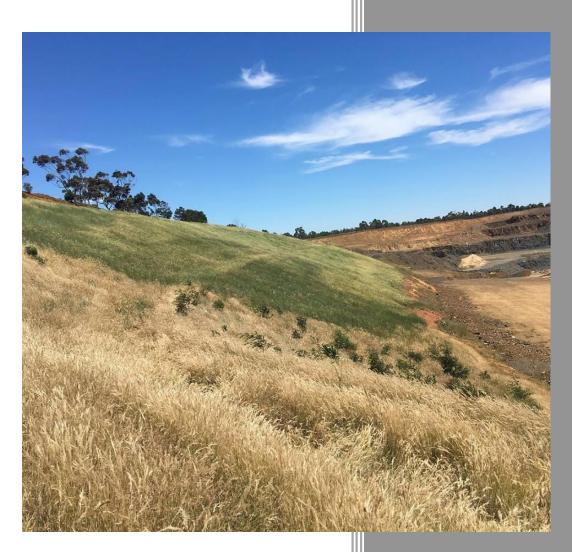
2021

Mt Shamrock Quarry Rehabilitation Report



Thomas Fee Naturelinks Landscape Management January 2021



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Report prepared by Thomas Fee.

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Cover photo: 2017 direct seeding are in foreground contrasted by 2018 direct seeding area. Photo taken by Thomas Fee for Naturelinks Landscape Management

Report Scope



This report addresses all revegetation and maintenance works carried out by Naturelinks over the period of 2020. Works were undertaken in areas known as Net Gain, Extraction, South-east Extraction and Phase A and B. This report simply offers a summary of all works undertaken in each area as well as outline any issues encountered and management challenges identified throughout the rehabilitation process. Following this a summary of proposed future management actions is detailed.

South-east Extraction Area Rehabilitation & Maintenance Works 2020

Figure 1 below details the area referred to as SE Extraction. Revegetation works were undertaken between 2017-2018 in the South-eastern corner of the operational Quarry area. This area is approximately 3.9 hectares in total and is comprised of three separate Areas (see Figure 2). Areas 1 and 2 [Figure 2 (left)] were revegetated in 2017 and together total approximately 2.7Ha, with the 2018 revegetation area totalling approximately 1.2Ha [Figure 2 (right)]. Restoration works were undertaken in all areas in the form of direct seeding using a sterile cover crop and native seed mix followed by an initial planting of mid and upper story tube-stock. Further details of these works can be found in the 2020 Mt Shamrock Rehabilitation Report (Naturelinks, 2020a).



Figure 1: Total Mt Shamrock South-east Extraction Re-vegetation area (Approx 3.9Ha).

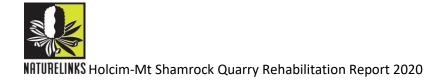




Figure 2: Left – Revegetation Areas 1 & 2 (2017). Right - Revegetation Area 3 (2018).

3100 understorey species were planted through all the revegetation areas over a period of 2 years after direct seeding occurred (2017-2018). During 2020 in-fill planting work were primarily focused on addressing gaps in the mid and upper stories, with only limited resources given to understorey plantings. As discussed in previous reporting (Naturelinks 2020a), significant upper and mid-storey species were lost in the SE Extraction area. As a result of this loss, Naturelink's sought to expand the species available for planting and increase diversity within these areas.

In order to achieve this Naturelinks undertook desktop analysis using Naturekit and located several parcels of native vegetation for all three EVC's 16, 45 and 128 located within 5km of Mt Shamrock. Naturelinks conducted on-ground species surveys in both Lowland Forest EVC 16 vegetation, and Shrubby Foothill Forest EVC 45 within 5km of Mt Shamrock at RJ Chambers Flora and Fauna Reserve and Grassy Forest EVC 128 at Beaconsfield Nature Conservation Reserve.

Species which were found in one or more of these EVC's and existing in similar conditions as that found at Mt Shamrock (considering slope, soil type and aspect) were considered appropriate for consideration for future planting lists for Mt shamrock. Species from EVC's 128 and 45 were sought due to their existence within a broader category of Dry Forests, a category which Lowland Forest does not fall within. Lowland Forests typically exist in areas of high soil fertility and relatively high rainfall compared with Dry Forests.

