring
		Eucalyptus incrassata	Ridge-fruited mallee	100	Fruiting
		Eucalyptus porosa	Mallee box	100-200	Flowering
		Eucalyptus diversifolia	Coastal mallee	100-200	
		Ficinia nodosa	Knobby club-rush	50	Planted and/or naturally occurring/regenerating

Table 55: Native plant density in each Eucalyptus diversifolia mallee polygon at Greys Paddock site

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
		Hakea mitchellii	Heath needlebush	<10	Planted, fruiting
		Helichrysum sp.	Everlasting	1	
		Leucophyta brownii	Coast cushion bush	<10	
		Melaleuca lanceolata	Dryland tea-tree	<10	Mostly planted in narrow band adjacent to M. halmaturorums
		Muehlenbeckia gunnii	Coastal climbing lignum	<10	
		Myoporum insulare	Common boobialla	10	
		Olearia axillaris	Coast daisy-bush	100	
		Pelargonium sp.	Storks-bill	<10	Planted in patches
		Pimelea serpyllifolia ssp. serpyllifolia	Thyme riceflower	<10	Naturally occurring
		Poa poiformis	Coast tussock- grass	<10	Planted in patches
		Rhagodia candolleana ssp. candolleana	Sea-berry saltbush	<10	
		Tetragonia implexicoma	Bower spinach	<10	
		Wahlenbergia sp.	Native bluebell	<10	
		Xanthorrhoea sp.	Yacca	1	One patch



Photo 22: Eucalyptus diversifolia mallee at Greys Paddock site

24.1.5 Allocasuarina verticillata low woodland - polygon W106

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W106	1.79	Acacia dodonaeifolia	Hop-bush wattle	<10	Р
		Acacia longifolia ssp. sophorae	Coastal wattle	<10	
		Acacia paradoxa	Kangaroo thorn	20	
		Acacia pycnantha and/or A. leiophylla	Golden wattle	20	
		Allocasuarina verticillata	Drooping sheoak	1000	Equivalent to ecosystem type density
		Bursaria spinosa ssp. spinosa	Sweet bursaria	<10	
		Callitris gracilis	Southern Cypress pine	<10	
		Dianella brevicaulis	Short-stem flax-lily	<10	
		Dodonaea viscosa ssp. cuneata	Wedge-leaf hop- bush	50	
		Dodonaea viscosa ssp. spatulata	Sticky hop-bush	<10	
		Enchylaena tomentosa var.	Ruby saltbush	<10	
		Eucalyptus incrassata	Ridge-fruited mallee	<10	
		Eucalyptus sp.	Eucalypt	20	
		Ficinia nodosa	Knobby club-rush	20	Planted and/or naturally occurring
		Leucophyta brownii	Coast cushion bush	<10	
		Melaleuca lanceolata	Dryland tea-tree	<10	Mostly planted in narrow band adjacent to M. halmaturorums
		Myoporum insulare	Common boobialla	<10	
		Poa poiformis	Coast tussock-grass	<10	Planted in patches
		Rhagodia candolleana ssp. candolleana	Sea-berry saltbush	<10	

Table 56: Native plant density in each Allocasuarina verticillata low woodland polygon at Greys Paddock site (Photo 23)



Photo 23: Allocasuarina verticillata low woodland at Greys Paddock site

24.2 PEST ANIMALS AND WEEDS

Table 57: Pest animal and weeds present at the site

Species	Common Name	Polygon	Cover	Notes
Lycium ferocissimum	African boxthorn	W108, W110	<1%	Scattered plants shown on map
Marrubium vulgare	Horehound	W102, W106	<1%	Patches as mapped and more dense in central W102
Thynopyrum elongatum	Tall wheat-grass	W110	<1%	Patch near internal unlocked gate
Leptospermum laevigatum	Coast tea-tree			Not found on site but has been removed from adjacent roadside, monitor for and control
Ehrharta villosa	Pyp grass			Not found in site but present in dunes in the adjacent revegetation area to the south
Pennisetum clandestinum	Kikuyu	W100	5%	Patches on banks
	Hare	W102, W106	2 observed	

In addition to the above pest plants, introduced annual grasses and broadleaf weeds are present throughout the site. These may prevent natural regeneration but are not considered high threat pest plants and should only be controlled as part of the revegetation actions outlined in the following section.

25. RECOMMENDED SITE MANAGEMENT ACTIONS

The revegetation recommendations are broken into two phases, with the first (year 1-2) focussed on enhancing the diversity and abundance of native species present on the site through active revegetation. The second phase (years 3-5) is focussed on increasing the abundance of native species through encouraging natural regeneration. The present species diversity is good for revegetation sites, and, without any further revegetation, this site could be expected to continue to improve in native species cover and diversity (on a unit area basis), albeit over a slower timeframe. The revegetation species recommendations are a guide only as there is a lack of nearby representative remnant vegetation on which to base these recommendations.

25.1 INFILL PLANTING

25.1.1 Channel

No management required in polygon W100 although planting of Duma florulenta could be trialled on steeper banks.

25.1.2 Samphire Swamp (including Melelaleuca halmaturorum shrublands)

Plant groundlayer species between *M. halmaturorum* ecosystem types at a density of up to 1000 plants per hectare (in total). Plant shrubs and ground layer species between samphires in samphire shrublands (except W101 and W108) at a density of up to 1000 plants per hectare each year. Species are recommended in Table 58. No plantings are recommended for W101 or W108 due to the proximity to the electric fence and potential that plantings will impact on the fence.

Table 58: Revegetation species for Samphire Swamp Ecosystem polygons

Туре	W101 0.60 ha	W103 0.57 ha	W104 2.34 ha	W108 0.21 ha	W110 1.37 ha	W112 1.09 ha
Atriplex paludosa ssp. paludosa	0	57	234	0	137	109
Disphyma crassifolium ssp. clavellatum	0	57	234	0	274	218
Gahnia filum	0	57	234	0	0	0
Lawrencia squamata	0	0	0	0	137	109
Maireana oppositifolia	0	57	234	0	0	0
Puccinellia stricta	0	285	1170	0	0	0
Samolus repens	0	0	0	0	685	545
Suaeda australis	0	57	234	0	137	109
Tecticornia arbuscular	0	285	1170	0	0	0
Threlkeldia diffusa	0	0	0	0	137	109
Totals (7,071)) 0	855	3,510	0	1,507	1,199

Natural regeneration for most of the planted species requires the right hydrological conditions occur. Therefore longer term management should aim to restore natural hydrological cycles, however this will need to be considered in relation to investment resources and priorities.

25.1.3 Eucalyptus diversifolia ssp. diversifolia mallee and Allocasuarina verticillata low woodland

This site would best be restored to an A. verticillata woodland with influences from E. porosa grassy woodland and coastal shrubland. Continue to plant understorey species in patches, no further planting of over and middle storey species required. Species and densities are recommended in Table 59, note that the planting densities should be viewed as a guide. The species and numbers are based on the A. verticillata woodland ecosystem type (Jellinek and Te, 2014).

Table 59: Revegetation species for Eucalyptus diversifolia ssp. diversifolia mallee and Allocasuarina verticillata low woodland Ecosystem polygons

Species	W102 10.76 ha	W105 0.11 ha	W106 1.77 ha	W107 0.03 ha	W109 0.02 ha	W111 0.07 ha
Adriana klotzschii	108	3	44	1	1	2
Austrostipa drummondii	5380	110	1770	30	20	70
Austrostipa elegantissima	1076	17	266	5	3	11
Austrostipa pilata	5380	110	1770	30	20	70
Billardiera cymosa ssp. cymosa	2690	55	885	15	10	35
Carpobrotus rossii	2152	22	354	6	4	14
Clematis microphylla	1076	22	354	6	4	14
Dianella brevicaulis	1076	110	1770	30	20	70
Enchylaena tomentosa	538	8	124	2	1	5
Exocarpos sparteus	0	1	18	0	0	1
Ficinia nodosa	0	6	89	2	1	4
Helichrysum leucopsideum	1076	28	443	8	5	18
Kennedia prostrata	108	6	89	2	1	4
Kunzea pomifera	5380	110	1770	30	20	70
Lomandra effuse, L. leucocephala	2690	28	443	8	5	18
Muehlenbeckia gunnii	538	11	177	3	2	7
Neurachne alopecuroidea	538	11	177	3	2	7
Rytidosperma caespitosum	5380	110	1770	30	20	70

Species	W102 10.76 ha	W105 0.11 ha	W106 1.77 ha	W107 0.03 ha	W109 0.02 ha	W111 0.07 ha
Tetragonia implexicoma	1076	17	266	5	3	11
Vittadinia australasica var. australasica	269	6	89	2	1	4
Totals (50,856)	36,531	791	12,668	218	143	505

In the longer term adopt a 'bushcare-type' management of the site, with the aim of encouraging natural regeneration of the planted and naturally occurring native species. This should focus on spot spraying annual weeds in rings up to 1 m radius around plants that are setting seed / fruit in early winter.

Continue to monitor for and control pest plants and animals as per Section 24.2.

