ECOS CONSULTING (AUST) Pty Ltd

KEMERTON LATERAL PIPELINE

Rehabilitation Plan

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DOCUMENT REVISION HISTORY

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A	Draft Issued for Client Review & Government Comment	GW	DW	-05
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DISCLAIMER

CONTENTS

APPENDICES

1 INTRODUCTION

Epic/Alinta and Worley are currently proposing to construct a gas pipeline within the Dampier to Bunbury Natural Gas Pipeline (DBNGP) easement. This pipline, referred to as the Kemerton lateral, will be constructed on the western side of an existing pipeline between the site of a proposed Western Power power station and MLV 154. The corridor also contains a electricity transmission line and existing access track. The proposed route is predominantly within native vegetation and crosses the Kemerton Silica Sand mine site.

The project will seek to re-establish native vegetation over the pipeline easement following installation of the pipe. This document addresses the requirement to produce a rehabilitation plan for the project.

2 EXISTING VEGETATION

2.1 Flora and Vegetation

The pipeline corridor was surveyed for flora and vegetation in December 2004 by Woodman Environmental Consulting Pty Ltd (Woodman Environmental 2005). A total of 93 plant taxa, including 88 native taxa and 5 introduced taxa, were recorded within the survey area. Two of the weed taxa recorded were aggressive perennial species that can quickly invade native vegetation if soil containing these species is transported along the route during construction. These species were *Watsonia meriana* var. *bulbillifera* and *Leptospermum laevigatum*. The locations of these are shown on the enclosed vegetation maps.

The number of species recorded is lower than would be expected along the route due to the timing of the survey. Many annual species, including the Declared Rare species *Drakaea micrantha,* are likely to be present along the proposed route but can only be surveyed for during Spring. *Drakaea micrantha* has been recorded within 500m of the pipeline route in habitat similar to that mapped along the route and it is highly likely that this species would be recorded along the proposed route if the survey had been conducted in early to mid Spring.

One Priority 1 species *Boronia juncea* subsp. *juncea* was recorded at one location along the proposed route during the survey (Figure 2). Priority One Flora are classified as:

> **‘Priority One – Poorly Known Taxa**
>
> Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are

> under consideration for declaration as 'rare flora', but are in urgent need of further survey.' (Department of Conservation and Land Management 2004).

This species has been previously recorded from damplands in the local area (Environ 2004, Mattiske Consulting Pty Ltd 2003). It was scattered through plant community H2 at this location, with only a small number of plants sighted.

One Priority 3 species, *Acacia semitrullata*, was recorded during this survey at five locations along the proposed route (Figures 1 and 2). Priority Three flora are classified as:

> **'Priority Three – Poorly Known Taxa**
>
> Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected.' (Department of Conservation and Land Management 2004).

This species was recorded in plant communities W1, W2 and H3 with only a few scattered plants sighted at each location. This species has been previously recorded in the area by Woodman Environmental Consulting Pty Ltd (2004), Muir Environmental 1999 and Mattiske Consulting Pty Ltd (2003).

A total of five plant communities, consisting of two Woodlands and three Heaths, were mapped over the survey area (Figures 1 and 2). In general, the vegetation was in Good to Very Good condition, with disturbance including weed invasion being confined to within the existing DBNGP corridor and the Kemerton Silica Sands minesite. The southern end of the proposed route was completely cleared, with some areas of *Eucalyptus globulus* plantations. Areas of disturbed woodland were also mapped adjacent to and north of the minesite (Figure 1).

Woodlands

W1: Open Low Woodland of *Eucalyptus marginata* and *Corymbia calophylla* over tall shrubs dominated by *Kunzea glabrescens* on grey sand

The condition of the vegetation in this plant community between the existing pipeline and the transmission line was rated Good, with some weed invasion. A total of 23 plant taxa were recorded within this plant community.

W1d: Disturbed areas of plant community W1

Areas of plant community W1 that have been significantly disturbed by human activity were mapped at the northern end of the proposed pipeline route. The vegetation within these areas was rated Poor.