By utilising species that occur within these EVC's gives us a greater range of species that can tolerate a broader range of site conditions. Species that were present within EVC 16 and also in EVC's 45 and 128 were given highest priority. The below species list is derived of species found to be present in one, both or all EVC's and found within 5km of Mt Shamrock under conditions similar to those experienced at Mt Shamrock. This list is not meant to be exhaustive as there are likely many more species that occur in one or all of these EVC's not mentioned in this list. Table 1 (below)provides both a list of current and additional species and species numbers for SE Extraction for the 2020 planting season.



Table 1. Holcim, Mt Shamrock SE Extraction 2021 species list			
Upper Story	y (canopy)		
Species	Common Name	Numbers	
Eucalyptus obliqua	Messmate	200	
Eucalyptus viminalis			
Eucalyptus radiata subsp. radiata	Narrow-leaved Peppermint	200	
Eucalyptus cypellocarpa			
Eucalyptus fulgens			
Eucalyptus goniocalyx	Long-leaf Box	100	
Eucalyptus dives	Broad-leaf Peppermint	150	
Upper - Mid Sto	rv (tall shrubs)		
Ozothamnus ferrugineus	Tree Everlasting	0	
Cassinia aculeata	Dogwood	0	
Cassinia longifolia	Long-leaf Cassinia	50	
Bursaria spinosa		100	
Acacia paradoxa	Hedge Wattle	400	
Hakea decurrens subsp. physocarpa	Bushy Needlewood	35	
Hakea nodosa		0	
Hakea ulicina	Furze Hakea	24	
Banksia marginata	Silver Banksia, Warrock	100	
Banksiaspinulosa var. cunninghamii	Hairpin Banksia	100	
Acacia mearnsii	Black Wattle	200	
Acacia stricta	Hop Wattle	150	
Acacia pycnantha	Golden Wattle	100	
Allocasuarina littoralis	Black Sheoak	150	
Acacia implexa	Lightwood	100	
Lower-mid story			
Pultanea scabra	Rough Bush-pea	50	
Davesia latifolia	Hop Bitter-pea	50	
Davesia leptophylla	Narrow-leaf Bitter Pea	30	
Correa reflexa	Common Correa	50	
Acacia genistifolia	Spreading Wattle	100	
Goodenia ovata	Hop Goodenia	100	
Grevillea alpina (Southern Hill form)		0	
Epacris impressa	Common Heath	0	
Ampeira xiphoclada	Broom Spurge	4	
Pimelea flava subsp. flava	Yellow Rice-flower	51	
Acacia myrtifolia	Myrtle Wattle	0	



Groundcover/Climbers			
Poa sieberiana	Grey Tussock Grass	100	
Dianella tasmanica	Tasman Flax-lily	50	
Dianella admixta var. revouluta	Black Anther Flax- lily	0	
Dianella amoena	Matted Flax-lily	0	
Poa rodwayii		0	
Platelobium obtusangulum	Common Flat-pea	0	
Lomatia ilicifolia	Holly Lomatia	0	
Veronica plebeia	Trailing Speedwell	0	
Billardieria scandens	Common Apple- berry	0	
Solongoyne sp.		0	
Hovea sp.		0	
Pimelea humilis	Common Rice- flower	0	
Lomandra longifolia	Spiny-headed Mat- rush	0	
Poa labillardieri	Common Tussock Grass	100	
Lomandra filiformis subsp	Wattle Mat-rush	0	
Tetrahena juncea	Forest Wire Grass	0	
Pandorea pandorana	Wonga Vine	0	
Austrostipa rudis ssp. rudis		0	
Lomandra longifolia var.exilis		0	
Themeda triandra	Kangaroo Grass	100	

Prior to 2020 a total of 2960 tree and shrub species have been planted overall, with a further 2900 trees, shrubs and understory species planted throughout South-east Extraction area in 2020 (above), 350 of which were understorey species. To date approximately 5500 upper and mid story species have been planted in South-east Extraction area. Survival data was not collected this year and will be reported on in 2021's annual works report.

Management activities undertaken in the SE Extraction revegetation areas included multiple broadleaf runs through the entire site and multiple perennial grass control runs also. Large infestations of perennial grasses located within irrigated areas were brushcut prior to treatment, with regrowth treated in areas with high rates of perennial grasses. Brushcutting of overgrown areas allows for a reduction of biomass prior to spraying, allowing for both the use of less herbicide on-site and to achieve a higher quality of spray by reducing off target damage, as there are often native grasses present throughout these areas. Some of these areas were planted with understorey species post spray in order to establish a native understorey following weed control activities. Figure 3 highlights the area where brushcutting and follow-up weed control occurred (left) and where infill understorey planting took place (right).





