Good Bush Pty Ltd
Report prepared by: Marcus Burgess
Date: 12th September 2019

Final Report for Bushland/Riparian Restoration Works at Boral Dunmore Quarry, Rocklow Road, Dunmore

Client	Boral Metro Quarries
Site Name	Rocklow Road, Dunmore
Contract Period	August 2018 – September 2019
Purchase Order Number	n/a
Value of Contract	$45,285.00 Ex GST

Greenhood Orchid (*Pterostylis curta*) within Zone 1, September 2019

Introduction

This final report is for bushland and riparian restoration works carried out by Good Bush Pty Ltd at Boral Metro Quarries, Rocklow Road, Dunmore from August 2018 to September 2019. The works carried out at this site are based on the recommendations outlined in the 'Boral Dunmore Vegetation Assessment 29/04/2017'.

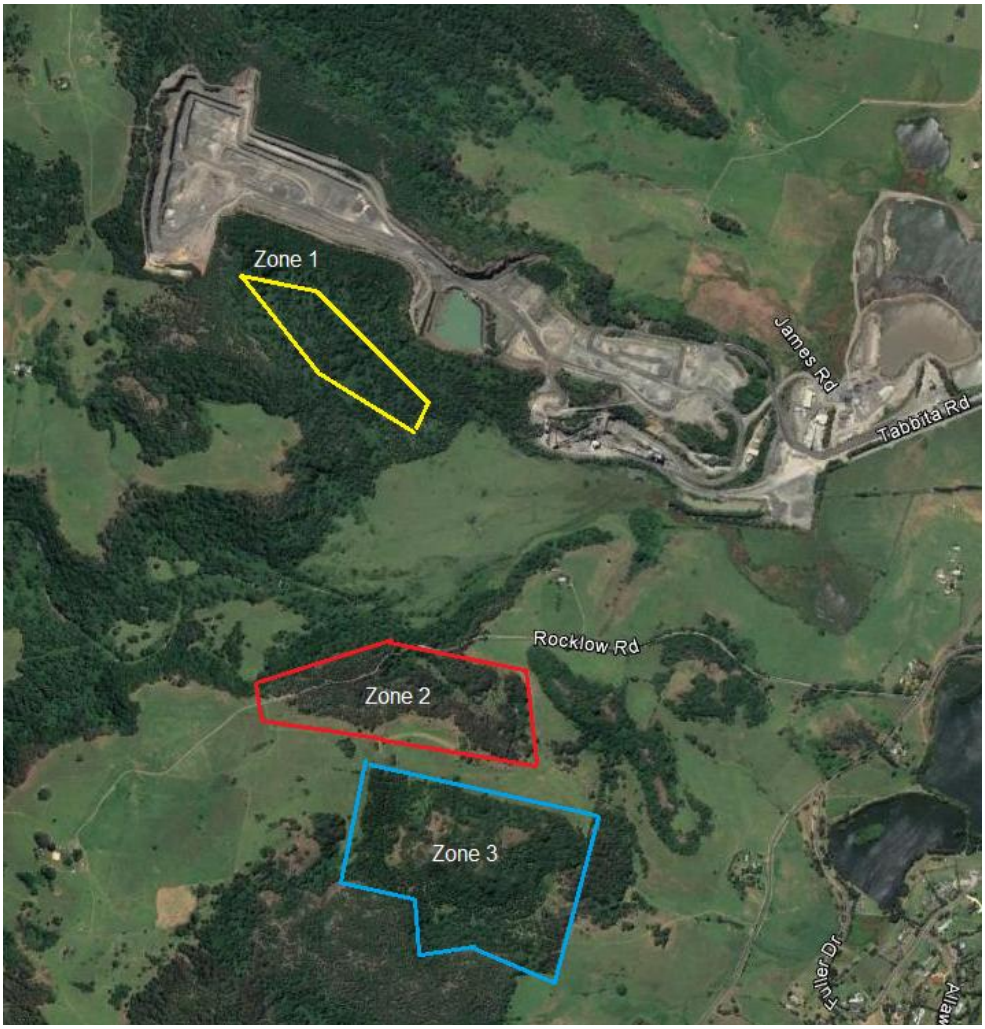
Objectives

The objective of these works was to undertake bushland restoration works in order to:

