



Vegetation and Flora Survey of the Bruce Rock – Narembreen Road Reserve
(PIN 11650235, Land ID 3677894)

Final Report to the Shire of Bruce Rock

By

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EXECUTIVE SUMMARY

The Shire of Bruce Rock submitted an application (CPS 8494/1) for a Purpose Permit under section 51E(1) of the Environmental Protection Act 1986 (the EP Act) for the proposed clearing of up to 1.82 hectares of native vegetation within Bruce Rock – Narembeen Road reserve (PIN 11650235). A flora survey was required for the area proposed to be cleared because the EPA identified a number of priority and threatened flora taxa that are known to occur within the local area and noted there is “a reasonable probability that these may occur in the application area based on similarities of soil and vegetation type”.

Specifically, within the proposed clearing at Bruce Rock – Narembeen Road reserve, the following flora species were identified as potentially occurring:

- *Acacia lirellata* subsp. *compressa* (P2)
- *Baeckea* sp. Narembeen (G.J. Keighery & N. Gibson 3010) (P2)
- *Ricinocarpos tuberculatus* (P2)
- *Acacia inophloia* (P3)
- *Acacia ancistrophylla* var. *perarcuata* (P3)
- *Eucalyptus subangusta* subsp. *virescens* (P3)
- *Hibbertia glabriuscula* (P3)
- *Phlegmatospermum eremaeum* (P3)
- *Thysanotus tenuis* (P3)
- *Daviesia oxylebium* (P4)
- *Eremophila caerulea* subsp. *merrallii* (P4)
- *Conospermum galeatum* (T)
- *Symonanthus bancroftii* (T)

A Reconnaissance Flora Survey was conducted by Leigh Whisson and Jackie Courtenay from Earth Creations on October 21 and 22 to clarify whether the area may support any significant flora or vegetation and in particular to determine whether any of the listed species identified by the EPA as potentially occurring in the area were actually present. The survey also incorporated elements of a Targeted Survey in that areas of potentially suitable habitat were more systematically searched for evidence of significant flora or vegetation. Searches were conducted using a Traverse Method whereby the entire area of vegetation was walked by the two observers in a zig-zag pattern with a total strip width of no more than 10 metres. Vegetation condition was assessed using the Vegetation Condition Scale (Environmental Protection Authority, 2016, p. 10) and structural vegetation classification was used to describe differences between vegetation units.

A total of 33 taxa were identified including 27 genera and 15 families. None of the listed species were observed and all native species identified were Not Threatened. There were no

Weeds of National Significance, although the vegetation condition in the area was a mixture of Degraded and Completely Degraded due to heavy infestation with weeds, particularly Wild Oat (*Avena fatua*). Four Vegetation Units were identified – (1) *Eucalyptus/Acacia* Open Low Woodland with 10% *Eucalyptus* cover, (2) *Eucalyptus/Acacia* Open Low Woodland with 2% *Eucalyptus* cover (emergents), (3) Open *Acacia* Scrub and (4) *Eucalyptus torquata* (individual tree). There were no TECs or PECs observed in the area and the vegetation through the reserve is lacking structural and floristic diversity.

The road realignment is proposed in order to improve visibility and safety at the junction of Cumminin Road and the Bruce Rock – Narembreen Road. This will require clearing of up to 1.82 ha of vegetation in the reserve. However, despite the degradation, the woodland vegetation will still have some value as habitat particularly for woodland birds as well as a range of reptiles and invertebrates. In such heavily fragmented habitat it is important that further damage to such remnant woodland patches is minimised and, where possible, some rehabilitation undertaken to mitigate any impacts.

It is recommended that the proposed road realignment should be oriented toward the southern part of the reserve, as far as safety allows, so that it is routed primarily through the Completely Degraded section with the aim of avoiding the large Eucalypts. Removal of some of the Degraded *Acacia acuminata* dominated Open Low Woodland (Vegetation Unit 2) towards the south west corner of the reserve will be unavoidable.

Clearing of the Degraded Woodland habitat should be kept to a minimum to preserve as much vegetation connectivity as possible.

It is our understanding that the eastern end of the slip road to the south of the reserve will be blocked off to prevent through traffic and the intention is to rip and rehabilitate that section of the road. Some consideration should be given to revegetating the area to the south-east of the new road alignment to improve vegetation connectivity between the Bruce Rock – Narembreen Road reserve and the patch of vegetation near the Water Authority pumping station.

The area is so heavily weed infested, particularly with Wild Oat (*Avena fatua*) that the road realignment is not going to add any significant weed management issues to the site that are not already present.

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INTRODUCTION

Bruce Rock Shire is located 245 km east of Perth in the Avon Wheatbelt IBRA sub-region AVW01 Merredin (Shire of Bruce Rock, n.d.; Department of Environment and Energy, 2012). It falls within the Avon River Catchment and occupies an area of 2,772 km² (Shire of Bruce Rock, n.d.). The area has a Mediterranean climate with warm dry summers and cool winters and receives an average of 332 mm rainfall per year (Weaving, 1995). The Shire as a whole retains less than 10% native vegetation cover with Shepherd, Beeston and Hopkins (2001) reporting that Bruce Rock Shire retains only 7.1% native vegetation cover and the advice from the EPA pertaining to the current clearing application stating that “the application is located within an extensively cleared landscape, with the application area only retaining approximately 8.9 percent remnant native vegetation”.

The Bruce Rock – Narembreen Road reserve (PIN 11650235, Land ID 3677894) is a 4.549 ha roughly triangular shaped reserve bounded by the Bruce Rock – Narembreen Road to the east, Cumminin Road to the west and an unnamed slip road to the south of the reserve that connects the Bruce Rock – Narembreen Road with Cumminin Road (Figure 1).