Figure 3: (Left) brushcut and follow-up grass treatment areas. Understory planting area (right)

Extraction and Phase C Revegetation and Maintenance

Extraction and Phase C areas have steadily required less attention as areas become more established. Infill planting in this zone was limited to small number of trees with priority going towards understory plantings in areas previously dominated by perennial grassy weeds. As was discussed in management actions for South East Extraction above, brushcutting and follow-up spray of select areas was undertaken with infill plantings occurring in June 2020 (see table 2 for all species planted). Figure 4 shows the area where the majority of understory weed control and subsequent plantings occurred.

Species	Common Name	Quantity
Dianella tasmanica	Tasman Flax-lily	450
Poa ensiformis	Purple Sheath Tussock Grass	250
Poa larbillardieri	Common Tussock Grass	400
Tetrahena juncea	Forest Wire-grass	200
Themeda triandra	Kangaroo Grass	350
Eucalyptus fulgens	Green Scent-bark	100
Eucalyptus cypellocarpa	Mountain Grey Gum	50
Pomaderis aspera	Hazel Pomaderis	50
Oleria lirata	Snowy Daisy Bush	50

Table 2. Extraction Planting List





Figure 4. Location of majority of understory plantings in extraction area.

Weed management action priorities were given to broadleaf control with multiple treatments occurring throughout both Extraction and Phase C areas throughout 2020. Phase C has seen a return of some Thistle species, Blackberry Pampas Grass and Broome species throughout the site. These were treated with follow-up to occur in 2021. Perennial grass species were also controlled throughout the site. Appendix 2 details most common and priority species targeted throughout the site along with their threat rating. The threat rating is based on Cardinia Shire Weed Management Strategy 2019-29 (2019). This takes information from the DELWP Advisory list of environmental weeds in Victoria 2018 and applies the threat rating to weeds known to be present in Cardinia Shire. This allows us to identify priority weeds on-site as detailed below.

Net Gain Management

For ease of management, Net Gain has been split into north and South zones (see Figure 4). The primary focus in Net Gain has been the improvement of understory quality in the Southern section of Net Gain. This has been achieved by bi-monthly weed control visits to specific areas targeting all weeds in the area. Good natural recruitment of native grasses has seen a steady replacement of natives in areas where weeds have consistently been treated. As the Northern section is significantly larger, primary focus is on maintaining low levels of high threat weeds. Biomass control has also been undertaken through annual slashing and brushcutting of exotic grasses. Prior to this any tree or shrub recruits are marked out prior to slashing works. Appendix 1 highlights in more detail all management actions undertaken in Net Gain.





Figure 4. Net Gain Northern and Southern sections

Phase A and B Planting and Maintenance

Significant dieback of previous plantings occurred in Phase A and B revegetation areas outside of the operational Quarry areas (see figure 4). Details of potential causes are outlined in an alternate report along with proposed corrective actions (Naturelinks 2020b). The Northern area was first planted in 2019, with in-fill occurring in 2020 to the tune of 600 plants. The southern zone was then planted in September 2020 with 700 tree and shrub species. Table 2 below details species planted and numbers. Initial planting utilised recycled cardboard guards, however, consistent damage from wildlife in these zones has necessitated the change towards Roo proof Tree Guards to be utilised in most recent plantings.

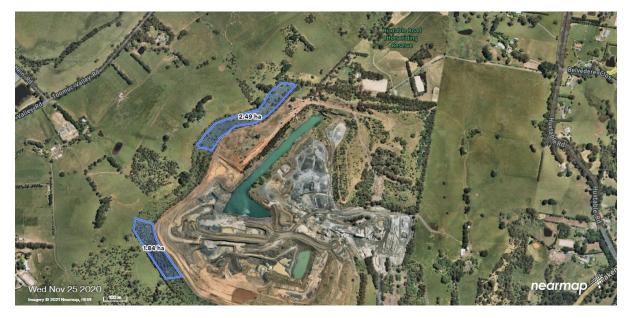


Figure 5. Phase A and B dieback in-fill planting areas 2020.