25.2 PEST ANIMAL AND WEED RECOMMENDATIONS

Table 60: Pest animal and weed recommendations

Туре	Task
African boxthorn	Drill and fill African boxthorn scattered as mapped in polygons W108, W110. Continue to monitor for and control any new plants; this is likely to be an on-going task that will need to be done at least every second year.
Horehound	Control isolated and small patches of horehound as mapped, then work from perimeter of infestation in W102 in. Can be cut and swabbed, spot sprayed or grubbed out by hand.
Tall wheat-grass	Brush-cut / snip plants and spot spray re-growth, plants are growing close to native plants so care will need to be taken to avoid off-target damage and if wet only use herbicide approved for use near watercourses.
Coastal tea-tree	Monitor for any regeneration adjacent to roadside and cut and swab or manually remove.
Pyp grass	Monitor for any regeneration along the southern boundary and spot spray.
Hare	Monitor for and control hares at the site.
Kikuyu	Control only as part of revegetation actions, take care to avoid off-target damage to the watercourse and native species

Wyndgate Property Revegetation Site Assessment

Site Name: Hunters Creek above Denver Road

Location: Wyndgate

Site Surveys completed: November 2015

Assessment submitted: November 2015

Author

Bill New – New Environmental Pty Ltd







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26.1 PLAN DETAILS

Table 61: Contact details relevant to this plan

PlanID: Plan Name	Hunters Creek at Denver Road
SiteID: Site Name	Hunters Creek at Denver Road
Landholder &/or Manager	Stuart Hicks
Landholder Contact	Mobile: 0428 168 626
Size of planting area	3.2 hectares (mapped plan area)
Planning Contact	Chris Butcher: 0457 509 154 or chris.butcher@sa.gov.au
Ops Contact	Mark Phillips: 0427192060 or Mark.Phillips4@sa.gov.au

26.2 PLAN OVERVIEW

26.2.1 Access

The site is directly adjacent to Denver Road, on the northern side just over causeway (Map 10). There is no vehicle access into the western section of the site, person access is through the fence. Vehicle access to the eastern section is available just past the site through an unlocked gate, this section is a materials depot for the property.

26.2.2 Landuse

The site is part of the Wyndgate property which is used for conservation and cattle grazing (**Error! Reference source not found.**). The restoration ite has been fenced from stock and progressively revegetated over a number of years, with the oldest plantings being the *Melaleuca* halmaturorum plantings along the perimeter of the samphire zones and more recent plantings on the loamy flats and sandy dune areas.

26.2.3 Site Mapping

Mapping of ecosystem polygons for the site was developed from on ground mapping of landscape features and ecosystems present, both natural and planted (Map 11). Further consideration of ecosystem types was developed using the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014).

26.3 SITE ACCESS MAP





26.4 MAP OF THE SITE SHOWING ECOSYSTEM POLYGONS



Map 11: Hunters Creek and surrounding sites boundary with ecosystem polygons

27. ECOSYSTEM DESCRIPTIONS

Table 62: Ecosystems identified at Hunters Creek

Polygon	Total hectares	Species	Notes		
W513	0.1	Phragmites australis and Bolboschoenus caldwellii sedgeland over *Paspalum vaginatum	- Artificial channel, all species occurring naturally		
W512	0.2	Bolboschoenus caldwellii +/- Juncus kraussii over Suaeda	- Low lying wet flats with fresh water influence from		
W507	0.5	australis, Samolus repens, Schoenoplectus pungens and Tecticornia sp.	the channel, extending to the samphire edge. - Scattered Melaleuca halmaturorum through W507.		
W501	0.2	Tecticornia sp. +/- Suaeda australis over Frankenia	- Low lying naturally occurring samphire swamp.		
W511	0.3	pauciflora, Disphyma crassifolium ssp. clavellatum, Distichlis distichophylla, Puccinellia stricta and Samolus repens	- Some revegetation has occurred on the edges of these polygons and slightly higher areas.		
W502	0.4	Melaleuca halmaturorum over introduced annual grasses	- Dense Melaleuca halmaturorum plantings on		
W504	0.1	+/- Tecticornia sp, Atriplex paludosa ssp. paludosa,	narrow edge around samphire swamp.		
W508	0.2	 Enchylaena tomentosa, Lawrencia squamata and Atriplex semibaceata, Occasional Executors spartaus 	- Melaleuca halmaturorum canopies are touching		
W510	0.2	and patches of Rytidosperma and Austrostipa	grasses where more open.		
			 Natural regeneration of Enchylaena tomentosa and Rytidosperma and Austrostipa. 		
W503	0.5	Allocasuarina verticillata +/- Eucalyptus porosa,	- Open revegetation of ex-paddock area with		
W505	0.1	Eucalyptus incrassata, Callitris gracilis. Groups of	middle and overstorey plantings established >5yrs.		
W506	0.2	 Melaleuca lanceolata across area and tringing Melaleuca halmaturorum. Scattered Dodongea viscosa 	- Open areas of dense annual weedy grasses.		
W509	0.1	spp. Spatulata, Myoporum insulare and Bursaria spinosa, Enchylaena tomentosa, Rhagodia candolleana ssp. candolleana and Dianella brevicaulis	- Natural regeneration ot Enchylaena tomentosa and Rytidosperma and Austrostipa.		

27.1 ECOYSTEMS FOUND IN THE SITE

27.1.1 Channel - polygons W513, W512, W507

This ecosystem type is not described in the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014).

Table 63: Plant density in each Channel ecosystem polygon (Photo 24) at Hunters Creek site

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W513	0.1	Bolboschoenus caldwellii	Salt club-rush	10000	Naturally occurring wet areas and channel edge
		Cotula sp.		100	Naturally occurring in water
		*Paspalum vaginatum	Salt-water couch		WEED - dense wetter areas and channel edge
		Typha domingensis	Narrow-leaf bulrush	1000	Naturally occurring in wet channel



Photo 24: Channel ecosystem, note fresh water influence extending out from channel (polygon W513)

27.1.2 Duma florulenta shrubland – polygons W512, W507

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W512	0.2	Bolboschoenus caldwellii	Salt club-rush	10000	Naturally occurring wet areas and channel edge
	0 5	Juncus kraussii	Sea rush	100	Naturally occurring, grouped in wetter sections
W507	0.5	Melaleuca halmaturorum	Swamp paper- bark	100	Planted, scattered groups planted in wetter samphire and channel edge
		*Paspalum vaginatum	Salt-water couch		WEED – dense in wet areas and channel edge
		Samolus repens	Creeping brookweed	100s	Naturally occurring
		Schoenoplectus pungens	Spiky club-rush	1000s	Naturally occurring wet areas and channel edge
		Suaeda australis	Austral seablite	1000	Naturally occurring
		Tecticornia sp.	Samphire	100s	Naturally occurring on higher ground drying edge to samphire

Table 64: Plant density in each Duma florulenta shrubland ecosystem polygon (Photo 25) at Hunters Creek site



Photo 25: Duma florulenta shrubland ecosystem, note fresh water influence with scattered plantings of Melaleuca halmaturorum

(polygon W507)

27.1.3 Samphire swamp - polygons W501, W511

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W501	0.2	Atriplex paludosa ssp. paludosa	Marsh saltbush	50-100	Naturally occurring. ? Planted
	0.0	Atriplex semibaccata	Berry saltbush	<10	Naturally occurring, edge
W511	0.3	*Cenchrus clandestinus	Kikuyu		WEED - road edge
		Disphyma crassifolium ssp. clavellatum	Round-leaf pigface	1000	Naturally occurring
		Distichlis distichophylla	Emu-grass	1000s	Naturally occurring
		Frankenia pauciflora var. gunnii	Southern sea- heath	100	1000 Naturally occurring
		*Hordeum marinum	Sea barley-grass		WEED
		*Lolium rigidum	Wimmera ryegrass		WEED
		*Parapholis incurva	Curly ryegrass		WEED
		*Paspalum vaginatum	Salt-water couch		WEED
		*Plantago coronopus ssp. coronopus	Bucks-horn plantain		WEED
		Puccinellia stricta	Australian saltmarsh-grass	1000s	Naturally occurring
		Samolus repens	Creeping brookweed	100's	Naturally occurring
		Suaeda australis	Austral seablite	1000s	Naturally occurring
		*Symphyotrichum subulatum	Aster-weed		WEED
		Tecticornia indica ssp. leiostachya	Brown-head samphire		See Tecticornia sp.
		Tecticornia pergranulata ssp. pergranulata	Black-seed samphire		See Tecticornia sp.
		Tecticornia sp.	Samphire	10000	Naturally occurring
		*Thinopyrum elongatum	Tall wheat-grass		WEED - Patch on roadside

Table 65: Plant density in each Samphire swamp polygon (Photo 26) at Hunters Creek site



Photo 26: Samphire shrubland at Hunters Creek (polygon W501)

27.1.4 Samphire swamp + Melaleuca halmaturorum Shrubland - polygons W502, W504, W508, W510

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W502	0.4	Atriplex paludosa ssp. ssp. paludosa	Marsh saltbush	10	Planted
	<u>.</u>	Atriplex semibaccata	Berry saltbush	20	<10 Naturally occurring
W504	0.1	Austrostipa puberula	Fine-hairy spear- grass	50	Naturally occurring- patch
VV 300	0.2	*Brachypodium distachyon	False brome	1000	WEED
W510	0.2	*Bromus diandrus	Great brome		WEED
		Distichlis distichophylla	Emu-grass	1000's	Naturally occurring
		Enchylaena tomentosa var. tomentosa	Ruby saltbush	10	Naturally occurring, under Melaleuca halmaturorum
		Exocarpos sparteus	Slender cherry	<10	Naturally occurring. Regeneration edge of samphire
		Lawrencia squamata	Thorny lawrencia	<10	Naturally occurring. WPT 781
		*Lolium rigidum	Wimmera ryegrass		WEED
		*Medicago sativa	Lucerne		WEED
		*Medicago sp.			WEED
		Melaleuca halmaturorum	Swamp paper-bark	1200	Planted- 3-4 m tall canopies touching, shading ground layer and building up leaf litter. Noted stress on samphire edging dense Melaleuca halmaturorum
		*Olea europaea ssp. europaea	Olive		WEED - one only
		*Paspalum vaginatum	Salt-water couch		WEED - Dense in wet areas and channel edge
		*Plantago coronopus ssp. coronopus	Bucks-horn plantain		WEED
		Rytidosperma caespitosum	Common wallaby- grass	100	Naturally occurring- seeding
		*Sonchus oleraceus	Common sow- thistle		WEED

Table 66: Plant density in each	Samphire swamp	+ Melaleuca balmaturoru	m shrubland polygo	n (Photo 27) at k	lunters Creek site
Table 66. Flam density in each	sampnine swamp	+ Melaleuca haimaiuroiui	n shi ubiana poiygo	n (Fnoio 27) ai r	Initials Cleak sile

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
		Tecticornia sp.	Samphire	200	Naturally occurring, edge and under Melaleuca halmaturorum canopy
		*Trifolium sp.	Rough clover		WEED



Photo 27: Samphire + *Melaleuca halmaturorum* shrubland swamp at Hunters Creek, edge with samphire swamp. Note stress on samphire plants adjacent to dense Melaleuca halmaturorum (polygon W502 with edge W501)

27.1.5 Allocasuarina verticillata low woodland- polygons W503, W505, W506, W509

The ecosystem type that best matches the revegetation species present at this site is a mix of Allocasuarina verticillata low woodland and Eucalyptus porosa grassy woodland (Jellinek and Te, 2014).