Figure 1: The Bruce Rock – Narembreen Rd Reserve provided by the Shire of Bruce Rock with the boundaries of the Reserve marked in dark red. The road labelling is from Landgate and the road labelled “Bruce Rock Narembreen Rd” is the road that is locally known as an unnamed slip road, with the Bruce Rock – Narembreen Road continuing round the curve and to the north (Map source Landgate November 20, 2020, provided by Shire of Bruce Rock).

The Reserve is located 16.2 km south east of Bruce Rock and 23.3 km north west of Narembeen (Figure 2) surrounded by heavily cleared agricultural land although there are some patches of Degraded remnant vegetation on nearby farms (Figure 3) and the Roach Nature Reserve is located 7.2 km to the east, and Wandjagill Nature Reserve and Seagroatt Nature Reserve are respectively located 10.3 km and 14.8km to the south west.

The Bruce Rock – Narembeen Reserve is a patch of remnant vegetation which is not known to have ever been cleared and there is no evidence of recent or historical fire such as fire scars on any of the larger trees. A single large, old Coral Gum (*Eucalyptus torquata*) is located north east of the centre of the reserve. *Eucalyptus torquata* occur naturally in an area between Kalgoorlie and Salmon Gums so its occurrence well out of range in the Bruce Rock – Narembeen Reserve suggests that this tree was planted there at some time in the past. The Shire of Narembeen website reports that European agricultural settlers started arriving in the area in the 1850s but it was not until 1910 that the area around Narembeen was surveyed and the population of sheep and wheat farmers rapidly increased. The town of Narembeen was established as a private town in 1920 (Shire of Narembeen, 2020). The Shire of Bruce Rock website reports that European agricultural settlers began moving into the area in the 1860s and the town of Bruce Rock was gazetted in 1913 (Shire of Bruce Rock, n.d.). It is likely therefore that the Bruce Rock – Narembeen Road dates back to somewhere between the mid-19th and early 20th centuries although it is difficult to determine exactly when the vegetation in the vicinity of the Bruce Rock – Narembeen Road Reserve was cleared for farming.

Vegetation surveys were carried out by Muir (1978) in some of the reserves in the Shire of Bruce Rock and in 1995 the then Department of Agriculture and Food produced a *Native Vegetation Handbook for the Shire of Bruce Rock* (Weaving, 1995) which was part of a series of similar handbooks produced to assist with the management of remnant vegetation in agricultural regions of Western Australia. The handbook includes background biogeographical, geological and ecological information about the Shire of Bruce Rock, as well as flora and fauna species lists which are a useful reference. There do not appear to have been any flora surveys done in the Bruce Rock – Narembeen Road Reserve, at least not recently, and no documentation of any surveys could be identified.

The Shire of Bruce Rock submitted an application (CPS 8494/1) for a Purpose Permit under section 51E(1) of the Environmental Protection Act 1986 (the EP Act) for the proposed clearing of a maximum of 1.82 hectares of native vegetation within the Bruce Rock – Narembeen Road reserve (PIN 11650235, Land ID 3677894). This proposed clearing is to enable the realignment of the Cumminin Road junction with the Bruce Rock - Narembeen Road to improve road visibility and safety.



Figure 2: Location of the Bruce Rock Naremben Road Reserve in regional context showing nearby towns, the Seagroatt Nature Reserve and larger patches of remnant vegetation. The town of Bruce Rock is located 16.2 km to the north east of the reserve and the town of Naremben is 23.3 km to the south west (Base image source: Google Satellite).



Figure 3: Location of the Bruce Rock-Narembeen Road Reserve in local context showing nearby patches of remnant vegetation (Base image source: Google Satellite)

A flora survey was required for the area proposed to be cleared because the EPA identified a number of priority and threatened flora taxa that are known to occur within the local area and noted there is “a reasonable probability that these may occur in the application area based on similarities of soil and vegetation type”.

Specifically, within the proposed clearing at Bruce Rock-Narembreen Road reserve, the following flora species were identified as potentially occurring:

- *Acacia lirellata* subsp. *compressa* (P2)
- *Baeckea* sp. Narembreen (G.J. Keighery & N. Gibson 3010) (P2)
- *Ricinocarpos tuberculatus* (P2)
- *Acacia inophloia* (P3)
- *Acacia ancistrophylla* var. *perarcuata* (P3)
- *Eucalyptus subangusta* subsp. *virescens* (P3)
- *Hibbertia glabriuscula* (P3)
- *Phlegmatospermum eremaeum* (P3)
- *Thysanotus tenuis* (P3)
- *Daviesia oxylebium* (P4)
- *Eremophila caerulea* subsp. *merrallii* (P4)
- *Conospermum galeatum* (T)
- *Symonanthus bancroftii* (T)

Degraded roadside vegetation on the western side of Cumminin Road provides a potential corridor linking the reserve with a 1.28 ha patch of remnant vegetation on a farm to the north of the reserve east of the Bruce Rock – Narembreen Road and with a larger patch of 28.27 ha on a farm on the western side of the Bruce Rock – Narembreen Road. Both of these patches are Degraded but, given the low percentage of retained native vegetation in the area, are still potentially of value particularly for fauna, for example as nesting habitat. The potential road reserve corridor on the western side of Cumminin Road is not affected by this clearing proposal. There is also a 1.25 ha patch of Degraded native vegetation around the Water Authority pumping station on the southern side of the slip road mentioned above and the eastern side of Cumminin Road (Figure 2).