- Protect and enhance the remnants of the existing vegetation communities: Illawarra Dry Subtropical Rainforest, Illawarra Grassy Woodland and Melaleuca armillaris Tall Shrubland
- To reduce the area of Boral Dunmore Quarry natural areas impacted by Noxious Weeds, WoNs and environmental invasive weeds.
- Treat significant woody weeds throughout establishing 10 – 15 year old revegetation areas to assist development and establishment
- To improve connectivity between local remnant bushland fragments through weed control activities, regeneration and planting
- Assist natural regeneration by removing significant weed species using bush regeneration techniques and methods
- Monitor works, progress and completing using visual based documentation

Vegetation Assessment Report Outcomes

The 'Boral Dunmore Vegetation Assessment 29/04/2017' identified three zones surrounding the hard rock quarry at Tabbitta Road and Rocklow Road, Dunmore as priority areas for restoration work. The three zones are as follows:



Zone 1 – Remnant Vegetation Conservation Area
Zone 2 – Offset Area
Zone 3 – Compensatory Habitat Area

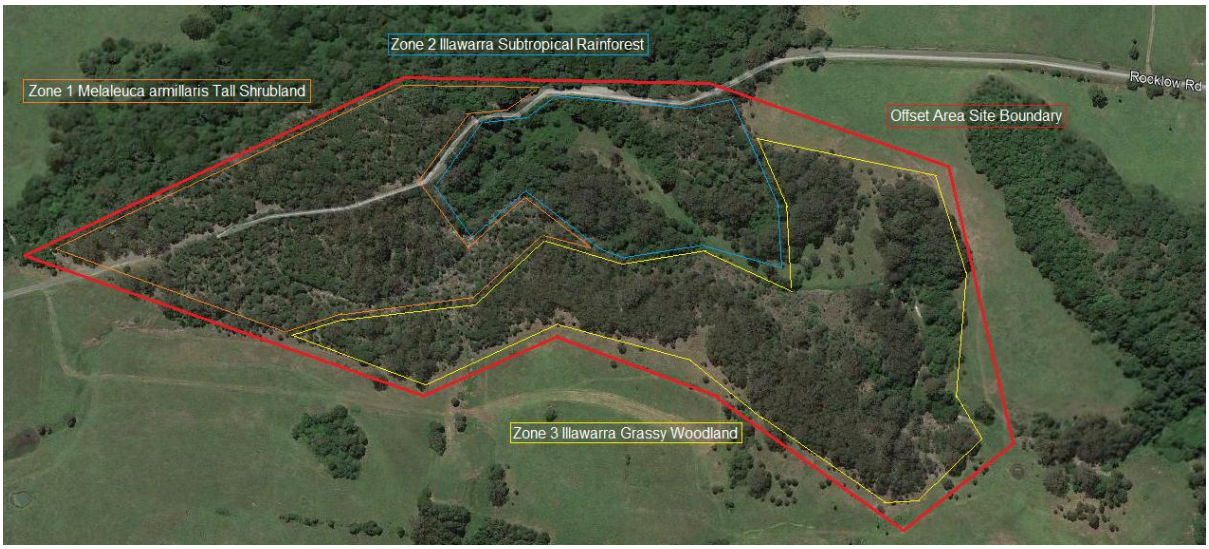
All works carried out to date have been within 'Zone 2 Offset Area' and 'Zone 3 Compensatory Habitat Area'

Zone 2 Offset Area Works

Zone 2 Offset Area Site Description

This zone is located south of Rocklow Road and consists of a large bushland remnant with a creek line flowing through the middle. The total site area of this zone covers approximately 18.3 hectares. The majority of this zone is perched on the rocky hillside immediately adjacent to Rocklow Road and supports the 'Melaleuca armillaris tall shrubland' vegetation community. The creekline drops toward the eastern end of the site forming a gully which is well defined by the presence of the rainforest tree species and is identified as the 'Illawarra Subtropical Rainforest' vegetation community. The creek flows close to Rocklow Road at one point where dumping of rubbish and weed material has introduced several highly invasive weed species. On the southern side of the gully a tall intact canopy of Forest Red Gum (*Eucalyptus tereticornis*) exists that defines the 'Illawarra Grassy Woodland' vegetation community on site.
The 'Pulpit Rock' is located within this zone which is a large basalt column projecting from the creek bank that has eluded the processes of erosion.