Based on the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014) and considering the loam over clay soil type with coastal and saline influences, this site would best be restored to Allocasuarina verticillata low woodland with influence from Eucalyptus porosa grassy woodland and keep an open grassy structure to these areas.

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W503	0.5	Allocasuarina verticillata	Drooping sheoak	200	Planted - Groups of 20-30
	0.1	*Avena barbata	Bearded oat		WEED - Dense across area
W 505	0.1	*Bromus diandrus	Great brome		WEED - Dense across area
W506	0.2	Bursaria spinosa ssp. spinosa	Sweet bursaria	10	Planted - Mature 2 m tall
		Callitris gracilis	Southern cypress pine	30	Panted - Groups of 10
W509	0.1	Dianella brevicaulis	Short-stem flax-lily	5	Planted - Groups of 5 well established large tussocks. Flowering and fruiting.
		Dodonaea viscosa ssp. spatulata	Sticky hop-bush	<10	Planted - Salt burn off and reshooting
		Enchylaena tomentosa var. tomentosa	Ruby saltbush	10	Naturally occurring - along fence and scattered
		Eucalyptus incrassata	Ridge-fruited mallee	10	Planted - 5 m tall, flowering
		Eucalyptus porosa	Mallee box	10	Planted
		*Lolium perenne	Perennial ryegrass		WEED
		*Lolium rigidum	Wimmera ryegrass		WEED
		Melaleuca lanceolata	Dryland tea-tree	50-100	Planted - Groups of 10-20 and edged with Melaleuca halmaturorum
		Myoporum insulare	Common boobialla	5	Planted
		Olearia axillaris	Coast daisy-bush	1	Planted
		Poa poiformis var. poiformis	Coast tussock-grass	10	Naturally occurring
		Rhagodia candolleana ssp. candolleana	Sea-berry saltbush	10	Planted

Table 67: Plant density in each Allocasuarina verticillata low woodland polygon (Photo 28) at Hunters Creek site

Polygon	Total hectares	Species	Common Nam e	Density (plants per hectare)	Notes
		Rytidosperma caespitosum	Common wallaby- grass	100	Naturally occurring - Seeding
		*Thinopyrum elongatum	Tall wheat-grass		WEED- One clump. On roadside and extensive in block across the road
		*Trifolium scabrum	Rough clover		WEED



Photo 28: Allocasuarina verticillata low woodland at Hunters Creek site (polygon W505)

27.2 PEST ANIMALS AND WEEDS

Table 68: Pest animal and weeds present at the site

Species	Common Name	Polygon	Cover	Notes
Olea europaea ssp.	Olive	W510	<1%	One plant noted
europaea				
Thinopyrum elongatum	Tall wheat-grass	W503	<1%	And adjacent W507 in roadside
Vulpes vulpes	Fox			Fox scat
Lepus europaeus	Hare			2 observed

In addition to the above pest plants, introduced annual grasses and broadleaf weeds are present throughout the site. These may prevent natural regeneration but are not considered high threat pest plants and should only be controlled as part of the revegetation actions outlined in the following section.

Table 69: Waypoints for some recorded weeds

Туре	Waypoints (GDA94, UTM Zone 54H)
Olive	E-309459 N-6066276 – Melaleuca halmaturorum and samphire edge
Tall wheat-grass	E-309360 N-6066207 – individual patch
	E-309430 N-6066157 – patch in roadside

28. RECOMMENDED SITE MANAGEMENT ACTIONS

28.1 INFILL PLANTING

Within the first 1-2 years focus on enhancing the diversity and abundance of native species present on the site through active revegetation. The second phase, years 3-5, is to focus on increasing the abundance of native species through encouraging natural regeneration. The present species diversity is good for revegetation sites and without any further revegetation this site could be expected to continue to improve in native species cover and diversity (on a unit area basis), albeit over a slower timeframe.

The revegetation species and planting density recommendations are a guide only as there is a lack of nearby representative remnant vegetation on which to base these recommendations. The species and numbers are based on the ecosystem type as guided by the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014).

28.1.1 Channel

The channel ecosystem is a modified ecosystem not described in the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014). The fresh water nature influences the adjacent *Duma florulenta* shrubland ecosystem and is therefore similar. Little management is required for these areas with planting limited to trying a few *Duma florulenta* on the higher banks of the channel.

Table 70: Revegetation Species for Channel Ecosystem Type at Hunters Creek Site (plants per polygon)

Species	Common Name	W513 - 0.1 ha
Duma florulenta	Lignum	50

The dense salt-water couch may impact on establishment, although the site is very wet and water stress for seedlings is unlikely. Brush-cut a 1 m diameter spot in the salt-water couch to prepare planting site and reduce smothering.

28.1.2 Duma florulenta shrubland

This ecosystem best matches the Duma florulenta shrubland ecosystem described in the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014), aside from not having any lignum present and not being suitable for *Eucalyptus camaldulensis* ssp. camaldulensis. The fresh water influence of this ecosystem extends from the adjacent artificial channel and is therefore similar. Little management is required for these areas with planting limited to trying a few Duma florulenta on the higher fresh areas.

Table 71: Revegetation Species for Duma florulenta shrubland Ecosystem Type at Hunters Creek Site (plants per hectare)

Species	Common Name	W507 – 0.5 ha	W512 – 0.2 ha	Total
Duma florulenta	Lignum	125	20	145

The dense salt-water couch may impact on establishment, although the site is very wet and water stress for seedlings is unlikely. Whipper snip a 1 m diameter spot in the salt-water couch to prepare planting site and reduce smothering.

Monitor and control tall wheat-grass (occurring in adjacent roadside) and other significant weed as required.

28.1.3 Samphire swamp

A reasonable species diversity and density already exist for the samphire swamp ecosystems present at the Hunters Creek site. As per personal communication with Richard Owen and reference to the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014) it is considered that the samphire species *Tecticornia arbuscula* is under represented for these ecosystems and is a key structural species. Plant the following species in more open areas towards the edges and higher sections of the samphire swamp.

Table 72: Revegetation Species for samphire swamp Ecosystem Type at Hunters Creek Site (plants per polygon)

Species	Common Name	W501 – 0.2 ha	W511 – 0.3 ha
Tecticornia arbuscula	Shrubby samphire	100	150
Atriplex paludosa ssp. paludosa	Marsh saltbush	10	15
Lawrencia squamata	Thorny lawrencia	20	30
Maireana oppositifolia	Salt bluebush	40	60
	Total (425)	170	255

The requirements of ongoing management of the samphire swamp ecosystem at Hunters Creek is low as the presence of environmental weeds is low. Monitor and control significant weeds as required. Weeds observed on other Wyndgate sites for this ecosystem, and adjacent ecosystems, include African boxthorn, African daisy and tall wheat grass.

28.1.4 Samphire swamp + Melaleuca halmaturorum Shrubland

Melaleuca halmaturorum is well established in this ecosystem type, opportunity exists to infill with understorey species in to the annual grass areas between the M. halmaturorum. Plant smaller species such as Atriplex semibaccata, Disphyma crassifolium ssp. clavellatum, Threlkeldia diffusa in groups at 1 m spacing. Plant the rest of the shrub species 3 m spacing.

Only plant W504 and the northern section of W502 and W510 where space is available. W508 and the southern sections of W502 and W510 generally have dense *Melaleuca halmaturorum* cover, under which it will be difficult to establish seedlings.

Table 73: Revegetation Species for samphire swamp + Melaleuca halmaturorum Shrubland Ecosystem Type at Hunters Creek Site (plants per polygon)

Species	Common Name	W502 - 0.4ha Section next to W507	W504 - 0.1ha	W508 - 0.2ha	W510 - 0.2ha Section next to W507
Atriplex paludosa ssp. paludosa	Marsh saltbush	40	10	0	20
Atriplex semibaccata	Berry saltbush	40	10	0	20
Disphyma crassifolium ssp. clavellatum	Round-leaf pigface	40	10	0	20
Enchylaena tomentosa var. tomentosa	Ruby saltbush	40	10	0	20
Lawrencia squamata	Thorny lawrencia	40	10	0	20
Maireana oppositifolia	Salt bluebush	40	10	0	20
Rhagodia candolleana ssp. candolleana	Sea-berry saltbush	40	10	0	20
Threlkeldia diffusa	Coast bonefruit	40	10	0	20
	Totals (560)	320	80	0	160

Adopt a 'bushcare-type' management of the site, with the aim of encouraging natural regeneration of the planted and naturally occurring native species. This should focus on spot spraying annual weeds in rings up to 1 m radius around plants that are setting seed / fruit in early winter.

Monitor and control olive and other significant weeds as required.

28.1.5 Allocasuarina verticillata low woodland / Eucalyptus porosa grassy woodland

The canopy and medium to large shrubs layers are well established in the older revegetation areas and are providing an open low woodland structure. Opportunity exists to build on this open structure with infill of understorey species in to the annual grass areas between the shrub and canopy layers. Create an open woodland structure with a grassy tussock, sedge and herb understorey.

Plant grass, sedge herb and smaller species in groups at 0.5-1 m spacing and medium shrub and ground cover spreading plants at 2-3 m spacing. Place climbing species throughout, near established tree species as structure to grow on.

In the first couple of years, only plant canopy and large shrub species in the areas not already established to these. Follow up with infill of understorey species.