Bruce Rock Shire requested that Earth Creations conduct a survey of the area of the Bruce Rock – Narembreen Road reserve bounded by the red lines as shown on Figure 4.

The objectives of the survey were to

- (1) determine whether any of the above listed Priority and Threatened flora species occurred in the area;
- (2) assess the vegetation condition and provide as complete a flora list as possible for the area of the reserve potentially impacted by the proposed road realignment;
- (3) make recommendations based on the outcomes of the first two objectives.



Figure 4: Bruce Rock – Narembeen Road reserve showing the area (bounded by red) that the Shire requested be surveyed for this proposal. Map provided by the Shire of Bruce Rock (Base image source: Google Earth).

METHODS

Scope of the Survey

As noted in the introduction, the primary objectives of the survey were to determine whether any of the Priority and Threatened flora species on the list provided by the EPA occurred in the area and to assess the vegetation condition and provide as complete a flora list as possible for the area of the reserve potentially impacted by the proposed road realignment. Because the exact route of the proposed road realignment had not been determined pending the outcome of the survey, the entire area of the reserve that could possibly be impacted (as shown in Figure 4) was surveyed.

Survey Methods

A Reconnaissance Flora Survey was conducted on October 21 and 22 to clarify whether the area may support any significant flora or vegetation communities and in particular to determine whether any of the listed species identified by the EPA as potentially occurring in the area were actually present. The survey also incorporated elements of a Targeted Survey in that areas of potentially suitable habitat were more systematically searched for evidence of significant flora or vegetation. Searches were conducted using a Traverse Method whereby the entire area of vegetation was walked by two observers in a zig-zag pattern with a total strip width of no more than 10 m (Figure 5) and a full list created of all species encountered in the vegetation patch. More detailed Targeted Searches were carried out in the more diverse vegetation along the Cumminin Road Edge and along the water pipeline on the southern edge of the reserve.

Vegetation condition was assessed using the Vegetation Condition Scale (Environmental Protection Authority, 2016, p. 10).

Structural vegetation classification was used to describe differences between vegetation units for a number of reasons. The survey undertaken was a reconnaissance survey to determine whether any significant flora or vegetation was present, the area surveyed was relatively small (approximately 2.32ha), it was clear from the aerial photograph that there were only two or three vegetation units within the survey area which was confirmed by the field survey, and the area was either Degraded (Units 1 and 2) or Completely Degraded (Unit 3) and so was lacking the floristic complexity that would suggest the need for a floristic composition vegetation classification.

Surveys were conducted under Regulation 62 Flora Taking (Biological Assessment) Licence numbers FB620000290 (Jacqueline Courtenay) and FB620000291 (Leigh Whisson).