Species	Common Name	Quantity	
Eucalyptus obliqua	Messmate	250	
Eucalyptus radiata	Narrow-leaved Peppermint	150	
Eucalyptus cypellocarpa	Mountain Grey Gum	100	
Eucalyptus fulgens	Green Scent Gum	50	
Acacia paradoxa	Hedge Wattle	100	
Hakea nodosa	Yellow Hakea	100	
Acacia mearnisii	Black Wattle	100	
Acacia pycnantha	Golden Wattle	100	
Acacia verticillata	Prickly Moses	50	
Acacia stricta		50	
Goodenia ovata	Hop Goodenia	50	
Cassinia aculeata	Dogwood	50	
Allocasuarina littoralis	Black Sheoak	50	
Acacia myrtifolia	Myrtle Wattle	50	
Ozothamnus ferrugineus		50	

Table 2. Phase A & B Infill Planting List

Supplementary watering of these plantings have been undertaken and will continue into 2021. An average of approximately 80% survival of 2020 plantings has been recorded in species counts undertaken in January. Large areas of Scotch Thistle, Blackberry and some localised patches of Chilean Needlegrass were located in the southern planting area. It is recommended that weed control of these species occur as part of a maintenance regime along with pre-treating these areas prior to any future plantings.

Future Management Recommendations

Considering that 2020 saw an ambitious planting season, 2021 will focus more on locking in gains from our weed control actions and continue to stage our eradication of certain weeds and reduce cover of perennial grasses in key areas. Naturelinks has been successfully controlling most weeds throughout our work areas with some zones requiring less attention over time and most broadleaf weeds are controlled to <1% cover across our works areas. As mentioned in previous reports Naturelinks began controlling perennial grasses amongst native grass understory in areas where exotic grasses dominated. Works to date have been successful and Naturelinks will continue its push to eradicate large sections of perennial exotic grasses and slowly replace these with more robust and appropriate understorey species. Figure 5 shows priority areas for future understory management of exotic grasses. This will include follow-up works on previously treated areas to ensure quality gains within these zones does not reduce over time. Wherever possible we will seek to use slashing of these grass areas with machinery and personnel provided by the Quarry. Following successful control, it is proposed that infill planting of appropriate species occur in 2022.





Figure 6. Proposed focal areas for Grass Control in 2021.



Reference List

Naturelinks Landscape Management (2020a). Mt Shamrock Quarry Rehabilitation Report 2019.

Naturelinks Landscape Management (2020b). Holcim - Mt Shamrock Quarry Phase A & B Planting – Dieback Report.