Table 74: Revegetation Species for Allocasuarina verticillata woodland / Eucalyptus porosa grassy woodland Ecosystem Type at Hunters Creek Site (plants per polygon)

Species	Common Name	W503 - 0.5ha	W505 - 0.1ha	W506 - 0.2ha	W509 - 0.1ha
Acacia paradoxa	Kangaroo thorn	50	10	20	0
Allocasuarina verticillata	Drooping sheoak	50	20	40	0
Austrostipa elegantissima	Feather spear-grass	75	15	30	15
Austrostipa flavescens	Coast spear-grass	75	15	30	15
Billardiera cymosa ssp. cymosa	Sweet apple-berry	100	20	40	20
Bursaria spinosa ssp. spinosa	Sweet bursaria	100	20	40	20
Callitris gracilis	Southern Cypress pine	0	10	20	0
Carpobrotus rossii	Native pigface	50	10	20	10
Clematis microphylla	Old man's beard	100	20	40	20
Dianella brevicaulis	Short-stem flax-lily	250	50	100	50
Enchylaena tomentosa var. tomentosa	Ruby saltbush	100	20	40	20
Eucalyptus diversifolia ssp. diversifolia	Coastal white mallee	25	5	10	0
Eucalyptus porosa	Mallee box	25	5	10	5
Ficinia nodosa	Knobby club-rush	50	10	20	10
Kennedia prostrata	Running postman	100	20	40	20
Kunzea pomifera	Muntries	100	20	40	20
Lomandra effusa	Scented mat-rush	125	25	50	25
Muehlenbeckia gunnii	Coastal climbing lignum	50	10	20	10
Myoporum insulare	Common boobialla	25	5	10	0

Species	Common Name	W503 - 0.5ha	W505 - 0.1ha	W506 - 0.2ha	W509 - 0.1ha
Rhagodia candolleana ssp. candolleana	Sea-berry saltbush	50	10	20	10
Rytidosperma caespitosum	Common wallaby-grass	500	100	200	100
Vittadinia australasica var. australasica	Sticky New Holland daisy	50	10	20	10
Vittadinia cuneata var. cuneata	Fuzzy New Holland daisy	100	20	40	20
	Totals (3,900)	2,150	450	900	400

Adopt a 'bushcare-type' management of the site, with the aim of encouraging natural regeneration of the planted and naturally occurring native species. This should focus on spot spraying annual weeds in rings up to 1 m radius around plants that are setting seed / fruit in early winter.

Monitor and control tall wheat-grass and other significant weeds as required.

28.2 PEST ANIMAL AND WEED RECOMMENDATIONS

Table 75: Pest animal and weed recommendations

Туре	Task
Olive	Cut and swab olive. Monitor for others present and continue to monitor for and control any new plants. This is likely to be an on-going task that will need to be done at least every second year. See waypoint for recored plant.
Tall wheat-grass	Control individual and small road side patch.
	Spray when actively growing. Brush-cut plants and spot spray re-growth, care will need to be taken to avoid off-target damage where weeds are growing close to native plants.
	Tall wheat-grass is showing up as a problem on a number of the sites on Wyndgate. A broader plan (with on- ground action) should be developed to manage tall wheat-grass at Wyndgate, in both existing revegetation sites and at areas to be revegetated.
	Tall wheat-grass will pose a significant future issue for both biodiversity and fire risk on Wyngate if it is not managed in revegetation areas.
Hare	Monitor for and control hares at the site and across Wyndgate. A number of individuals were observed.
Fox	Monitor for and control fox at the site and across Wyndgate. A number of signs of fox were observed.

Wyndgate Property Revegetation Site Assessment

Site Name: Wayne's World

Location: Wyndgate

Site Surveys completed: November 2015

Assessment submitted: November 2015

Author

Bill New – New Environmental Pty Ltd



ment Government of South Australia



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30. PLAN DETAILS

Table 76: Contact details relevant to this plan

PlanID: Plan Name	Wayne's World
SiteID: Site Name	Wayne's World
Landholder &/or Manager	Stuart Hicks
Landholder Contact	Mobile: 0428 168 626
Size of planting area	4.8 hectares (mapped plan area)
Planning Contact	Chris Butcher: 0457 509 154 or chris.butcher@sa.gov.au
Ops Contact	Mark Phillips: 0427 192 060 or Mark.Phillips4@sa.gov.au

30.1 PLAN OVERVIEW

30.1.1 Access

The site is directly adjacent to Denver Road, on the south side just over the causeway (Map 12). Vehicle access is only practical into the middle woodland section of the site through an unlocked gate. Another gate exists off Denver Road to north end of the site, this is however blocked by plantings. Walking access to the rest of the site is reasonable although is restricted to walking around the channel areas. Access through the adjacent paddocks could be an option with appropriate permission.

30.1.2 Land use

The site is part of the Wyndgate property which is used for conservation and cattle grazing. The restoration site has been fenced from stock and progressively revegetated over a number of years, with the oldest plantings being the *Melaleuca halmaturorum* plantings along the perimeter of the samphire zones and more recent plantings on the loamy flats and sandy dune areas.

30.1.3 Site Mapping

Mapping of ecosystem polygons for the site was developed from on ground mapping of landscape features and ecosystems present, both natural and planted (Map 13). Further consideration of ecosystem types was developed using the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014).

30.2 SITE ACCESS




30.3 ECOSYSTEM POLYGONS



Map 13: Wayne's World and surrounding sites boundary with ecosystem polygons

31. ECOSYSTEM DESCRIPTIONS

Table 77: Ecosystems identified at Wayne's World

Total hectares	Species	Notes		
0.40	Typha domingensis and Bolboschoenus caldwellii sedgeland over *Paspalum vaginatum	- Artificial channel, all species occurring naturally		
0.44	Bolboschoenus caldwellii +/- Eleocharis acuta over	- Low-lying wet flats with fresh water influence from the channel,		
0.10	Sudeda australis, Samolus repens and lecticornia	extending to the samphire edge.		
0.06	sp.	- Grouped Melaleuca halmaturorum through W613, W616		
0.13				
0.99	Tecticornia sp. +/- Suaeda australis over Frankenia	- Low lying naturally occurring samphire swamp.		
0.23	pauciflora, Disphyma crassifolium ssp. clavellatum, Distichlis distichophylla, Puccinellia stricta and Samolus repens	- Some revegetation has occurred on the edges of these polygons and slightly higher areas.		
0.09	Melaleuca halmaturorum over introduced annual	 Dense Melaleuca halmaturorum plantings on narrow edge around samphire swamp. 		
0.25	grasses +/- Tecticornia sp., Atriplex paludosa ssp.			
0.31	squamata and Atriplex semibaccata. Occasional	- Melaleuca halmaturorum canopies are touching and shading. Very little weed where dense, annual grasses where more open.		
0.44	Myoporum insulare	Wetter great have dense tall wheat grace		
0.04				
0.01				
<0.01				
0.05	Allocasuarina verticillata +/- Eucalyptus porosa.	- Very open revegetation of ex-paddock area with middle and		
0.06	Groups of Melaleuca lanceolata fringing	overstorey plantings established >5yrs.		
0.04	 Melaleuca nalmaturorum. Scatterea Myoporum insulare, Enchylaena tomentosa, Rytidosperma 	- Very open areas of dense annual weedy grasses and scattered tall		
1.05	and Austrostipa sp.	wheth-grass.		
0.06		- Natural regeneration of Enchylaena tomenetosa and Austrostipa.		
	Total hectares 0.40 0.41 0.10 0.06 0.13 0.99 0.23 0.09 0.25 0.31 0.44 0.04 0.01 <0.01	Total hectaresSpecies0.40Typha domingensis and Bolboschoenus caldwellii sedgeland over *Paspalum vaginatum0.44Bolboschoenus caldwellii +/- Eleocharis acuta over Suaeda australis, Samolus repens and Tecticornia sp.0.10Suaeda australis, Samolus repens and Tecticornia sp.0.13O.990.23Tecticornia sp. +/- Suaeda australis over Frankenia pauciflora, Disphyma crassifolium ssp. clavellatum, Distichlis distichophylla, Puccinellia stricta and Samolus repens0.09Melaleuca halmaturorum over introduced annual grasses +/- Tecticornia sp., Atriplex paludosa ssp. paludosa, Enchylaena tomentosa, Lawrencia squamata and Atriplex semibaccata. Occasional Myoporum insulare0.04O.010.05Allocasuarina verticillata +/- Eucalyptus porosa. Groups of Melaleuca lanceolata fringing Melaleuca halmaturorum. Scattered Myoporum insulare, Enchylaena tomentosa, Rytidosperma 		

Note: *Introduced species

31.1 ECOYSTEMS FOUND IN THE SITE

31.1.1 Channel - polygons W618

This ecosystem type is not described in the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014).

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Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W618	0.40	Bolboschoenus caldwellii	Salt club-rush	10000	Naturally occurring wet areas and channel edge
		Cotula sp.		100	Naturally occurring
		Cyperus sp.		100	Naturally occurring
		Eleocharis acuta	Common spike-rush	1000	Naturally occurring
		*Paspalum vaginatum	Salt-water couch		WEED- dense channel edge
		Samolus repens	Creeping brookweed	100s	Naturally occurring
		*Thinopyrum elongatum	Tall wheat-grass		WEED- dense edges of channel
		Typha domingensis	Narrow-leaf bulrush	1000	Naturally occurring in wet channel

Note: *Denotes weed species

31.1.2 Duma florulenta shrubland - polygons W613, W616, W617, W619

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W613	0.44	Bolboschoenus caldwellii	Salt club-rush	10000	Naturally occurring wet areas and channel edge
W616	0.10	Eleocharis acuta	Common spike-rush	1000	Naturally occurring
W617	0.06	Melaleuca halmaturorum	Swamp paper-bark	100	Planted, scattered groups planted in wetter samphire and channel edge
W619	0.13	*Parapholis incurva	Curly ryegrass		WEED
		*Paspalum vaginatum	Salt-water couch		WEED- dense channel edge
		*Plantago coronopus ssp. coronopus	Bucks-horn plantain		WEED
		Puccinellia stricta	Australian saltmarsh-grass	1000s	Naturally occurring
		Samolus repens	Creeping brookweed	100s	Naturally occurring
		Suaeda australis	Austral seablite	1000	Naturally occurring
		*Symphyotrichum subulatum	Aster-weed		WEED
		Tecticornia sp.		100s	Naturally occurring, drying edge to samphire
		*Thinopyrum elongatum	Tall wheat-grass		WEED- dense edges of channel