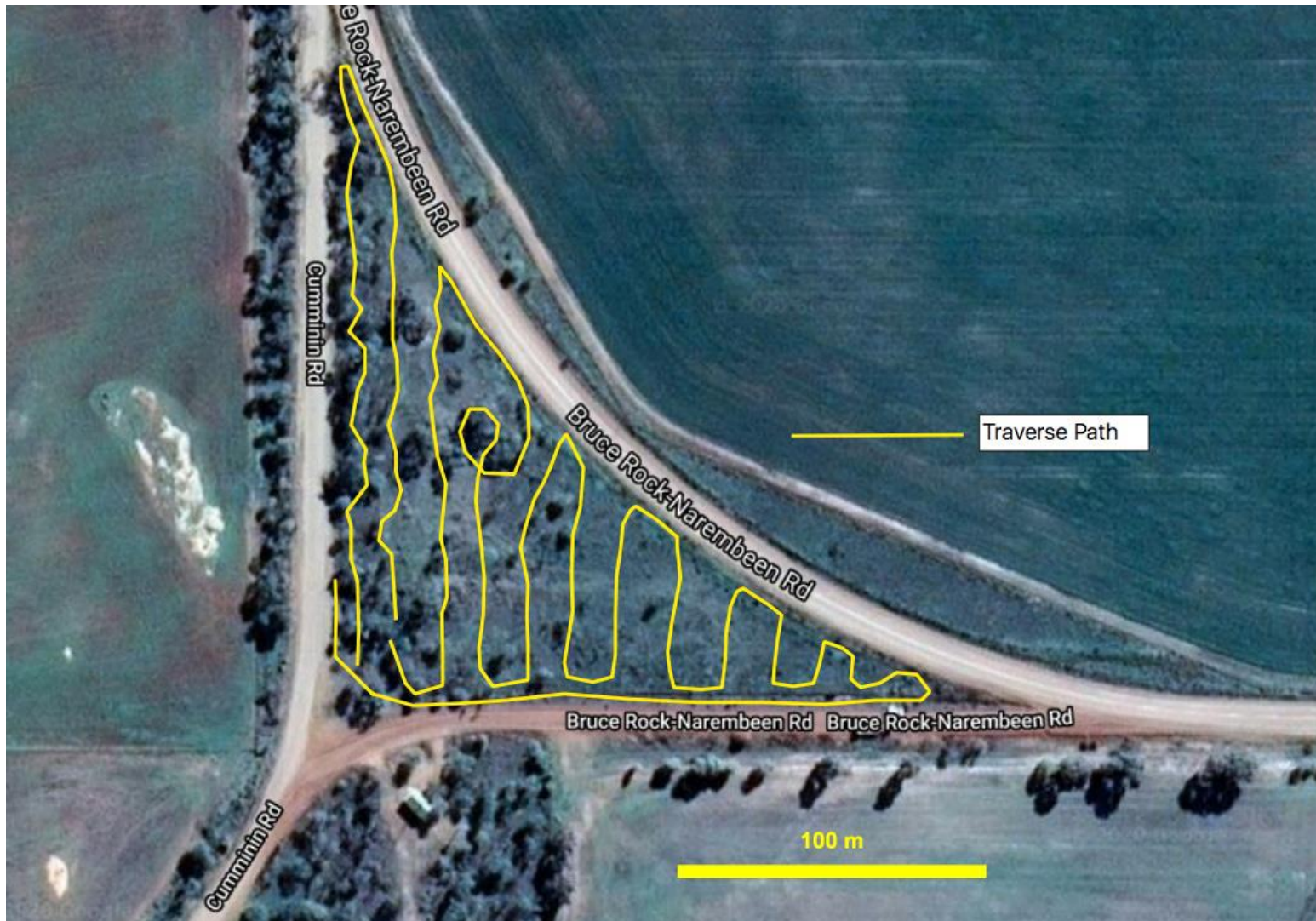


Figure 5: A representation of the Traverse Path walked by the two observers when surveying the Bruce Rock – Naremburn Road reserve. The two observers generally followed the same path but were walking side by side several metres apart thus ensuring a strip width of no more than 10 metres (Base image source: Google Satellite)

Limitations

Availability of contextual information at a regional and local scale;

As noted in the Introduction, vegetation surveys had been conducted by Muir (1978) in some of the reserves in the Shire of Bruce Rock and a *Native Vegetation Handbook for the Shire of Bruce Rock* produced by the Department of Agriculture and Food in 1995 (Weaving, 1995) as part of a series of similar handbooks produced to assist with the management of remnant vegetation in agricultural regions of Western Australia. However there do not appear to have been any flora surveys done specifically in the Bruce Rock – Narembreen Road Reserve, at least not recently, and no documentation of any surveys could be identified.

Competency/experience of the team carrying out the survey, including experience in the bioregion surveyed;

Leigh Whisson and Jackie Courtenay of Earth Creations have a combined 50 years of experience working in biological survey, threatened species and land management planning, vegetation survey and rehabilitation. We have been part of teams co-authoring two books on wheatbelt vegetation with staff from the Northern Agricultural Catchment Council (the 2nd edition of *Trees and Shrubs for the Midlands and Northern Wheatbelt* and writing additional sections for an extended and updated edition of *Riparian Plants of the Avon Catchment*). Leigh Whisson has most recently spent 5 years working with Wheatbelt NRM initially as Regional Landcare Facilitator including conducting several BioBlitzes in the Wheatbelt and subsequently as Project Officer working on a range of biodiversity projects including assessing vegetation for the presence of Wheatbelt Woodlands TECs.

Proportion of flora recorded and/or collected, any identification issues;

The entire area was surveyed using a walking traverse method with two observers and all flora encountered was recorded and identified. There were some annual species that were dead and other perennial species that were not flowering but all the Threatened and Priority species identified by the EPA as possibly occurring in the area were perennial and we are confident they would have been noted had they been present. There was one taxon *Crassula sp.* that could not be identified below genus level without dissection which was not possible at this time. While we are confident that we identified a very high proportion of the species that were present at the time, there may have been some annual species that were missed due to the dry year and the timing of the survey.

Was the appropriate area fully surveyed (effort and extent);

The area was fully surveyed by two observers who surveyed the entire patch identified in Figure 2 using a walking traverse method as shown in Figure 4. This was necessary as while the proposal was only for clearing of a maximum of 1.82 ha of the approximately 2.32 ha

patch, the exact route of the proposed road realignment, and hence the area to be cleared, had not been determined pending the outcome of the survey. Time spent in the patch totalled 5h 30 min (2h 45 min/observer) to cover 2.32ha.

Access restrictions within the survey area;

None

Survey timing, rainfall, season of survey;

The survey was undertaken on October 21 and 22, 2020 which is mid-spring. Based on the weather records for Narembreen from the Bureau of Meteorology (2020) the year to date had been drier than average (210.9 mm to end of October compared to a long term average of 305 mm) with the month of October being extremely dry with only 0.2mm of rain falling on October 3 and none for the rest of the month. The long term average for the month of October is 19.1 mm. The survey was conducted within the known flowering season of five of the twelve Threatened or Priority species listed by the EPA as potentially occurring in the site, and in the month following the flowering season for another four.

Disturbance that may have affected the results of survey such as fire, flood or clearing.

None

RESULTS

Flora

The survey identified 33 taxa, including 27 genera and 15 families. The full species list is provided in Appendix 1, Table A1. All native species identified were Not Threatened. There were no Weeds of National Significance, although the vegetation condition in the area was a mixture of Degraded and Completely Degraded as described below. The Completely Degraded area was heavily dominated by Wild Oat (*Avena fatua*) and there were at least eight other species of weeds found in both the Degraded and Completely Degraded areas. There were no significant flora species or populations of significant species recorded within the survey area.

Vegetation

The survey identified four Vegetation Units as indicated in Figure 6. Descriptions of each identified Vegetation Type using both the vegetation classification system of Muir (1978) and NVIS Structural Formation Terminology (DBCA, n.d.) can be found in Appendix 2. A matrix of the full list of all species found in each Vegetation Unit and whether they are native or alien/weeds can be found in Appendix 3.