Appendix 1. Details of Net Gain Management Actions

Spreadsheet	ClientPoNumber	Month Update (Brief Description of Work undertaken this month)
Net Gain - Jan	4599044951	22/01/2020 Spot spray in northern section around orchid beds. Broadleaf and perennial grass control in southern zone WEEDS: Anthoxanthum aristatum Dactylis glomerata Hypochaeris glabra Lotus creticus Paspalum dilatatum Plantago lanceolata Sonchus asper s.l. CHEMICALS: Lontrel Mixed 5ml/L BS1000 Surfactant Mixed 1ml/L Weedmaster Duo 10ml/L mixed
Net Gain - Feb	4599044951	19/02/2020 Checked landslip - Plantings are doing well. All works conducted in southern section. Hand weeded and sprayed around plantings, and sensitive remnant areas. 28/02/2020 Pack spray southern section top and bottom half hitting perennial grasses and annual broadleaf with non selective and selective herbicide. WEEDS: Agrostis capillaris s.l. Anthoxanthum odoratum Dactylis glomerata Ehrharta erecta var. erecta Festuca arundinacea Galium aparine Holcus lanatus Paspalum dilatatum Phalaris aquatica Plantago lanceolata Solanum nigrum s.l. Sonchus oleraceus CHEMICALS: BS1000 Surfactant Mixed 1ml/L Weedmaster Duo 10ml/L mixed Spot On Blue - Herbicide Dye CONCENTRATE Mixed 4ml per litre Spot On Blue - Herbicide Dye CONCENTRATE Mixed 4ml per litre
Net Gain - March	4599044951	24/03/2020 Pack spraying around plantings and high threat weeds in southern zone. WEEDS: Brassica fruticulosa Bromus arenarius Dactylis glomerata Ehrharta erecta var. erecta Holcus lanatus Sonchus oleraceus Vicia disperma CHEMICALS: BS1000 Surfactant Mixed 1ml/L Kamba M 6ml/L Weedmaster Duo 10ml/L mixed Spot On Blue - Herbicide Dye CONCENTRATE Mixed 4ml per litre
Net Gain - April	4599044951	01/04/2020 Willow removal from top swamp north section. Handweed and spot spray in top swamp area 17/04/2020 Tanker spray of lontrel in areas with large broadleaf infestations becoming a problem in northern section of Net gain WEEDS: Hypochaeris radicata Lonicera japonica Onopordum acanthium ssp. acanthium Plantago lanceolata Salix fragilis Sonchus asper s.l. Sonchus oleraceus Taraxacum officinale spp. agg. CHEMICALS: BS1000 Surfactant Mixed 1ml/L Lontrel Mixed 5ml/L Weedmaster Duo 10ml/L mixed Spot On Blue - Herbicide Dye CONCENTRATE Mixed 4ml per litre BS1000 Surfactant Mixed 1ml/L Lontrel Mixed 3ml/L Spot On Blue - Herbicide Dye CONCENTRATE Mixed 4ml per litre
Net Gain - May	4599044951	29/05/2020 spot spray around sensitive areas in southern and northern section 29/05/2020 Tanker spray of thistles etc at Northern section WEEDS: Arctotheca calendula Galium aparine Hypochaeris radicata Onopordum acanthium ssp. acanthium Plantago lanceolata Senecio jacobaea Sonchus asper s.l. Sonchus oleraceus Taraxacum officinale spp. agg. CHEMICALS: BS1000 Surfactant Mixed 1ml/L Lontrel Mixed 3ml/L BS1000 Surfactant Mixed 1ml/L Kamba M 6ml/L Weedmaster Duo 10ml/L mixed Spot On Blue - Herbicide Dye CONCENTRATE Mixed 4ml per litre
Net Gain - June	4599044951	24/06/2020 brushcutting and chainsaw work tidying up fallen tree in Southern section. Backpack thistle run and perennial grasses in northern section. Deer observed on-site and dmaging vegetation WEEDS: Dactylis glomerata Holcus lanatus Onopordum acanthium ssp. acanthium Plantago lanceolata Taraxacum officinale spp. agg. CHEMICALS: BS1000 Surfactant Mixed 1ml/L Lontrel Mixed 5ml/L Weedmaster Duo 10ml/L mixed Spot On Blue - Herbicide Dye CONCENTRATE Mixed 4ml per litre
Net Gain - July	4599044951	29/07/2020 Handweeding and backpack spray in southern zone. WEEDS: Cirsium spp Phalaris aquatica CHEMICALS: BS1000 Surfactant Mixed 1ml/L Kamba M 6ml/L Weedmaster Duo 10ml/L mixed Spot On Blue - Herbicide Dye CONCENTRATE Mixed 4ml per litre



Net Gain - August	4599044951	18/08/2020 Handweed and monitoring of plantings and site 18/08/2020 Site start allowance for Andrew and Kirby WEEDS: Cirsium vulgare Ehrharta erecta var. erecta Hedera helix1
Net Gain - September`	4599044951	11/09/2020 Pack spray of perennial grasses in southern zone 11/09/2020 SSA 11/09/2020 Tanker spraying Thistles and high threat weeds in northern section 14/09/2020 Tanker spraying Thistles and high threat weeds in northern section WEEDS: Anthoxanthum odorous Brassica fruticulosa Cirsium arvense Dactylis glomerata Ehrharta erecta var. erecta Festuca arundinacea Holcus lanatus Hypochaeris radicata Plantago lanceolata Taraxacum officinale spp. agg. CHEMICALS: Spot On Blue Dye Mixed 4ml per litre BS1000 Surfactant Mixed 1ml/L Weedmaster Duo 10ml/L mixed Spot On Blue Dye Mixed 4ml per litre BS1000 Surfactant Mixed 1ml/L Kamba M 8ml/L Lontrel Mixed 5ml/L
Net Gain - October	4599044951	12/10/2020 SSA 12/10/2020 Thistle and broadleaf spray in northern section. Pampas Grass spray on dam wall in southern zone. Broadleaf run in Southern section targeting Angled Onion, Blackberry and Spear Thistle WEEDS: Allium triquetrum Cirsium vulgare Hypochaeris radicata Plantago lanceolata Rubus fruticosus spp. agg. Rumex bidens Sonchus oleraceus Taraxacum officinale spp. agg. CHEMICALS: BS1000 Surfactant Mixed 1ml/L Kamba M 6ml/L Weedmaster Duo 20ml/L mixed Spot On Blue Dye Mixed 4ml per litre Brushwet Surfactant Mixed 1 ml//L Associate 0.1gm/L Clopyralid 300 Herbicide (Clopyralid) Mixed 5ml/L
Net Gain- November	4599044951	24/11/2020 Brushcutting areas unable to reached by recent slashing in areas with tall annual weeds in preparation for future spray works. 24/11/2020 Handweed in north and south section around plantings that have become overgrown. 24/11/2020 Planting 100 Banksia, plants were ready from the nursery late in season and used to replace those damaged and destroyed by deer. Planting all in northern section of site. 25/11/2020 Brushcut corner area near top gate southern section in preparation for future spray works. 25/11/2020 Handweed southern section top half around plantings. WEEDS: Anthoxanthum odoratum Banksia marginata Dactylis glomerata Ehrharta erecta Holcus lanatus
Net Gain - December	4599044951	11/12/2020 Southern Section: Handweed around plantings top half eastern side of creekline, pack spray non selective bottom half western side of creekline. 17/12/2020 Handweeding weedy grasses in top half of Net Gain -South. Spot sprayed broadleaf and grasses in southern half of Net Gain South. WEEDS: Anthoxanthum odoratum Bromus sp Dactylis glomerata Ehrharta erecta Holcus lanatus Phalaris aquatica Sonchus asper s.l. CHEMICALS: Weedmaster Duo 10ml/L mixed BS1000 Surfactant Mixed 1ml/L Spot On Blue Dye Mixed 4ml per litre BS1000 Surfactant Mixed 1ml/L Weedmaster Duo 10ml/L mixed Spot On Blue Dye Mixed 4ml per litre
TOTAL		