Table 79: Native plant density in each Duma florulenta shrubland ecosystem (Photo 29) polygon at Wayne's World site

Note: *Denotes weed species



Photo 29: Duma florulenta Shrubland ecosystem, note fresh water influence extending out from channel (polygon W618)



Photo 30: Duma florulenta shrubland ecosystem, note fresh water influence with edge of Melaleuca halmaturorum

(Polygon W613)

31.1.3 Samphire swamp - polygons W602, W610

	Table 80: Native	plant density	in each same	phire swamp	polvaon at Wa	vne's World site	(Photo 31)
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Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W602	0.99	Atriplex paludosa ssp. paludosa	Marsh saltbush	50-100	50-100 Naturally occurring ? Planted
W610	0.23	*Casuarina glauca	Swamp oak		WEED- suckering from Melaleuca halmaturorum edge W602 adjacent to W611
		Disphyma crassifolium ssp. clavellatum	Round-leaf pigface	200	200 Naturally occurring
		Distichlis distichophylla	Emu-grass	1000s	1000s Naturally occurring
		Frankenia pauciflora var. gunnii	Southern sea-heath	100	100 Naturally occurring
		Lawrencia squamata	Thorny lawrencia	1	1 Naturally occurring
		*Lolium rigidum	Wimmera ryegrass		WEED
		Medicago sp.			WEED
		Myoporum insulare	Common boobialla	10	10 Planted, not thriving
		Nitraria billardierei	Nitre-bush	2	2 Naturally occurring. Edge
		*Parapholis incurva	Curly ryegrass		WEED
		*Plantago coronopus ssp. coronopus	Bucks-horn plantain		WEED
		Puccinellia stricta	Australian saltmarsh-grass	1000s	1000s Naturally occurring
		Samolus repens	Creeping brookweed	1000	1000 Naturally occurring
		Suaeda australis	Austral seablite	1000	1000 Naturally occurring
		Tecticornia sp.		2500-5000	2500-5000 Naturally occurring
		*Thinopyrum elongatum	Tall wheat-grass		WEED- Patches and edge

Note: *Denotes weed species



Photo 31: Samphire Shrubland at Wayne's World (polygon W602)

31.1.4 Samphire Swamp + Melaleuca halmaturorum Shrubland - polygons W601, W604, W605, W609, W612, W614, W615

Polygon	Total ha	Species	Common Name	Density (plants per ha)	Notes
W601	0.09	Atriplex paludosa ssp. paludosa	Marsh saltbush	10	Naturally occurring
W604	0.25	Atriplex semibaccata	Berry saltbush	100	Naturally occurring
W605	031	*Avena barbata	Bearded oat		WEED
11000	0.01	*Bromus diandrus	Great brome		WEED
W609	0.44	*Casuarina glauca	Swamp oak		WEED- suckering Melaleuca halmaturorum edge in W612
W612	0.04	Disphyma crassifolium ssp. clavellatum	Round-leaf pigface	10	Naturally occurring
W614	0.01	Distichlis distichophylla	Emu-grass	1000s	Naturally occurring
W615	< 0.01	Enchylaena tomentosa var. tomentosa	Ruby saltbush	100s	Naturally occurring and to samphire edge
		Frankenia pauciflora var. gunnii	Southern sea-heath	100	Naturally occurring, samphire edge
		*Hordeum marinum	Sea barley-grass		WEED
		*Lagurus ovatus	Hare's tail grass		WEED
		*Lolium rigidum	Wimmera ryegrass		WEED
		Medicago sp.			WEED
		Melaleuca halmaturorum	Swamp paper-bark	1200	Planted- 3-4 m tall canopies touching, shading ground layer and building up leaf litter.
		Myoporum insulare	Common boobialla	<10	? Naturally occurring
		*Paspalum vaginatum	Salt-water couch		WEED- Dense in wet areas and channel edge
		*Plantago coronopus ssp. coronopus	Bucks-horn plantain		WEED
		Suaeda australis	Austral seablite	1000	Naturally occurring samphire edge
		Tecticornia sp.		500	Naturally occurring, edge and under Melaleuca halmaturorum canopy
		*Thinopyrum elongatum	tall wheat-grass		WEED

Table 81: Plant density in each Samphire swamp + Melaleuca halmaturorum shrubland polygon at Wayne's World site (Photo 32)

Polygon	Total ha	Species	Common Name	Density (plants per ha)	Notes
		Threlkeldia diffusa	coast bonefruit	<10	Naturally occurring
		Velia sp.			WEED

Note: *Denotes weed species



Photo 32: Samphire + Melaleuca halmaturorum shrubland swamp at Wayne's World, edge with samphire swamp.

(Polygon W609 with edge W618)

31.1.5 Allocasuarina verticillata low woodland- polygons W603, W606, W607, W608, W611

With the lack of species diversity at his site the ecosystem type that best matches the revegetation species present at this site is *Eucalyptus* porosa grassy woodland (Photo 33) (Jellinek and Te, 2014).

Based on the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014) and considering the heavy loam over clay soil type with coastal and saline influences, this site would best be restored to *Eucalyptus porosa* grassy woodland and keep an open grassy structure to these areas.

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W603	0.05	Allocasuarina verticillata	Drooping sheoak	200	Planted- Groups of 20-30
	0.07	Atriplex semibaccata	Berry saltbush	100	Naturally occurring
W606	0.06	Austrostipa sp.		100	Naturally occurring patches
W607	0.04	*Avena barbata	Bearded oat		WEED- Dense across area
		*Bromus diandrus	Great brome		WEED- Dense across area
W608	1.05	*Casuarina glauca	Swamp oak		WEED- Experimental planting spreading W611, W612
W611	0.06	Dianella brevicaulis	Short-stem flax-lily	<10	Naturally occurring
		Enchylaena tomentosa var. tomentosa	Ruby saltbush	10	Naturally occurring
		Eucalyptus diversifolia ssp. diversifolia	Coastal white mallee	10	Planted
		Eucalyptus fasciculosa	Pink gum	1	Planted
		Eucalyptus porosa	Mallee box	20	Planted
		Eucalyptus odorata	Peppermint box	5	Planted W603
		Eucalyptus sp.			Experimental planting W603, W611, W612
		*Lolium rigidum	Wimmera ryegrass		WEED
		*Lycium ferocissimum	African boxthorn		WEED
		Melaleuca lanceolata	Dryland tea-tree	100	Planted edged with Melaleuca halmaturorum
		*Melaleuca nesophila			WEED- Experimental planting spreading W611, W612

Table 82: Native plant density in eac	Allocasuarina verticillata low woodland	polygon at Wayne's World site
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Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
		Myoporum insulare	Common boobialla	<10	? Planted
		Nitraria billardierei	Nitre-bush	1	Naturally occurring
		Rhagodia candolleana ssp. candolleana	Sea-berry saltbush	100	Naturally occurring
		Rytidosperma caespitosum	Common wallaby- grass	100	Naturally occurring
		*Sonchus oleraceus	Common sow- thistle		WEED
		*Thinopyrum elongatum	Tall wheat-grass		WEED- edge with Melaleuca halmaturorum and scattered across area
		Velia sp.			WEED

Note: *Denotes weed species



Photo 33: Allocasuarina verticillata low woodland at Wayne's World site (polygon W505)

31.2 PEST ANIMALS AND WEEDS

Table 83: Pest animal and weeds present at the site

Species	Common Name	Polygon	Cover	Notes
*Lycium ferocissimum	African boxthorn	W605	<1%	One plant noted
*Casuarina glauca	Swamp oak	W611, W612	<1%	Suckering and spreading
*Melaleuca nesophila		W611, W612	<1%	Seeding and spreading
Vulpes vulpes	Fox			Fox scat and skull
Lepus europaeus	Hare			2 observed

Note: *Denotes weed species

In addition to the above pest plants, introduced annual grasses and broadleaf weeds are present throughout the site. These may prevent natural regeneration but are not considered high threat pest plants and should only be controlled as part of the revegetation actions outlined in the following section.

Table 84: Waypoints for some recorded weeds

Туре	Waypoints (GDA94, UTM Zone 54H)
African boxthorn	E-309458 N-6065925
Casuarina glauca	E-309459 N-6065997 – Suckering and spreading from trial planting area. MUST be controlled. Assess method of control with bush weed contractor. Cut and swab may be best to avoid off target damage to ecosystem plants.
Melaleuca nesophila	E-309311 N-6065997 - Seeding and spreading from trial planting area. MUST be controlled. Assess method of control with bush weed contractor. Cut and swab may be best to avoid off target damage to ecosystem plants.

32. RECOMMENDED SITE MANAGEMENT ACTIONS

32.1 INFILL PLANTING

Within the first 1-2 years focus on enhancing the diversity and abundance of native species present on the site through active revegetation. The second phase, years 3-5, is to focus on increasing the abundance of native species through encouraging natural regeneration. The present species diversity is good for revegetation sites and without any further revegetation this site could be expected to continue to improve in native species cover and diversity (on a unit area basis), albeit over a slower timeframe.

The revegetation species and planting density recommendations are a guide only as there is a lack of nearby representative remnant vegetation on which to base these recommendations. The species and numbers are based on the ecosystem type as guided by the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014).

32.1.1 Channel

The channel ecosystem is a modified ecosystem not described in the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014). The fresh water nature influences the adjacent *Duma florulenta* shrubland ecosystem and is therefore similar. Little management is required for these areas with planting limited to trying a few *Duma florulenta* on the higher banks of the channel.

Table 85: Revegetation species for Channel Ecosystem polygons

Species	Common Name	W618 0.40ha
Duma florulenta	Lignum	200

The dense salt-water couch may impact on establishment, although the site is very wet and water stress for seedlings is unlikely. Brush-cut a 1 m diameter spot in the salt-water couch to prepare planting site and reduce smothering.