Figure 6: The Bruce Rock – Narembeen Rd Reserve showing the areas covered by each of the four identified Vegetation Units (Base image source: Google Satellite)

Vegetation Units and Condition

Vegetation Unit 1 (*Eucalyptus*/*Acacia* Open Low Woodland) occupies an area of 0.27 hectares in a strip along the north western edge of the patch adjacent to Cumminin Road (Figure 7). It was assessed as Degraded as the basic vegetation structure was severely impacted by weed species, particularly Wild Oat *Avena fatua*, that almost completely replaced the native ground stratum (G) and the mid-stratum (M) had reduced species diversity. There is scope for regeneration but intensive and ongoing weed management and biodiversity plantings would be required to achieve a state approaching Good condition. The potential for regeneration is further limited by the fact that the reserve is surrounded by agricultural land and the adjacent vegetation unit (Unit 3) within the reserve is Completely Degraded being even more heavily impacted by weed species that would require very intensive management to prevent continual reinvasion of the site.



Figure 7: Vegetation Unit 1 (*Eucalyptus*/*Acacia* Open Low Woodland) on the right hand side of the road) showing the mix of *Eucalyptus loxophleba* subsp. *loxophleba* and *Acacia acuminata* and the dense Wild Oats (*Avena fatua*) in the understorey. The vegetation on the left hand side of the road is part of a potential vegetation corridor that will not be impacted by the road realignment (Photo: Mandy Schilling).

Vegetation Unit 2 (*Eucalyptus*/*Acacia* Open Low Woodland) occupies an area of 0.571 hectares and differs from Vegetation Unit 1 in that the *Eucalypt* cover is reduced and there are some differences in mid stratum and ground stratum species (see Table A3 in Appendix 3). It was similarly assessed as Degraded as the basic vegetation structure was again severely impacted by weed species, particularly Wild Oat, *Avena fatua*, that had almost completely replaced the native ground layer (G). The mid-stratum (M) layer had reduced

species diversity (Figure 8). As with Vegetation Unit 1, there is scope for regeneration but intensive and ongoing weed management and biodiversity plantings would be required to achieve a state approaching Good condition.



Figure 8: Vegetation Unit 2 (*Eucalyptus*/*Acacia* Open Low Woodland) showing the characteristic open *Acacia* woodland with occasional York Gum (*Eucalyptus loxophleba* subsp. *loxophleba*) emergents and the ground stratum heavily infested with Wild Oats (*Avena fatua*). This Vegetation Unit is very similar to Vegetation Unit 1, the main difference being the number of York Gum emergents. There were also some differences in mid-stratum and ground stratum species. (Photo: Mandy Schilling).

The potential for regeneration is again further limited by the fact that the reserve is surrounded by agricultural land and the adjacent vegetation unit (Unit 3) within the reserve is Completely Degraded being even more heavily impacted by weed species that would require very intensive management to prevent continual reinvasion of this vegetation unit.

Vegetation Unit 3 (Open *Acacia* scrub) occupies 1.46 hectares or approximately 63 percent of the site and was assessed as Completely Degraded as the structure of the vegetation is no longer intact and the area is totally dominated by Wild Oat, *Avena fatua* (Figure 9). While the area retains 15 native species, except for scattered *Acacia acuminata*, they are all in extremely low numbers with just the occasional plant, with much of the diversity concentrated along the water pipeline that runs along the southern edge of the vegetation patch from the Bruce Rock – Narembreen Road towards the Water Authority pumping station. This pipe is leaking water in some places providing a moister environment for a number of species including *Exocarpos aphyllus*, *Acacia acanthaster* and *Solanum hoplopetalum* (Figure 10). The ground (G) stratum is heavily dominated by Wild Oat (*Avena fatua*) with a few other weed species found in the ground layer, a few widely scattered native shrubs and the occasional *Acacia acuminata*.



Figure 9: Vegetation Unit 3 (Open *Acacia* Scrub) at the Bruce Rock – Narembeen Road reserve showing the dominance of Wild Oat (*Avena fatua*) and scattered Acacias (Photo: Leigh Whisson).



Figure 10: The increased vegetation diversity in Vegetation Unit 3 along the water pipeline showing *Exocarpos aphyllus* and *Acacia acanthaster* as well as the generally greener vegetation where leakage from the water pipe is creating a moister environment (Photo: Leigh Whisson).

Vegetation Unit 4 is a small patch of 0.022 hectares surrounding a single, old *Eucalyptus torquata* (Figure 11). This species is out of range for the area, occurring naturally in one patch south of Kalgoorlie and entirely within the Eremaean Province (Western Australian Herbarium, 1998) suggesting that it may have been planted at some unknown time in the 20th century.



Figure 11: Left - Coral gum (*Eucalyptus torquata*) flowers just prior to opening and beginning to open with the operculum still in place Right - Coral gum (*Eucalyptus torquata*) flowers fully open. Photos: Leigh Whisson.

The vegetation communities present in the survey area do not represent known TECs or PECs. The Degraded Eucalypt woodland patch that takes up about 0.27 hectares of the survey area does not meet the criteria of a Wheatbelt Woodlands TEC patch as while one of the listed Wheatbelt Woodlands Eucalypt species, York Gum (*Eucalyptus loxophleba* subsp. *loxophleba*), is present, *Acacia acuminata* forms a distinct and dominant tree canopy and is in greater abundance in the patch than the York Gum. The understorey is also heavily weed infested. The Approved Conservation Advice for the Western Australian Wheatbelt Woodlands TEC (2015) notes that while *Acacia acuminata* commonly co-occurs in a canopy with York gum, where it becomes “sufficiently abundant and tall to form a distinct and dominant tree canopy...this represents a shift in vegetation type away from eucalypt woodlands to other, non-eucalypt woodlands or tall shrublands that are not part of the WA Wheatbelt Woodlands ecological community”. This shift in vegetation type to another non-eucalypt woodland is clearly what is observed in Vegetation Unit 1 in this site.