W2: Low Woodland of *Eucalyptus marginata*, *Banksia ilicifolia* and *Banksia attenuata* over shrubs dominated by *Kunzea glabrescens* and *Adenanthos meisneri* on grey sand

Plant community W2 was mapped along large sections of the pipeline corridor south of the Kemerton Silica Sands mine. The condition of the vegetation in this community varied between Good and Excellent. A total of 48 plant taxa were recorded within this plant community.

W2d: Disturbed areas of plant community W2

Areas of plant community W2 that have been significantly disturbed by human activity were mapped in the northern section of the proposed pipeline route adjacent to the Kemerton Silica Sands mine. The vegetation within these areas was rated Poor.

Heaths

H1: Dense Heath of *Kunzea glabrescens* and *Adenanthos meisneri* with occasional emergent *Eucalyptus marginata* and *Melaleuca preissiana* on grey sand

Plant community H1 was mapped at one location in the southern half of the proposed pipeline route (Figure 2). The condition of the vegetation within this plant community was ranked Very Good with some minor weed invasion. A total of 26 plant taxa were recorded within this plant community.

H2: Dense Heath dominated by *Astartea affinis* with occasional emergent *Melaleuca preissiana* on black peaty loam

Plant community H2 was mapped at several locations along the length of the pipeline route (Figures 1 and 2). Each of these locations is mapped as a Conservation Category Wetland (EPA 2004). The condition of the vegetation within this plant community was ranked Very Good with some minor weed invasion. A total of 31 plant taxa were recorded within this plant community.

H3: Dense Heath dominated by *Kunzea glabrescens*, *Hypocalymma angustifolium* and *Pericalymma ellipticum* over sedges on sandy peat

Plant community H3 was mapped at four locations along the survey area (Figures 1 and 2). One of these locations immediately south of the Kemerton Silica Sands mine is located within a Conservation Category Wetland. The condition of the vegetation within this plant community was ranked Excellent, however there has been some degradation and weed invasion between the existing gas pipeline and transmission line. A total of 45 plant taxa were recorded within this plant community.

2.2 Vegetation Recovery on the Easement

Woodman Environmental have conducted preliminary investigations of the easement following the installation of the existing pipe 25 years ago to compare the condition of the regenerated vegetation with the adjacent undisturbed vegetation. These studies were designed to provide an indication of the potential for regeneration of the easement following the proposed installation of the lateral.

2.2.1 Study Method

Twenty four transects each consisting of ten four metre square quadrats (2m x 2m) were established in pairs in vegetation on the easement and in adjacent undisturbed vegetation. Pairs of transects were established in each plant community mapped during December 2004 (Woodman Environmental 2004).

Within each quadrat, the following data was collected for each plant species:

- Number of plants (except for rhizatomous species)
- Percentage foliage cover

Quadrat data was grouped for each plant community and species richness (number of species within each community), plant density (average) and percentage foliage cover (average) values were calculated for quadrats on and off the easement. The data was then analysed using a two-tailed *t* test to determine whether the parameters recorded on the easement was significantly different from those calculated from data recorded off the easement.

2.2.2 Study Results

Figures 3 to 5 present the results for the flora assessment in each plant community mapped by Woodman Environmental in December 2004.

Statistical analysis of the results using paired two samples for means *t* tests indicates that significant results were obtained for the following:

- differences in foliage cover and plant density for community H2;
- differences in foliage cover and species richness for community W1;
- differences in plant density for community W2d; and
- differences in species richness for community W2;

The majority of transects recorded no statistically significant differences in plant density, foliage cover and species richness between vegetation on and off the easement.

Live Foliage Cover (%)

The results generally indicate that the woodland plant communities had higher cover of plants off the easement compared to on the easement, however Figure 3 illustrates contrasting results for cover of plants in community W2.