Monitor and control tall wheat-grass occurring extensively in W618, monitor and control other significant weed as required.

32.1.2 Duma florulenta shrubland

This ecosystem best matches the Duma florulenta shrubland ecosystem described in the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014), aside from not having any lignum present and not being suitable for *Eucalyptus camaldulensis* ssp. *camaldulensis*. The fresh water influence of this ecosystem extends from the adjacent artificial channel and is therefore similar. Little management is required for these areas with planting limited to trying a few Duma florulenta on the higher fresh areas.

Table 86: Revegetation Species for Duma florulenta shrubland polygons

Species	Common Name	W613 0.44 ha	W616 0.10 ha	W617 0.06 ha	W619 0.13 ha
Duma florulenta	Lignum	220	50	30	65

The dense Salt-water Couch may impact on establishment, although the site is very wet and water stress for seedlings is unlikely. Whipper snip a 1 m diameter spot in the Salt-water Couch to prepare planting site and reduce smothering.

Monitor and control tall wheat-grass occurring extensively in W613, W616, W617, W619 monitor and control other significant weed as required.

32.1.3 Samphire swamp

A reasonable species diversity and density already exist for the Samphire Swamp ecosystems present at the Wayne's World Site. As per personal communication with Richard Owen and reference to the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014) it is considered that the samphire species *Tecticornia arbuscula* is under represented for these ecosystems and is a key structural species. Plant the following species in more open areas towards the edges and higher sections of the samphire swamp.

Table 87: Revegetation species for Samphire Swamp polygon

Species	Common Name	W602 0.99 ha	W610 0.23 ha
Tecticornia arbuscula	Shrubby samphire	500	115
Atriplex paludosa ssp. paludosa	Marsh saltbush	50	12
Lawrencia squamata	Thorny lawrencia	100	23
Maireana oppositifolia	Salt bluebush	200	46
	Totals (1,046)	850	196

Monitor and control tall wheat-grass occurring extensively in W602, W610 monitor and control other significant weed as required.

32.1.4 Samphire Swamp + Melaleuca halmaturorum Shrubland

Melaleuca halmaturorum is well established in this ecosystem type, opportunity exists to infill with understorey species in to the annual grass areas between the M. halmaturorum. Plant smaller species such as Atriplex semibaccata, Disphyma crassifolium ssp. clavellatum, Threlkeldia diffusa in groups at 1 m spacing. Plant the rest of the shrub species 3 m spacing.

Dense areas of Melaleuca halmaturorum cover will be difficult to establish seedlings under. Plant seedlings to the edge of dense areas.

Species	Common Name	W601 0.09 ha	W604 0.25 ha	W605 0.31 ha	W609 0.44 ha	W612 0.04 ha	W614 0.01 ha	W615 <0.01 ha
Atriplex paludosa ssp. paludosa	Marsh saltbush	9	25	31	44	4	1	1
Atriplex semibaccata	Berry saltbush	9	25	31	44	4	1	1
Disphyma crassifolium ssp. clavellatum	Round-leaf pigface	9	25	31	44	4	1	1
Enchylaena tomentosa var. tomentosa	Ruby saltbush	9	25	31	44	4	1	1
Lawrencia squamata	Thorny lawrencia	9	25	31	44	4	1	1
Maireana oppositifolia	Salt bluebush	9	25	31	44	4	1	1
Rhagodia candolleana ssp. candolleana	Sea-berry saltbush	9	25	31	44	4	1	1
Threlkeldia diffusa	Coast bonefruit	9	25	31	44	4	1	1
	Totals (920)	72	200	248	352	32	8	8

 Table 88: Revegetation species for Samphire Swamp + Melaleuca halmaturorum shrubland polygons

Adopt a 'bushcare-type' management of the site, with the aim of encouraging natural regeneration of the planted and naturally occurring native species. This should focus on spot spraying annual weeds in rings up to 1 m radius around plants that are setting seed / fruit in early winter.

Monitor and control African boxthorn and other significant weeds as required.

32.1.5 Eucalyptus porosa grassy woodland

The canopy and medium to large shrubs layers are well established areas and are providing an open low woodland structure. Opportunity exists to build on this open structure with infill of understorey species in to the annual grass areas between the shrub and canopy layers. Given the close proximity and similarities with 'Hunters Creek' site it is planned to continue the theme and create an open woodland structure with a grassy tussock, sedge and herb understorey.

Plant grass, sedge herb and smaller species in groups at 0.5-1 m spacing and medium shrub and ground cover spreading plants at 2-3 m spacing. Place climbing species throughout, near established tree species as structure to grow on.

In the first couple of years, only plant canopy and large shrub species in the areas not already established to these. Follow up with infill of understorey species.

Table 89: Revegetation species for Eucalyptus porosa grassy woodland polygons

Species	Common Name	W603 0.05 ha	W606 0.06 ha	W607 0.04 ha	W608 1.05 ha	W611 0.06 ha
Acacia paradoxa	Kangaroo thorn	5	6	0	105	6
Allocasuarina verticillata	Drooping sheoak	5	12	0	210	12
Austrostipa elegantissima	Feather spear-grass	8	9	6	158	9
Austrostipa flavescens	Coast spear-grass	8	9	6	158	9
Billardiera cymosa ssp. cymosa	Sweet apple-berry	10	12	8	210	12
Bursaria spinosa ssp. spinosa	Sweet bursaria	10	12	8	210	12
Callitris gracilis	Southern Cypress pine	0	6	0	105	0
Carpobrotus rossii	Native pigface	5	6	4	105	6
Clematis microphylla	Old man's beard	10	12	8	210	12
Dianella brevicaulis	Short-stem flax-lily	25	30	20	525	30
Enchylaena tomentosa var. tomentosa	Ruby saltbush	10	12	8	210	12
Eucalyptus diversifolia ssp. diversifolia	Coastal white mallee	0	3	0	53	0
Eucalyptus porosa	Mallee box	0	3	0	53	3
Ficinia nodosa	Knobby club-rush	5	6	4	105	6
Kennedia prostrata	Running postman	10	12	8	210	12
Kunzea pomifera	Muntries	10	12	8	210	12
Lomandra effusa	Scented mat-rush	13	15	10	263	15
Muehlenbeckia gunnii	Coastal climbing lignum	5	6	4	105	6
Myoporum insulare	Common boobialla	3	3	0	53	3

Species	Common Name	W603 0.05 ha	W606 0.06 ha	W607 0.04 ha	W608 1.05 ha	W611 0.06 ha
Rhagodia candolleana ssp. candolleana	Sea-berry saltbush	5	6	4	105	6
Rytidosperma caespitosum	Common wallaby-grass	50	60	40	1,050	60
Vittadinia australasica var. australasica	Sticky New Holland daisy	5	6	4	105	6
Vittadinia cuneata var. cuneata	Fuzzy New Holland daisy	10	12	8	210	12
	Totals (5,629)	212	270	158	4,728	261

Adopt a 'bushcare-type' management of the site, with the aim of encouraging natural regeneration of the planted and naturally occurring native species. This should focus on spot spraying annual weeds in rings up to 1 m radius around plants that are setting seed / fruit in early winter.

Before any planting is to occur in W611, control *Casuarina glauca and *Melaleuca nesophila. Monitor and control other significant weeds as required.

32.2 PEST ANIMAL AND WEED RECOMMENDATIONS

Table 90: Pest animal and weed recommendations

Туре	Task
African boxthorn	Cut and swab African boxthorn and monitor andf control for further occurances.
*Casuarina glauca	Suckering and spreading from trial planting area. MUST be controlled. Assess method of control with bush weed contractor. Cut and swab may be best to avoid off target damage to ecosystem plants.
*Melaleuca nesophila	Seeding and spreading from trial planting area. MUST be controlled. Assess method of control with bush weed contractor. Cut and swab may be best to avoid off target damage to ecosystem plants.
Tall wheat-grass	Spray when actively growing. Brush-cut plants and spot spray re-growth, care will need to be taken to avoid off-target damage where weeds are growing close to native plants.
	Tall wheat-grass is showing up as a problem on a number of the sites on Wyndgate. A broader plan (with onground action) should be developed to manage tall wheat-grass at Wyndgate, in both existing revegetation sites and at areas to be revegetated. Tall wheat-grass will pose a significant future issue for both biodiversity and fire risk on Wyngate if it is not
	managed in revegeration dreas.
Hare	Monitor for and control nares at the site and across Wynagate. A number of individuals were observed.
Fox	Monitor for and control fox at the site and across Wyndgate. A number of signs of fox were observed.

Wyndgate Property Revegetation Site Assessment

Site Name: Homestead

Location: Wyndgate

Site Surveys completed: November 2015

Assessment submitted: November 2015

Author

Bill New – New Environmental Pty Ltd





ent Government of South Australia



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34. PLAN DETAILS

Table 91: Contact details relevant to this plan

PlanID: Plan Name	Homestead
SiteID: Site Name	Homestead
Landholder &/or Manager	Stuart Hicks
Landholder Contact	Mobile: 0428 168 626
Size of planting area	5.08 hectares (mapped plan area)
Planning Contact	Chris Butcher: 0457 509 154 or chris.butcher@sa.gov.au
Ops Contact	Mark Phillips: 0427192060 or Email: Mark.Phillips4@sa.gov.au

34.1 PLAN OVERVIEW

34.1.1 Access

The site is directly adjacent to Denver Road, on the Northern side and is approximately 3.7 km from Semaschko Road to the access gate, and directly opposite the secure road to the barrages (Map 14). All weather vehicle access is available to the whole site via tracks and fire breaks through the whole site. The access gate may or not be locked.

34.1.2 Landuse

The site is part of the Wyndgate property which is used for conservation and cattle grazing (**Error! Reference source not found.**). The restoration ite has been fenced from stock and progressively revegetated over a number of years, with the oldest plantings being the *Melaleuca* halmaturorum plantings along the perimeter of the samphire zones and more recent plantings on the loamy flats and sandy dune areas.