DISCUSSION

As mentioned in the introduction, Shepherd, Beeston and Hopkins (2001) reported that Bruce Rock Shire retains only 7.1% native vegetation cover and, in their advice pertaining to

the current clearing application, the EPA note that the application area retains only approximately 8.9% remnant native vegetation. Both estimates are below the threshold of 10 to 20 percent remaining habitat that Wallace, Beecham and Bone (2003, p. 51) identified as “showing increased rates of species loss due to the combined effects of habitat loss and fragmentation”. A study of woodland birds in south east Australia in 1997 found that once the amount of retained vegetation in the landscape falls below 10% there is a rapid decline in the number of woodland bird species present (Bennett and Ford, 1997 cited in Wallace, Beecham and Bone, 2003). During the 2 h 45 mins spent in the reserve undertaking the flora surveys five species of woodland birds were recorded – a Regent Parrot, Willie Wagtail, Yellow-throated Miner, Striated Pardalote and Australian Raven. All of these species are considered Least Concern under IUCN Red List criteria (IUCN, 2020) but their presence in such a Degraded patch of vegetation was nevertheless encouraging.

Degraded roadside vegetation on the western side of Cumminin Road (see vegetation on the left hand side of the road in Figure 7) provides a potential corridor linking the reserve with an approximately 1.28 ha patch of remnant vegetation on a farm to the north of the reserve east of the Bruce Rock – Narembeen Road and with a larger patch of 28.27 ha on a farm on the western side of the Bruce Rock – Narembeen Road. Both of these patches are Degraded but given the low percentage of retained native vegetation in the area are still potentially of value particularly for birds, for example as nesting habitat. The potential road reserve corridor on the western side of Cumminin Road is not affected by this clearing proposal. There is also an approximately 1.25 ha patch of Degraded native vegetation around the Water Authority pumping station on the southern side of the slip road mentioned above and the eastern side of Cumminin Road. This patch is already separated from the survey area by the unnamed slip road to the south of the Bruce Rock – Narembeen Road reserve (Figure 2 above).

This survey was required because the EPA identified a number of priority and threatened flora taxa that are known to occur within the local area and noted there is “a reasonable probability that these may occur in the application area based on similarities of soil and vegetation type”. None of the 13 Threatened and Priority species listed by the EPA in their advice were found in the area surveyed in the Bruce Rock – Narembeen Road reserve. As noted in the results, the entire area of the reserve is either Degraded or Completely Degraded with heavy weed infestations and substantially altered vegetation structure. The Completely Degraded area in the eastern and southern portion of the reserve was dominated by Wild Oat, with frequent occurrences of other weeds such as *Bromus diandrus*, *Mesembryanthemum crystallinum*, Cape Weed and only occasional native shrubs such as *Exocarpos aphyllus*, *Enchylaena tomentosa* var. *tomentosa* and *Maireana brevifolia*, and scattered *Acacia acuminata*.

CONCLUSIONS

The road realignment is proposed in order to improve visibility and safety at the junction of Cumminin Road and the Bruce Rock – Narembreen Road. This will require clearing of up to 1.82 ha of vegetation in the reserve. None of the species listed by the EPA as potentially occurring in the reserve were observed and no other significant flora or vegetation were noted. There were no TECs or PECs observed in the area and the vegetation through the reserve is heavily weed infested and lacking structural and floristic diversity. The Bruce Rock – Narembreen Road Reserve contains four vegetation units – (1) a Degraded Eucalypt/Acacia Open Low Woodland A (Muir, 1978) primarily occupying the western section of the reserve along the Cumminin Road, (2) a Degraded Acacia/Eucalypt (occasional emergents) Open Low Woodland A primarily occupying the south west section of the reserve, (3) a Completely Degraded patch to the east and south east dominated by Wild Oat and other weeds with scattered *Acacia acuminata* and other native low shrubs and (4) a single, old Coral Gum *Eucalyptus torquata* which is well outside its native range south of Kalgoorlie and was probably planted sometime in the 20th Century. Despite the degradation, the woodland vegetation will still have some value as habitat particularly for woodland birds as well as a range of reptiles and invertebrates. In such heavily fragmented habitat it is important that further damage to such remnant woodland patches is minimised and, where possible, some rehabilitation undertaken to mitigate any impacts.

Recommendations

- The road realignment should be oriented toward the southern part of the reserve as far as safety allows so that it is routed primarily through the Completely Degraded section with the aim of avoiding the large Eucalypts. This should include the apparently planted Coral Gum *Eucalyptus torquata* which although not native to the area nevertheless appears to provide nesting/feeding habitat for local bird species. Removal of some of the Degraded *Acacia* dominated Low Woodland (Vegetation Unit 2) towards the south west corner of the reserve will be unavoidable.
- Clearing of the Degraded Woodland habitat (Vegetation Unit 1) should be kept to a minimum to preserve as much vegetation connectivity and bird habitat as possible.
- It is our understanding that the eastern end of the slip road to the south of the reserve will be blocked off to prevent through traffic and the intention is to rip and rehabilitate that section of the road. Some consideration should be given to revegetating the area to the south-east of the new road alignment to improve vegetation connectivity between the Bruce Rock -Narembreen Road reserve and the patch of vegetation near the Water Authority pumping station.
- The area is so heavily weed infested, particularly with Wild Oat that the road realignment is not going to add any significant weed management issues to the site that are not already present.

REFERENCES

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Appendix 1: Complete list of flora species recorded

Table A1: Complete list of all the species recorded during the survey of the Bruce Rock – Narembeen Road Reserve grouped by family.