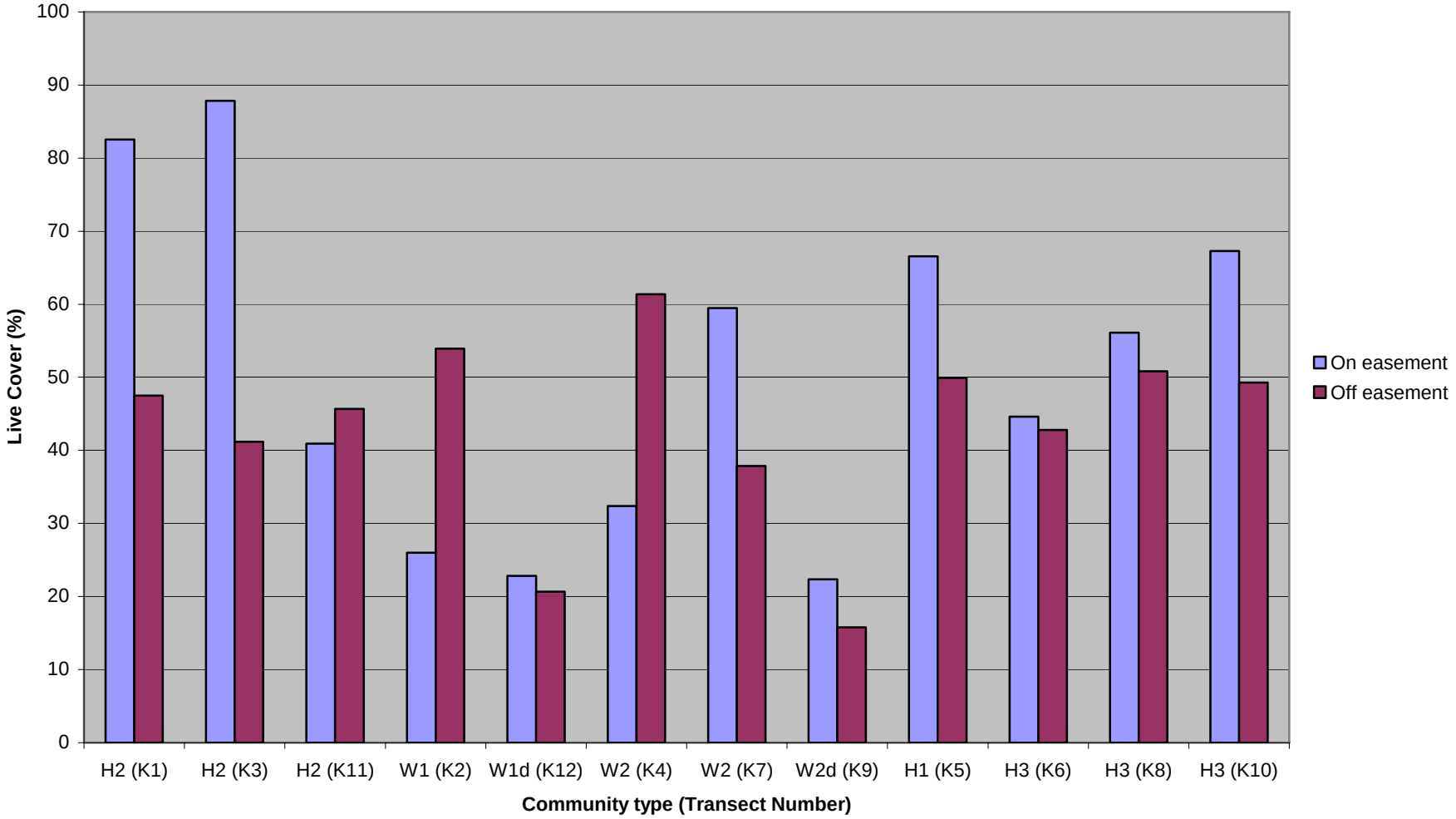

Figure 3: Foliage Cover Measured On and Off the Pipeline Easement

The high foliage cover recorded in transect K7 on the easement may be attributed to extensive cover of *Adenanthos meisneri* and moderate cover of *Kunzea glabrescens* within quadrats on the easement. Within quadrats off the easement few species had high covers.

The high foliage cover recorded in transect K4 off the easement may be attributed to the presence of large trees (*Eucalyptus marginata* and *Banksia attenuata*) in the transect.