34.1.3 Site Mapping

Mapping of ecosystem polygons for the site was developed from on ground mapping of landscape features and ecosystems present, both natural and planted (Map 15). Further consideration of ecosystem types was developed using the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014).

34.2 SITE ACCESS MAP





35. MAP OF THE SITE SHOWING ECOSYSTEM POLYGONS



Map 15: Homestead and surrounding sites boundary with ecosystem polygons

36. ECOSYSTEM DESCRIPTIONS

Table 92: Ecosystems identified at Homestead site

Polygon	Total hectares	Species	Notes
W711 W712	0.64 0.29	Eucalyptus diversifolia, Allocasuarina verticillata, Eucalyptus porosa, Eucalyptus incrassata and Callitris gracilis. Groups of Melaleuca lanceolata across area and in lower areas along driveway into office. Scattered Dodonaea viscosa spp. spatulata, Myoporum insulare and Acacia paradoxa, Acacia dodonaefolia, Enchylaena tomentosa, Rhagodia candolleana ssp. candolleana and Dianella brevicaulis	Sparse >5 year old revegetation with recent plantings amongst this. Dense patched of kikuyu throughout polygons.
W704 W706 W710 W713	0.07 1.25 0.19 0.19	Allocasuarina verticillata +/- Melaleuca lanceolata. Over areas of dense Ehrharta calycina and Ehrharta villosa.	10? year old plantings of dense Allocasuarina verticillata. Good build-up of leaf litter and sparse weeds in areas, other areas over dense Ehrharta calycina and Ehrharta villosa.
W715 W716	0.18 0.07	Dense Ehrharta calycina. And weed annual grasses.	Unplanted patches amongst dense Allocasuarina verticillata plantings.
W708 W709	0.18 0.43	Scattered older plantings of Allocasuarina verticillata over dense Ehrharta villosa.	Recent plantings of Acacia cupularis, Acacia dodonaeifolia, Dodonaea viscosa ssp. spatulata, Eucalyptus porosa, Myoporum insulare and Olearia axillaris on the lower slope to the East.
W703	1.49	Dense kikuyu	Slashed firebreak
W705	0.10	Cupressus macrocarpa over Enchylaena tomentosa and Austrostipa sp.	Cypress pine windbreak

Note: *Denotes weed species

36.1 ECOYSTEMS FOUND IN THE SITE

36.1.1 Eucalyptus diversifolia ssp. diversifolia Mallee - polygons W711, W712

The ecosystem type that best matches the revegetation species present at this site (Photo 34) is Eucalyptus diversifolia ssp. diversifolia Mallee (Jellinek and Te, 2014).

Based on the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014) and considering the mixed sandy to heavy loam over clay soil type with occasional outcropping limestone and coastal influences, this site would best be restored to *Eucalyptus porosa* grassy woodland and keep an open grassy structure to these areas.

[able 93: Plant density in each Eucalyptus diversifolia s	. diversifolia Mallee ecosystem polygon at Homestead site
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Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W711	0.64	Acacia dodonaeifolia	hop-bush wattle	10	Planted
		Acacia paradoxa	kangaroo thorn	100	Planted
W712	0.29	Acacia pycnantha	golden wattle	10	Planted
		Allocasuarina verticillata	drooping sheoak	100	Planted
		*Aloe maculata	broad-leaf aloe		WEED
		*Bromus diandrus	great brome		WEED
		Callitris gracilis	southern Cypress pine	20	Planted
		*Cenchrus clandestinus	kikuyu		WEED- Patches throughout
		Dianella brevicaulis	short-stem flax-lily	10	Planted
		Dodonaea viscosa ssp. cuneata	wedge-leaf hop- bush	10	Planted
		Dodonaea viscosa ssp. spatulata	sticky hop-bush	20	Planted
		Enchylaena tomentosa var. tomentosa	ruby saltbush	50	Planted / Naturally occurring
		Eucalyptus diversifolia ssp. diversifolia	coastal white mallee	10	Planted
		Eucalyptus incrassata	ridge-fruited mallee	10	Planted
		Eucalyptus porosa	mallee box	10	Planted
		Eucalyptus sp.			? non-local species - Planted older
		*Euphorbia terracina	false caper		WFFD
		Ficinia nodosa	knobby club-rush	10	Planted

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
		Hakea mitchellii	heath needlebush	10	Planted
		Hordeum sp.			WEED
		*Lagunaria patersonii	pyramid tree		Planted older ornamental planting
		Leucophyta brownii	coast cushion bush	50	Planted
		*Lolium sp.			WEED
		*Lycium ferocissimum	African boxthorn		WEED
		*Malva sp.			WEED
		*Medicago sp.			WEED
		Melaleuca lanceolata	dryland tea-tree	20	Planted
		Myoporum insulare	common boobialla	20	Planted
		Myoporum parvifolium	creeping boobialla	10	Planted
		Poa labillardieri var. labillardieri	common tussock- grass	20	Planted
		Rhagodia candolleana ssp. candolleana	sea-berry saltbush	20	Planted
		Rytidosperma caespitosum	common wallaby- grass	100	Naturally occurring
		*Sonchus oleraceus	common sow- thistle		WEED
		Vittadinia sp.		20	Naturally occurring

* Introduced species



Photo 34: Eucalyptus diversifolia ssp. diversifolia Mallee ecosystem, note fresh water influence extending out from channel (polygon W711)

36.1.2 Allocasuarina verticillata low woodland - polygons W704, W706, W710, W713

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W704	0.07	Acacia cupularis	cup wattle	1	Planted / Naturally occuring
W706	1.25	Allocasuarina verticillata	drooping sheoak	1500	Planted large groves and Western boundary windbreak
		Atriplex cinerea	coast saltbush	100	Planted
W710	0.19	*Cenchrus clandestinus	kikuyu		WEED
		*Cynodon dactylon var. dactylon	couch		WEED
W713	0.19	Dianella brevicaulis	short-stem flax-lily	10	Naturally occurring
		*Ehrharta calycina	perennial veldt grass		WEED- dense patches
		*Ehrharta villosa var. maxima	pyp grass		WEED
		Enchylaena tomentosa var. tomentosa	ruby saltbush	200	Naturally occurring
		*Lagurus ovatus	hare's tail grass		WEED
		*Medicago sp.			WEED
		Melaleuca lanceolata	dryland tea-tree	20	Planted
		Myoporum insulare	common boobialla	5	Planted / Naturally occurring
		*Oenothera stricta ssp. stricta	common evening primrose		WEED
		*Olea europaea ssp. europaea	olive		WEED
		Salsola australis	buckbush		
		*Scabiosa atropurpurea	pincushion		WEED
		*Senecio pterophorus	African daisy		WEED
		Tetragonia implexicoma	bower spinach	100	Naturally occurring
		Threlkeldia diffusa	coast bonefruit	100	Naturally occurring
		*Vulpia sp.			WEED

Table 94: Plant density (Photo 35) in each Allocasuarina verticillata low woodland ecosystem polygon at Homestead site

* Introduced species



Photo 35: Allocasuarina verticillata low woodland ecosystem, note fresh water influence with scattered plantings of Melaleuca halmaturorum

(polygon W706)

36.1.3 Allocasuarina verticillata low woodland over dense pyp grass - polygons W708, W709

Polygon	Total hectares	Species	Common Name	Density (plants per hectare)	Notes
W708	0.18	Acacia cupularis	cup wattle	2	Planted
14/700	0.42	Acacia dodonaeifolia	hop-bush wattle	10	Planted
VV/09	0.43	Allocasuarina verticillata	drooping sheoak	50	Planted
		*Aloe maculata	broad-leaf aloe		WEED
		Callitris gracilis	southern cypress pine	50	Planted
		*Cupressus macrocarpa	Monterey Cypress		Planted older ornamental planting
		Dodonaea viscosa ssp. spatulata	sticky hop-bush	20	Planted
		*Ehrharta calycina	perennial veldt grass		WEED- Dense areas
		*Ehrharta villosa var. maxima	pyp grass		WEED- Dense
		Enchylaena tomentosa var. tomentosa	ruby saltbush	20	Naturally occurring
		Eucalyptus porosa	mallee box	5	Planted
		*Lagurus ovatus	hare's tail grass		WEED
		*Lycium ferocissimum	African boxthorn		WEED- under Cypress Pine
		Myoporum insulare	common boobialla	20	Planted
		*Oenothera stricta ssp. stricta	common evening primrose		WEED
		Olearia axillaris	coast daisy-bush	10	Planted
		*Trifolium arvense var. arvense	hare's-foot clover		WEED
		Acacia cupularis	cup wattle	2	Planted
		Acacia dodonaeifolia	hop-bush wattle	10	Planted

* Introduced species



Photo 36: Allocasuarina verticillata low woodland at Homestead (polygon W708)

36.2 PEST ANIMALS AND WEEDS

Table 96: Pest animal and weeds present at the Homestead site

Species	Common Name	Polygon	Cover	Notes
*Aloe maculata	Broad-leaf aloe	W709 W712	<1%	Edge of these two polygons amongst pyp grass
*Lycium ferocissimum	African boxthorn	W709 W711	<1%	
*Olea europaea ssp. europaea	Olive	W706	<1%	One plant noted
*Senecio pterophorus	African daisy	W706	<1%	
Lepus europaeus	Hare			1 observed
Vulpes vulpes	Fox			Signs recorded on neaby sites

In addition to the above pest plants, introduced annual grasses and broadleaf weeds are present throughout the site. These may prevent natural regeneration but are not considered high threat pest plants and should only be controlled as part of the revegetation actions outlined in the following section.

Table 97: Waypoints for some recorded weeds

Туре	Waypoints (GDA94, UTM Zone 54H)
African boxthorn	E- 309865 N-6066097 – under Eucalyptus sp.
	E- 309897 N-6065974 – under Cypress pine
African daisy	E- 309659 N-6066024 -
Broad-leaf aloe	E- 309875 N-6066009 – spreading amongst pyp grass
Olive	E- 309659 N-6066024 -

37. RECOMMENDED SITE MANAGEMENT ACTIONS

37.1 INFILL PLANTING

Within the first 1-2 years focus on enhancing the diversity and abundance of native species present on the site through active revegetation. The second phase, years 3-5, is to focus on increasing the abundance of native species through encouraging natural regeneration. The present species diversity is good in W711 and W712 for revegetation sites and without any further revegetation this site could be expected to continue to improve in native species cover and diversity (on a unit area basis), albeit over a slower timeframe. Species diversity is relatively low in the rest of the revegetation polygons with dense areas of pyp grass and perennial veldt.