Appendix 2. Common Weeds found at Mt Shamrock Quarry

RP = Regionally Prohibited, RC = Regionally Controlled, WONS = Weeds of National Significance, R = Restricted in the whole of the state.

**Threat ratings (where rated) are derived from the risk rating score in the DELWP Advisory list of environmental weeds in Victoria 2018.

Scientific name	Common name	State classifications (where listed in a noxious weed category)	Cardinia Shire Threat rating (2019) **Threat rating (Low, Medium, Medium High, High, Very high)
Anthoxanthum odoratum	Sweet Vernal-grass		
Arctotheca calendula	Cape Weed		Μ
Allium triquetrum	Angled Onion	R	Н
Brassica fruticulosa	Twiggy Turnip		
Bromus sp	Bromus species		
Cirsium vulgare	Spear Thistle	Noxious (RC)	MH
Cratageus monogyna	Hawthorn	Noxious (RC)	Н
Cynodon dactylon var. dactylon	Couch		
Cyperus erogrostis	Drain Flat-sedge		Μ
Cortaderia selloana	Pampas Grass		Н
Dittrichia graveolens	Stinkwort		
Dactylis glomerata	Cocksfoot		
Ehrharta erecta	Panic Veldt-grass		Н
Erica lusitanica	Spanish Heath		VH
Erigeron bonariensis	Tall Fleabane		
Erigeron spp	Fleabane		
Festuca arundinaceae	Tall Fescue		
Galium aparine	Cleavers		Н
Genista linifolia	Flax-leaf Broome	Noxious (RC)	VH
Genista monspessulana	Montpellier Broome	Noxious (RC)	VH
Hedera helix	English Ivy		VH
Helminthotheca echioides	Ox-tongue		
Holcus lanatus	Yorkshire Fog		Н
Hypochaeris radicata	Cat's Ear		
Lonicera japonica	Japanese Honeysuckle		VH
Malva nicaeenis	Mallow-of-Nice		
Onopordum acanthium ssp. acanthium	Scotch Thistle		
Oxalis Pes-carpae	Soursob	R	VH
Paspalum dilatatum	Paspalum		
Phalaris aquatica	Toowoomba Canary- grass		L



Plantago lanceolata	Ribwort		
Polygonum arenastrum	Wireweed		
Raphanus raphanistrum	Wild Radish		
Solanum nigrum s.l	Black Nightshade		
Sonchus asper ssp. asper	Rough Sow-thistle		
Sonchus oleraceus	Sow-thistle		
Ranunculus repens	Creeping Buttercup		VH
Rubus fruticosus spp. agg.	Blackberry	Noxious (RC) WONS	VH
Salix cinerea	Willow	WONS, R	VH
Senecio jacobeana	Ragwort	Noxious (RC)	MH
Silybum marianum	Variegated Thistle		
Solanum nigrum	Black Nightshade		Μ
Ulex europeas	Gorse	Noxious (RC), WONS	Н