Family	Species Name	Common Name	Status
AIZOACEAE	<i>Mesembryanthemum crystallinum</i>	Ice plant	Weed
AMARANTHACEAE	<i>Ptilotus holosericeus</i>		Not threatened
ASPARAGACEAE	<i>Chamaexeros fimbriata</i>		Not threatened
ASTERACEAE	<i>Angianthus tomentosus</i>	Camel-grass	Not threatened
	<i>Arctotheca calendula</i>	Cape Weed	Weed
	<i>Hyalochlamys globifera</i>		Not threatened
	<i>Rhodanthe manglesii</i>		Not threatened
	<i>Sonchus asper</i>	Rough Sowthistle	Weed
	<i>Waitzia acuminata</i>	Orange Immortelle	Not threatened
CHENOPODIACEAE	<i>Enchylaena tomentosa</i> var <i>tomentosa</i>	Barrier Saltbush	Not threatened
	<i>Maireana brevifolia</i>	Small Leaf Bluebush	Not threatened
CRASSULACEAE	<i>Crassula</i> sp		?Weed
FABACEAE	<i>Acacia acanthaster</i>		Not threatened
	<i>Acacia acuminata</i>	Jam (Fine leafed and weeping forms)	Not threatened
	<i>Acacia merrallii</i>		Not threatened
	<i>Trifolium arvense</i>	Hare's Foot Clover	Weed
	<i>Trifolium hirtum</i>	Rose Clover	Weed
HEMEROCALLIDACEAE	<i>Dianella revoluta</i>	Blueberry Lily	Not threatened
MALVACEAE	<i>Sida calyxhymentia</i>	Tall Sida	Not threatened
MONTIACEAE	<i>Calandrinia eremaea</i>	Twining Purslane	Not Threatened
MYRTACEAE	<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	York Gum	Not threatened
	<i>Eucalyptus torquata</i>	Coral Gum	Not Threatened* Possibly planted because a long way out of range
POACEAE	<i>Aira cupaniana</i>	Silvery Hairgrass	Weed
	<i>Austrostipa elegantissima</i>		Not threatened
	<i>Austrostipa tenuifolia</i>		Not threatened, Weed?
	<i>Avena fatua</i>	Wild Oat	Weed
	<i>Bromus diandrus</i>	Great Brome	Weed
	<i>Neurachne alopecuroidea</i>	Foxtail Mulga Grass	Not threatened
	<i>Rytidosperma acerosum</i>		Not threatened
	<i>Rytidosperma setaceum</i>		Not threatened
PROTEACEAE	<i>Hakea preissii</i>	Needle Tree	Not threatened
SANTALACEAE	<i>Exocarpos aphyllus</i>	Leafless Ballart	Not threatened
SOLANACEAE	<i>Solanum hoplopetalum</i>	Thorny Solanum	Not threatened ?Weed. Agricultural Weed and disturbance species that is native to parts of the Wheatbelt but a weed elsewhere

Appendix 2: Description of Vegetation Types

Description of each identified Vegetation Type using both the vegetation classification system of Muir (1978, p.2) and NVIS Structural Formation Terminology (DBCA, n.d.), including dominant flora (full flora lists per vegetation unit are in Appendix 3), allocated vegetation unit, location details (referenced to Figure 6), and site photographs.

Vegetation Unit 1

Location: See Figure 6

Vegetation Type: *Eucalyptus/Acacia* Open Low Woodland

Description:

1. Muir Description: Open Low Woodland A over Low Woodland B over Dense Tall Grass on Rocky - loam.

2. NVIS Description

Stratum 1 (U): *Eucalyptus loxophleba* subsp. *loxophleba* (e1), stratum height up to 15 m tall, 10% canopy cover.

Stratum 2 (M): *Acacia acuminata* (a1), stratum height, up to 5 m tall, 20% canopy cover.

Stratum 3 +(G): *Avena fatua*, *Maireana brevifolia*, stratum height 0.5-1.0m tall, 70% canopy cover.

Comments: Lichen and moss species in the understorey and some lichens and wood fungi/bracket fungi on *Acacia acuminata* trunks in mid-storey, 2% canopy cover on soil surface. Litter: 0-5 cm deep, 30% ground cover composed mainly of leaves, some small twigs and some large logs.

NVIS Summary Code

U[^]*Eucalyptus loxophleba*\Eucalyptus\^tree\i\7;

M[^]*Acacia acuminata*\Acacia\^tree\i\6;

G+[^]*Avena fatua*, *Maireana brevifolia* \Avena\^other grass\c\2;

Flora Recorded: See full species list in Appendix 3 Table A3

Site Photographs: See Figure 7 and below. Photo by Mandy Schilling.



Vegetation Unit 2

Location: See Figure 6

Vegetation Type: *Eucalyptus/Acacia* Open Low Woodland

Description:

1. Muir Description: Open Low Woodland A over Low Woodland B over Dense Tall Grass on Rocky - loam.

2. NVIS Description

Stratum 1 (U): *Eucalyptus loxophleba* subsp. *loxophleba* (e1), stratum height up to 15 m tall, 2% canopy cover.

Stratum 2 (M): *Acacia acuminata* (a1), stratum height, up to 5 m tall, 25% canopy cover.

Stratum 3 +(G): *Avena fatua*, *Maireana brevifolia*, stratum height 0.5-1.0m tall, 70% canopy cover.

Comments: Lichen and moss species in the understorey and some lichens and wood fungi/bracket fungi on *Acacia acuminata* trunks in mid-storey, 2% canopy cover on soil surface. Litter: 0-5 cm deep, 30% ground cover composed mainly of leaves, some small twigs and some large logs.