The Offset Area has been divided into three zones based on the three different vegetation communities found within this zone. Each of the three vegetation communities have had primary and secondary weed control works targeting woody weeds and invasive vines. The three zones with the Offset Area are as follows:



Zone 1: Melaleuca armillaris Tall Shrubland
Zone 2: Illawarra Subtropical Rainforest
Zone 3: Illawarra Grassy Woodland

Summary of Works

This contract period bush regeneration works focused on secondary weed control within the areas worked in the previous period to treat recruitment of woody weed species and minimal re-growth of previously treated woody weeds. Secondary weed control requirements were minimal due to the very dry period experienced during these works. Very little recruitment of annual weeds and weed grasses was observed and when these weeds did appear they generally did not reach maturity which has assisted in breaking the seed cycle. The dry period also resulted in little regeneration from native species although the rainforest zone shows good signs of recruitment within the shaded and moist areas. Primary weed control was carried out within all zones and the three zones within this site have now been linked as one large continuous management area.

The following hours worked and square metres covered were carried out within the three zones at this site:

Zone	Vegetation Community	Hours Worked	m² Worked Secondary	m² Worked Primary
Zone 1	Melaleuca armillaris Tall Shrubland	22 hours	8,450m²	800m²
Zone 2:	Illawarra Subtropical Rainforest	93 hours	8,900m²	2,200m²
Zone 3	Illawarra Grassy Woodland	179 hours	6,600m²	4,800m²
Total		**677 hours**	**23,950m²**	**7,800m²**

ZONE 1: Melaleuca armillaris Tall Shrubland - Description of Works

Works within this area focused on:

- Secondary weed control covering approximately 8,450m² throughout all areas worked in the previous year over the duration of the contract period
- Additional primary weed control covering approximately 800m² over the duration of the contract period
- Primary weed control targeting woody weeds such as Lantana, African Olive, Cassia and Wild Tobacco using the cut and paint method and mulching materials on site
- Treatment of invasive vines such as Cape Ivy and Moth Vine using hand removal and cut and paint methods and leaving materials suspended in the canopy after careful removal of viable propagules
- Frilling many large African Olive trees using a hammer and chisel

ZONE 2: Illawarra Subtropical Rainforest - Description of Works

Works within this area focused on:

- Secondary weed control covering approximately 8,900m² throughout all areas worked in the previous year over the duration of the contract period
- Additional primary weed control covering approximately 2,200m² over the duration of the contract period
- Primary weed control targeting woody weeds such as Lantana, African Olive, Cassia and Wild Tobacco using the cut and paint method and mulching materials on site
- Treatment of invasive vines such as Cape Ivy, Madiera Vine and Moth Vine using hand removal and cut and paint methods and leaving materials suspended in the canopy after careful removal of viable propagules
- Spray treatment of annual weeds and Madiera Vine using the Brush Off herbicide composition

ZONE 3: Illawarra Grassy Woodland - Description of Works

Works within this area focused on:

- Secondary weed control covering approximately 6,650m² throughout all areas worked in the previous year over the duration of the contract period
- Additional primary weed control covering approximately 4,800m² over the duration of the contract period
- Primary weed control targeting woody weeds such as Lantana, African Olive, Cassia and Wild Tobacco using the cut and paint method and mulching materials on site
- Treatment of invasive vines such as Cape Ivy and Moth Vine using hand removal and cut and paint methods and leaving materials suspended in the canopy after careful removal of viable propagules
- Frilling many large African Olive trees using a hammer and chisel

Work Areas Map

The following map identifies the approximate areas worked within the three zones:

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Vegetation Condition Assessment

The vegetation condition assessments are based on a 20m² area surrounding the established photo points within each zone.

Zone 1: Melaleuca armillaris Tall Shrubland

Photo Point	**A1, A3**		
Commencement of works date	August 2017		
Completion of works date	September 2018		
Vegetation Condition		**Percentage Cover prior to works**	**Percentage Cover post works**
Upper Stratum (emergent canopy)	The upper stratum surrounding this photo point is dominated by a tall canopy of *Melaleuca armillaris* *Eucalyptus tereticornis*	100% native cover	100% native cover
Mid Stratum (sub canopy)	The mid stratum surrounding this photo point is dominated by *Zieria granulata* *Dodonea viscosa* *Olea europaea* subsp. *cuspidate**	80% native cover 20% weed cover	100% native cover 0% weed cover
Shrub layer	The shrub layer surrounding this photo point is dominated by *Lantana camara** *Indigofera australis* *Leucopogon juniperinus*	30% native cover 70% weed cover	100% native cover 0% weed cover
Ground Layer	The ground layer surrounding this photo point is dominated by native and weed grasses as well as a range of annual weeds and woody weed seedlings such as *Lantana camara** *Bidens pilosa** *Tagetes minuta**	40% native cover 60% weed cover	90% native cover 10% weed cover