The revegetation species and planting density recommendations are a guide only as there is a lack of nearby representative remnant vegetation on which to base these recommendations. The species and numbers are based on the ecosystem type as guided by the 'Site Planners Guide for the CLLMM Region' (Jellinek and Te, 2014).

37.1.1 Eucalyptus porosa grassy woodland

The older canopy and medium to large shrubs layers are well established with more recent plantings still establishing. With reasonable survival the site will have a reasonable canopy and shrub layer. Opportunity exists to infill understorey species in to the areas between the shrub and canopy plants. Given the close proximity and similarities with 'Hunters Creek' and 'Waynes World' sites it is planned to continue the theme to plant amongst the canopy and shrub layers with climbers and a grassy tussock, sedge and herb understorey.

Plant grass, sedge herb and smaller species in groups at 0.5-1 m spacing and medium shrub and ground cover spreading plants at 2-3 m spacing. Place climbing species throughout, near established tree species as structure to grow on.

In the first couple of years, only plant canopy and large shrub species in the areas not already established to these. Follow up with infill of understorey species.

Table	98:	Reve	geta	tion 3	Speci	es fo	Eucal	yptus	porosa	grassy	woodle	and I	Ecosyst	em T	ype a	t Hom	estead	Site	(plan	ts per	poly	gon)	

Species	Common Name	W711 - 0.64ha	W712 - 0.29ha
Austrostipa elegantissima	feather spear-grass	96	44
Austrostipa flavescens	coast spear-grass	96	44
Billardiera cymosa ssp. cymosa	sweet apple-berry	128	58
Carpobrotus rossii	native pigface	64	29
Clematis microphylla	old man's beard	128	58
Dianella brevicaulis	short-stem flax-lily	320	145
Enchylaena tomentosa var. tomentosa	ruby saltbush	128	58

Species	Common Name	W711 - 0.64ha	W712 - 0.29ha
Ficinia nodosa	knobby club-rush	64	29
Kennedia prostrata	running postman	128	58
Kunzea pomifera	muntries	128	58
Lomandra effusa	scented mat-rush	160	73
Muehlenbeckia gunnii	coastal climbing lignum	64	29
Rhagodia candolleana ssp. candolleana	sea-berry saltbush	64	29
Rytidosperma caespitosum	common wallaby-grass	640	290
Vittadinia australasica var. australasica	sticky New Holland daisy	64	29
Vittadinia cuneata var. cuneata	fuzzy New Holland daisy	128	58
	Totals (3,489)	2,400	1,089

Adopt a 'bushcare-type' management of the site, with the aim of encouraging natural regeneration of the planted and naturally occurring native species. This should focus on spot spraying annual weeds in rings up to 1 m radius around plants that are setting seed / fruit in early winter.

Significant patches of kikuyu occur through these polygons spot spray for planting of seedlings and manage kikuyu around existing plantings. Work towards removing kikuyu from the revegetation area.

37.1.2 Allocasuarina verticillata low woodland

The canopy layer is well established in the older revegetation areas and is providing a low woodland structure. Opportunity exists to build on this open structure with infill of understorey species in to the leaf litter and annual grass areas. Create a woodland structure with a low shrub, grassy tussock, sedge, climber and herb understorey.

Plant grass, sedge herb and smaller species in groups at 0.5-1 m spacing and medium shrub and ground cover spreading plants at 2-3 m spacing. Place climbing species throughout, near established tree species as structure to grow on.

In the first couple of years, only plant canopy and large shrub species in the areas not already established to these. Follow up with infill of understorey species.

W704 is a narrow windbreak section of Allocasuarina verticillata, no further planting in this area.

W708 and W709, requires extensive control of pyp grass prior to revegetating (see 5.2, Table 15), follow this by only planting sheoak while continuing control of pyp grass. Assess suitability to introduce understorey at a point where pyp grass is successfully under control.

W710 and W713, have established sheoak over extensive pyp grass and perennial veldt, control pyp grass and perennial veldt through these areas prior to planting understorey (see 5.2, Table 15).

W715 and W716 are unplanted openings in the densely planted sheoak of W706 polygon. For site variation, only plant a few Eucalyptus porosa in these areas with low shrub, grassy tussock, sedge, climber and herb understorey.

W706 is densely established sheoak canopy. Plant this area to low shrub, grassy tussock, sedge, climber and herb understorey. Pyp grass and perennial veldt occurs through higher dune areas of this polygon, control these prior to planting understorey.

Species	Common Name	W706 Existing Sheoak	W710 Existing Sheoak	W713 Existing Sheoak	W715 Unplanted	W716 Unplanted	W708 Pyp grass 0.18ha	W709 Pyp grass 0.43ha
		1.25ha	0.19ha	0.19ha	0.18ha	0.07ha		
Acacia paradoxa	kangaroo thorn	0	19	19	0	0	0	0
Allocasuarina verticillata	drooping sheoak	0	0	0	0	0	180	430
Austrostipa elegantissima	feather spear-grass	188	29	29	27	11	0	0
Austrostipa flavescens	coast spear-grass	188	29	29	27	11	0	0
Billardiera cymosa ssp. cymosa	sweet apple-berry	250	38	38	36	14	0	0
Bursaria spinosa ssp. spinosa	sweet bursaria	250	38	38	0	0	0	0
Callitris gracilis	southern Cypress pine	0	19	19	0	0	0	0
Carpobrotus rossii	native pigface	125	19	19	18	7	0	0
Clematis microphylla	old man's beard	250	38	38	36	14	0	0

Table 99: Revegetation Species for Allocasuarina verticillata woodland low woodland Ecosystem Type at Homestead Site (plants per polygon)
Species	Common Name	W706 Existing Sheoak	W710 Existing Sheoak	W713 Existing Sheoak	W715 Unplanted	W716 Unplanted	W708 Pyp grass 0.18ha	W709 Pyp grass 0.43ha
		1.25ha	0.19ha	0.19ha	0.18ha	0.07ha		
Dianella brevicaulis	short-stem flax-lily	625	95	95	90	35	0	0
Enchylaena tomentosa var. tomentosa	ruby saltbush	250	38	38	36	14	0	0
Eucalyptus porosa	mallee box	0	0	0	2	1	0	0
Ficinia nodosa	knobby club-rush	125	19	19	18	7	0	0
Kennedia prostrata	running postman	250	38	38	36	14	0	0
Kunzea pomifera	muntries	250	38	38	36	14	0	0
Lomandra effusa	scented mat-rush	313	48	48	45	18	0	0
Muehlenbeckia gunnii	coastal climbing lignum	125	19	19	18	7	0	0
Myoporum insulare	common boobialla	0	10	10	0	0	0	0
Rhagodia candolleana ssp. candolleana	sea-berry saltbush	125	19	19	18	7	0	0
Rytidosperma caespitosum	common wallaby- grass	1250	190	190	180	70	0	0
Vittadinia australasica var. australasica	sticky New Holland daisy	125	19	19	18	7	0	0
Vittadinia cuneata var. cuneata	fuzzy New Holland daisy	250	38	38	36	14	0	0
	Totals (8,091)	4,939	800	800	677	265	180	430

Adopt a 'bushcare-type' management of the site, with the aim of encouraging natural regeneration of the planted and naturally occurring native species. This should focus on spot spraying annual weeds in rings up to 1 m radius around plants that are setting seed / fruit in early winter.

Monitor and control tall wheat-grass and other significant weeds as required.

37.2 PEST ANIMAL AND WEED RECOMMENDATIONS

	Table	100: P	est animal	and weed	recommendation
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Туре	Task
African boxthorn	Drill and fill African boxthorn, cut and swab or pull out smaller plants. Monitor for others present and continue to monitor for and control any new plants. This is likely to be an on-going task that will need to be done at least every second year. See waypoint for recored plants.
African daisy	Cut and swab African daisy, pull out smaller plants. Monitor for others present and continue to monitor for and control any new plants. This is likely to be an on-going task that will need to be done at least every second year. See waypoint (Table 9) for recored plant.
Broad-leaf aloe	Investigate chemical application to assist with control. Grub and dig out broad-leaf aloe plants with as much root as possible, they are likely to reshoot. Deep bury removed plants. Monitor for others present and continue to monitor for and control any new plants. This is likely to be an on- going task that will need to be done at least every second year. See waypoint (Table 9) for recored plant.
Olive	Cut and swab olive. Monitor for others present and continue to monitor for and control any new plants. This is likely to be an on-going task that will need to be done at least every second year. See waypoint (Table 9) for recored plant. See waypoint for recored plant.
Perennial veldt grass pyp grass kikuyu	Control as part of the revegetation activities, it would be best to control more extensive areas prior to revegetation activities, particulary before planting understorey species. Spray when actively growing. Brush-cut plants and spot spray re-growth, care will need to be taken to avoid off-target damage where weeds are growing close to native plants.
	The broad area of pyp grass in W708 and W709 could potentially be machine slashed to knock down dense old growth. Allow to regrow and spray. The area should have enough build up of debris and pyp grass roots to not be an erosion risk prior establishing revegetation.
Hare	Monitor for and control hares at the site and across Wyndgate.
Fox	Monitor for and control fox at the site and across Wyndgate. A number of signs of fox were recorded on neaby sites.

38. REFERENCES

Jellinek S and Te T, Site planners guide for the CLLMM region, unpublished DEWNR document

Richard Owen, personal communication, October and November 2015

Croft SJ, Pedlar JA and Milne TI, 2006, Coastal Vegetation Communities of the Southern Mount Lofty Ranges, Part of the Bushland Condition Monitoring Manual: Southern Mount Lofty Ranges, Nature Conservation Society of SA Inc.