In contrast to the woodland communities, the wetland heath communities have developed similar or greater foliage covers on the easement compared to the adjacent undisturbed vegetation. Figure 3 illustrates a significantly higher cover of plants in two transects in community H2 on easement compared to off the easement. This may be attributed to very high covers of *Hypocalymma angustifolium* and *Melaleuca preissiana* in transect K1. Also, the species composition on the easement appears to be slightly different with several key species having developed significantly higher covers on the easement. In particular, very high covers of *Astartea affinis* were recorded on the easement in contrast to much reduced covers of this species off the easement for transect K3.

Plant Density

Plant densities were generally higher in quadrats located off the easement, however several quadrats located in a disturbed woodland had higher densities recorded on the easement. Figure 4 illustrates significantly higher density of plants in two transects in wetland heath communities H2 and H3 off the easement.

The high plant densities off the easement in wetlands is attributed to extremely high numbers of *Pericalymma ellipticum* stems recorded in transects K1 and K2. Also, high numbers of individual plants including *Quinetia urvillei*, *Lomandra caespitosa*, *Drosera erythrorhiza* and *Pyrorchis nigricans*. These species have not recolonised the easement in numbers similar to adjacent bush. The high plant density recorded from the disturbed woodland community W2d (transect K9) is attributed to the presence of very large numbers of *Podotheca* ?*angustifolia* and *Quinetia urvillei* which are small annual plants known to colonise disturbed soils. Off the easement these species occur in much lower numbers as a result of increase litter and surface soil crusting.

Species Richness

Figure 5 illustrates that in general more species were recorded off the easement than on it, though the wetland heath communities had similar numbers of species recorded both on and off the easement. However, significantly more species were recorded on the easement in comparison to off the easement in community type H2. This may be attributed to the presence of a different community type on the easement that is much more diverse than the *Pericalymma ellipticum* swamp that occurs off the easement in K1. This community type may have developed as a result of the easement disturbance, however it is also possible that the easement coincides with a natural boundary between two plant communities.