* indicates exotic plant species

Photographs

A1 Photo point prior to commencement of works

A1 Photo point after primary weed control and maintenance, September 2019

A3 Photo point prior to commencement of works

A3 Photo point after primary weed control and maintenance, September 2019

Mature Forest Red Gum (Eucalyptus tereticornis) surrounded by dense woody weeds such as Lantana prior to commencement of works

The same view post works demonstrating the success of woody weed treatment, September 2019

Zone 2: Illawarra Subtropical Rainforest

Photo Point	**B1**		
Commencement of works date	August 2017		
Completion of works date	September 2018		
Vegetation Condition		**Percentage Cover prior to works**	**Percentage Cover post works**
Upper Stratum (emergent canopy)	The upper stratum surrounding this photo point is dominated by a tall canopy of rainforest species such as Red Cedar, Red Ash, Ficus spp.	100% native cover	100% native cover
Mid Stratum (sub canopy)	The mid stratum surrounding this photo point is dominated by rainforest species such as *Guoia semiglauca* *Hibiscus heterophyllus*	95% native cover 5% weed cover	100% native cover
Shrub layer	The shrub layer surrounding this photo point is dominated by small regenerating rainforest species and Lantana, Wild Tobacco*, Cassia*	20% native cover 80% weed cover	100% native cover
Ground Layer	The ground layer surrounding this photo point is dominated by regenerating native rainforest trees and ferns as well as a range of annual weeds and invasive vines such as Cape Ivy* and Madiera Vine*	40% native cover 60% weed cover	70% native cover 30% weed cover

* indicates exotic plant species

Photographs

Looking east adjacent to Rocklow Road throughout an area dominated by woody weeds and invasive vines post works

The same view September 2019

Looking west adjacent to Rocklow Road throughout an area dominated by woody weeds and invasive vines post works

The same view September 2019

Zone 3: Illawarra Grassy Woodland

Photo Point	**A2**		
Commencement of works date	August 2018		
Completion of works date	September 2019		
Vegetation Condition		**Percentage Cover prior to works**	**Percentage Cover post works**
Upper Stratum (emergent canopy)	The upper stratum surrounding this photo point is dominated by a tall canopy of *Melaleuca armillaris* *Eucalyptus tereticornis*	100% native cover	100% native cover
Mid Stratum (sub canopy)	The mid stratum surrounding this photo point is dominated by *Notolea venosa* *Dodonea viscose* *Acaica maidenii* *Olea europaea* subsp. *cuspidata**	80% native cover 20% weed cover	100% native cover 0% weed cover
Shrub layer	The shrub layer surrounding this photo point is dominated by *Lantana camara** *Indigofera australis*	30% native cover 70% weed cover	100% native cover 0% weed cover
Ground Layer	The ground layer surrounding this photo point is dominated by native and weed grasses as well as a range of annual weeds and woody weed seedlings such as *Lantana camara** *Bidens pilosa** *Tagetes minuta**	40% native cover 60% weed cover	90% native cover 10% weed cover

* indicates exotic plant species

A2 Photo point prior to commencement of works


A2 Photo point after primary weed control and maintenance, September 2019

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Zone 3 Compensatory Habitat Area

Zone 3 Compensatory Habitat Area Site Description

This zone is located south of Rocklow Road and consists of a large bushland remnant on a hilltop with a small ephemeral creek line within a gully to the south of the hill . The total site area of this zone covers approximately 23.1 hectares. The majority of this zone is perched on the rocky hillside and supports the Melalecua armillaris tall shrubland vegetation community. The gully drops at the southern end of the zone which is well defined by the presence of rainforest species and some very impressive land large Moreton Bay Fig (Ficus macrophylla) trees.
Extensive revegetation has been carried out within this zone within the southern gully and on the eastern and western edges of the zone. Hundreds of thousands of trees have been planted within this zone and are now reaching maturity. Many open areas that have been cleared of vegetation also exist within this zone with the majority of these clearings occurring on the rocky hill tops.
Works within this zone have focused on treating woody weeds within the establishing revegetation along the western boundary if the zone.

Vegetation community boundaries within the compensatory habitat zone are as follows:

Summary of Works

Works within this contract period focused heavily on primary weed control throughout established revegetation areas. Works commenced for the northern fence line that defines this zone and have continued south covering over 1ha. The western fence line defined the boundary of this work area and an old dry stone wall that divides the revegetation areas from the natural bushland was used to define the eastern boundary.
A new previously unrecorded and large population of the threatened species Illawarra Socketwood (*Daphnandra johnsonii*) was identified at the southern extent of the work area. See below for population details.