NVIS Summary Code

U^{Eucalyptus loxophleba}\Eucalyptus\^tree\r\7;

M^{Acacia acuminata}\Acacia\^tree|i\6;

G^{Avena fatua, Maireana brevifolia}\Avena\^other grass\c\2;

Flora Recorded: See full species list in Appendix 3 Table A3

Site Photographs: See Figure 7 and below. Photo by Mandy Schilling.



Vegetation Unit 3

Location: See Figure 6

Vegetation Type: Open Scrub

Description:

1. Muir Description: Open Scrub over Dense Tall Grass on Rocky-loam

2. NVIS Description

Stratum 1 (M): *Acacia acuminata* (a1), stratum height >2 m tall, 2% canopy cover.

Stratum 2 +(G): *Avena fatua*, *Maireana brevifolia*, *Enchylaena tomentosa*, stratum height 0.5-1.0m tall, 85% canopy cover.

Comments: Additional species include *Exocarpos aphyllus*, *Acacia acanthaster* and *Solanum hoplopetalum* which occur only along the water pipeline on the southern boundary of the patch particularly around water leaks.

NVIS Summary Code

M[^]*Acacia acuminata* \Acacia\ ^shrub\r\4;

G+[^]*Avena fatua*, *Maireana brevifolia* \Avena\ ^other grass\c\2;

Flora Recorded: See full species list in Appendix 3 Table A3

Site Photographs: See Figures 8 and 9, and below. Photo by Leigh Whisson.



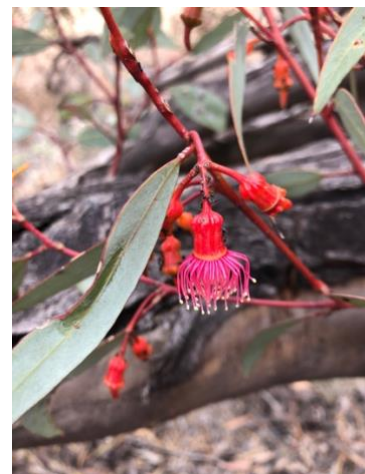
Vegetation Unit 4:

Location: See Figure 6

Vegetation Type: *Eucalyptus torquata* (one individual)

Flora Recorded: See full species list in Appendix 3 Table A3

Site Photographs: See Figure 11 and right. Photo by Leigh Whisson



Appendix 3: Matrix of Flora Species by Vegetation Type

Table A3: Matrix of all flora species recorded during the survey of the Bruce Rock – Narembreen Road Reserve by vegetation type. Weed species are indicated with an asterisk (*).

Family	Species Name	Vegetation Type 1 – Eucalypt Woodland	Vegetation Type 2 – Acacia shrubland	Vegetation Type 3 – Mixed shrub and grassland	Vegetation Type 4 - Outlier
AIZOACEAE	<i>Mesembryanthemum crystallinum*</i>	X	X	X	
AMARANTHACEAE	<i>Ptilotus holosericeus</i>	X			
ASPARAGACEAE	<i>Chamaexeros fimbriata</i>	X			
ASTERACEAE	<i>Angianthus tomentosus</i>	X	X		
	<i>Arctotheca calendula*</i>			X	
	<i>Hyalochlamys globifera</i>		X		
	<i>Rhodanthe manglesii</i>		X		
	<i>Sonchus asper*</i>			X	
	<i>Waitzia acuminata</i>	X	X	X	
CHENOPODIACEAE	<i>Enchylaena tomentosa</i> var <i>tomentosa</i>	X	X	X	
	<i>Maireana brevifolia</i>	X	X	X	
CRASSULACEAE	<i>Crassula sp*</i>		X		
FABACEAE	<i>Acacia acanthaster</i>			X	
	<i>Acacia acuminata</i>	X	X	X	
	<i>Acacia merrallii</i>			X	
	<i>Trifolium arvense*</i>	X	X		
	<i>Trifolium hirtum*</i>		X	X	
HEMEROCALLIDACEAE	<i>Dianella revoluta</i>	X	X	X	
MALVACEAE	<i>Sida calyxhymenia</i>			X	
MONTIACEAE	<i>Calandrinia eremaea</i>	X	X		

Table A3: Matrix of all flora species recorded during the survey of the Bruce Rock – Narembreen Road Reserve by vegetation type. Weed species are indicated with an asterisk (*).

Family	Species Name	Vegetation Unit 1 – Eucalypt Woodland	Vegetation Unit 2 – Acacia shrubland	Vegetation Unit 3- Mixed shrub and grassland	Vegetation Type 4 - Outlier
MYRTACEAE	<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	X	X		
	<i>Eucalyptus torquata</i>				X
POACEAE	<i>Aira cupaniana</i> *			X	
	<i>Austrostipa elegantissima</i>	X	X	X	
	<i>Austrostipa tenuifolia</i>	X	X	X	
	<i>Avena fatua</i> *	X	X	X	
	<i>Bromus diandrus</i> *			X	
	<i>Neurachne alopecuroidea</i>		X	X	
	<i>Rytidosperma acerosum</i>	X	X	X	
	<i>Rytidosperma setaceum</i>	X	X	X	
PROTEACEAE	<i>Hakea preissii</i>		X		
SANTALACEAE	<i>Exocarpos aphyllus</i>		X	X	
SOLANACEAE	<i>Solanum hoplopetalum</i>			X	
	TOTAL SPECIES	18	21	22	1
	WEED SPECIES	3	5	7	N/A