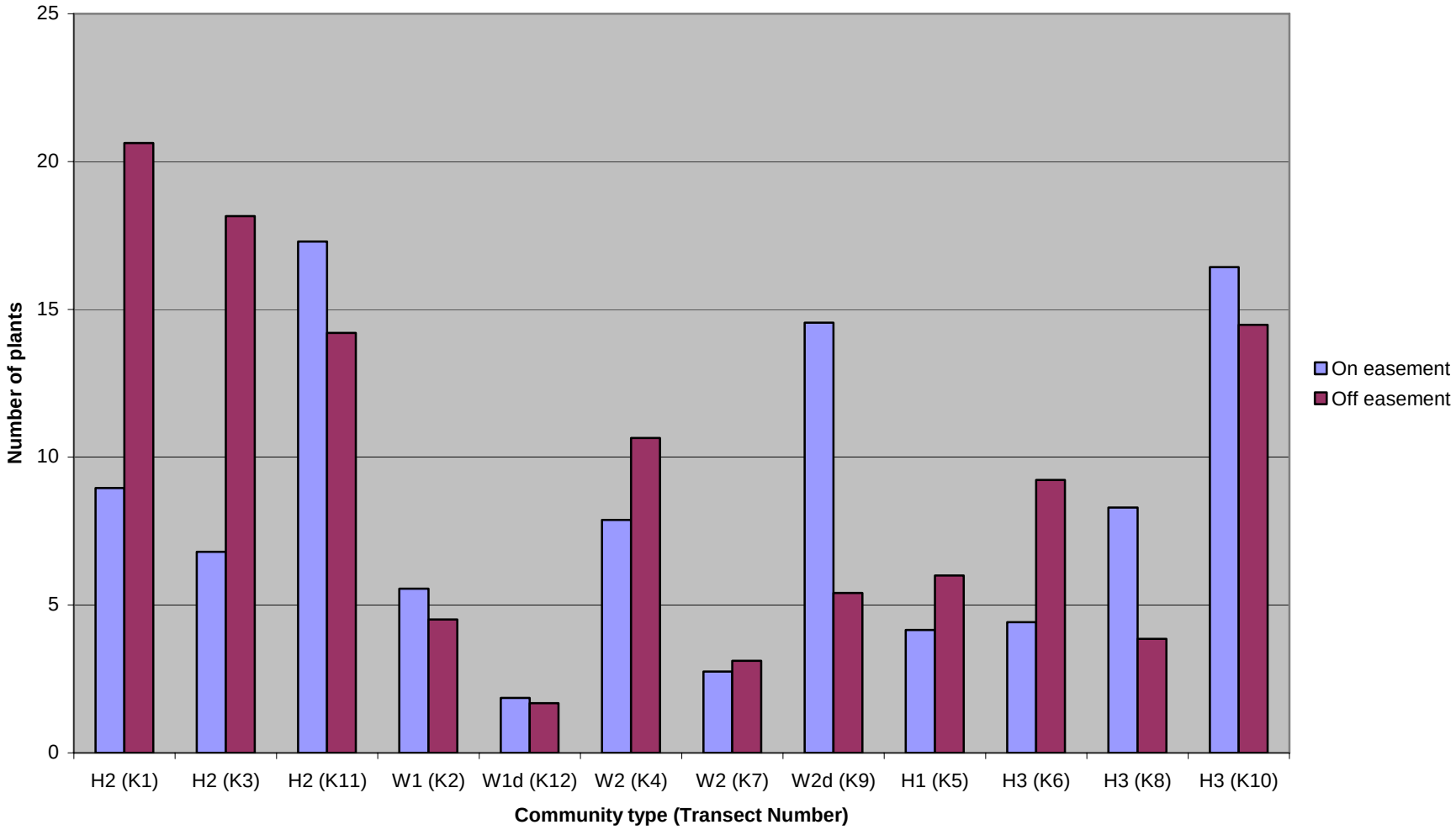

Figure 4: Plant Density Measured On and Off the Pipeline Easement

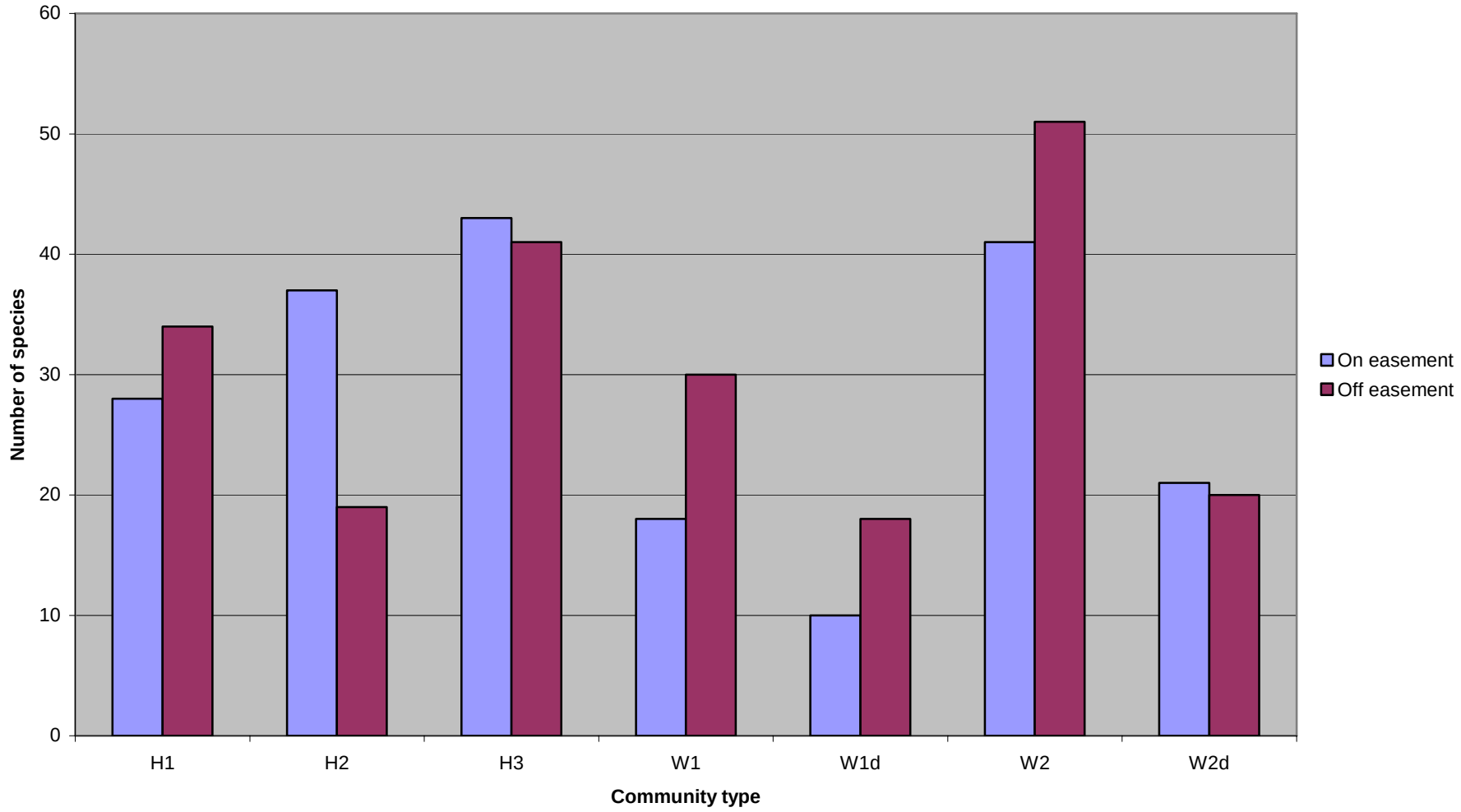

Figure 5: Species Richness Measured On and Off the Pipeline Easement

2.2.3 Study Conclusions

This brief study indicates that the wetland communities along the Kemerton Lateral Pipeline easement have recovered from the installation of the existing Dampier to Bunbury Pipeline to a level where the regenerating communities closely resemble the adjacent undisturbed vegetation. The dunal woodland communities have not regenerated to the same extent as the wetland communities, though the requirement to remove trees from the easement to protect the integrity of the pipe has contributed to this significantly.

2.3 Other Environmental Values

The pipeline corridor crosses several wetland areas along its length. These areas have all been mapped as Conservation Category wetlands. These areas are described as wetlands that possess a high degree of naturalness and should be managed to maintain and enhance natural attributes and functions (Hill *et al*. 1996). Both the Wetlands Conservation Policy for Western Australia (Government of Western Australia 1997) and the Water and Rivers Commission Position Statement: Wetlands (2001) oppose any activities that lead to further loss or degradation of Conservation Category wetlands or their buffers. These wetlands are all listed on the draft Register of Protected Wetlands (Map Sheet 2033) under the *Revised Draft Environmental Protection (Swan Costal Plain Wetlands) Policy 2004*.

3 REHABILITATION OBJECTIVES

Department of Environment correspondence has indicated that Government stakeholders require world best practise rehabilitation procedures to be implemented for this project. The vegetation of the project easement is locally and regionally significant and also sensitive with respect to its position within the kemerton wetland system that supports threatened ecological communities, threatened flora and fauna species.

The following key objectives have been identified for the rehabilitation process:

1. Provide a stable soil profile that is the same as the pre-existing land surface, will not erode and will not impede surface water flows;
2. Provide a cover of indigenous plant species that is consistent with the immediately adjacent vegetation and that provides for stabilisation of the soil surface and provision of habitat for fauna and flora species; and
3. Provide a cover of indigenous species that has weed species covers that are similar or less than surrounding areas.