The following hours worked and square metres covered were carried out within this site:

Vegetation Community	Hours Worked	m² Worked Primary Weed Control
Established Revegetation Areas	384 hours	10,300m^2

Description of Works

Works within this area focused on:

- Primary weed control covering approximately 10,300m² throughout all establishing revegetation areas form the northern fenced site boundary heading south between the rock wall and the western fenced boundary
- Primary weed control targeting woody weeds such as Lantana, African Olive, Cassia and Wild Tobacco using the cut and paint method and mulching materials on site
- Treatment of invasive vines such as Cape Ivy and Moth Vine using hand removal and cut and paint methods and leaving materials suspended in the canopy after careful removal of viable propagules

Work Areas Map

The following map identifies the approximate areas worked within this contract period:

Vegetation Condition Assessment

The vegetation condition assessments are based on a 20m² area surrounding the established photo points within each zone.

Establishing Revegetation Area on the western edge of the zone

Photo Point	**B1, B2**		
Commencement of works date	January 2019		
Completion of works date	September 2019		
Vegetation Condition		**Percentage Cover prior to works**	**Percentage Cover post works**
Upper Stratum (emergent canopy)	The upper stratum surrounding this photo point is dominated by a tall planted canopy of *Eucalyptus quadrangulata* *Eucalyptus XX*	100% native cover	100% native cover
Mid Stratum (sub canopy)	The mid stratum surrounding this photo point is dominated by *Lantana camara** *Solanum mauritianum** *Olea europaea* subsp. *cuspidata**	20% native cover 80% weed cover	90% native cover 10% weed cover
Shrub layer	The shrub layer surrounding this photo point is dominated by *Lantana camara* *Sida rhombifolia** *Solanum pseduocapsicum**	10% native cover 90% weed cover	90% native cover 10% weed cover
Ground Layer	The ground layer surrounding this photo point is dominated by native and weed grasses as well as a range of annual weeds such as *Bidens pilosa* *Tagetes minuta*	20% native cover 80% weed cover	80% native cover 20% weed cover

* indicates exotic plant species

Threatened Species Register

The following new populations of threatened species listed under THE EPBC Act 1999 were identified on this site:

Family	Atherospermataceae
Common Name	Illawara Socketwood
Genus / Species	*Daphnandra johnsonii*
Date	4/04/2017
Site Description	Zone 2 Offset Area, Boral Dunmore Hills
GPS Co-ordinates	Easting: 299843.4 Northing: 6166708.04
Number of Plants / Stems	Approximately 10 – 15 mature stems
Size / Age of Plants	Mature trees up to 10 metres tall and many suckers
Vegetation Community	*Illawarra subtropical rainforest*
Growing in association with	*Doryphora sassafrass, Baloghia inophylla, Cryptocarya microneura, Dendrocnide excelsa*
Weeds Present	*Lantana camara, Ehrharta erecta, Bidens pilosa*

Photographs

3A Photo point prior to commencement of works


The same view after primary weed control works, September 2019

3A Photo point prior to commencement of works


The same view after primary weed control works, September 2019

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3B Photo point prior to commencement of works

The same view after primary weed control works, September 2019

3B Photo point prior to commencement of works

The same view after primary weed control works, September 2019

Management Issues

The following management issues were identified at this site:

- This work period has been significantly dry and very little rainfall has been recorded at this site throughout the duration of these works. While the dry has had a beneficial impact on regeneration of weed species it has also been detrimental to regeneration of native species.
- The typical August winds were quite severe this year and many mature trees have fallen in the exposed areas off Rocklow Rd.
- Dumping of rubbish at the end of Rocklow Road remains an ongoing problem and large amounts of rubbish exist within the rainforest remnant areas adjacent to the road
- Dumped vegetative material within the same area is creating weed management issues with highly invasive weed species such as Morning Glory and Madiera Vine present within this area originating from vegetation dumping
- Cattle have entered the work site within both work areas despite the site being surrounded by fencing. Cattle can be very detrimental to establishing vegetation by grazing and trampling native regeneration although damage within the areas worked on this site has been minimal

Management Recommendations

I recommend the following management recommendations to continue the restoration works at this site:

- Installation of cameras and signage to deter the area being regularly used as a dumping ground
- Additional primary weed control within all zones to link fragmented remnants and provide assistance for natural regeneration
- Continued secondary weed control throughout all previously worked areas to continue to assist plant establishment and natural regeneration
- Maintenance of the fencing surrounding the sites to prevent cattle from gaining access to the site