4 REHABILITATION STRATEGY

4.1 Best Practise Benchmark

This section provides a limited description of rehabilitation methods utilised in the south-west of Western Australia with particular reference to existing projects where possible. A more extensive review of projects is possible as there have been numerous

development projects including pipelines conducted on the Swan Coastal Plain, however due to a lack of time available to prepare this review, the benchmarking has been limited to the following projects:

- DBNGP – MLV154 to the prioposed Kemerton power Station site.
- Kemerton Silica Sand Mine project.
- DBNGP – 3A Looping from MLV154 to Worsley Refinery.
- Tiwest Cooljarloo Mineral Samds mine near Cataby.
- Iluka Eneabba Operations Mineral Sands Mine.

The mining operations are seen as not directly comparable to the pipeline installation project, however some of the rehabilitation processes applied to those operations to increase plant cover and species richness may be applicable to the current proposal.

4.1.1 DBNGP – MLV154 to Proposed Kemerton Power Station

The data presented in section 2.2 provides an analysis of the existing easement as an example of rehabilitation of a pipeline in this region. This example provides the most applicable data with respect to the Kemerton Lateral Pipeline in that it demonstrates the ability of the existing communities to recover from the proposed operation without active rehabilitation measures.

Issues

The primary issues related to the rehabilitation of the existing easement included:

- Wetland vegetation
- Water tables
- Dieback (*Phytophthora cinnamomi*)
- Weeds

Rehabilitation Method

The easement was originally cleared to a width of 20m with retention of some trees where possible. The process was completed during dry summer months and included the following:

- Cleared vegetation was stored off the Right of Way (ROW).
- Topsoil (50 to 100mm) was graded to one side of the ROW.
- Trench spoil was stored on the ROW adjacent to the stored topsoil.
- The pipe was layed and the spoil returned to the trench.
- The easement was recontoured to match the surrounding landform.
- Topsoil was respread evenly over the right of way.
- Stored vegetation was spread over the easement.

No additional seed or brush material was added to the rehabilitated easement.
No additional weed management was applied to the easement.

Key Points

The entire process was completed in dry soil conditions allowing for topsoil stored seed and seed on the stored vegetation brush to retain viability and contribute directly to the plant cover on the easement that year.

The Priority One species *Boronia juncea* subsp. *juncea* has recolonised the easement in one location (Woodman Environmental 2004).

Wetland vegetation and soils appeared to be more resilient to the disturbance than the dunal environment. This indicates that additional effort will be required in these portions of the easement with respect to active rehabilitation measures.

4.1.2 Kemerton Silica Sand Mine Project

The Kemerton Silica Sand Mine (KSS) is a dredge mining operation that removes significant volumes of sand from the soil profile, leaving a void in the mined area. The rehabilitation focus for this operation is to create wetland communities in the rehabilitation, primarily fringing vegetation for waterbodies. Supporting documentation for this operation is still pending.

Rehabilitation Method

Topsoil is removed from the orebody areas prior to mining. This topsoil is stored in stockpiles for indeterminate periods of time prior to re-use. The edges of the mined void have stored topsoil respread over them followed by seeding of species typical of local wetland fringes. Some transplanting of sedges into these areas from surrounding areas on the lease have also been trialled.

Some areas adjacent to the dredge pond have been rehabilitated utilising topsoil directly spread from sites cleared for dredge pond enlargement. Topsoil was stripped to a depth of 200-250mm with understorey plants stripped with the soil. This area also received planted seedlings of native species depending on predicted hydrological conditions of the rehabilitated area (wet, moist, dry). The dry areas have had a good response from the topsoil and seedling plantings, however the wetter sites have resulted in poorer establishment due to waterlogging and potentially unsuitable species for the site conditions (Mattiske Consulting Pty Ltd 2004).

Key Points

The rehabilitation process, objectives and methods utilised for this operation are not directly comparable to the Kemerton Lateral Pipeline project. However, the direct spreading technique for topsoil and supplementary planting has provided good results for some areas of the rehabilitation.

4.1.3 DBNGP – 3A Looping from MLV154 to Worsley Refinery – sandplain section

Rehabilitation Method

The easement was originally cleared with retention of some trees where possible. The process conducted is similar to that applied to the Kemerton Lateral Project area during installation of the Dampier to Bunbury Pipeline. The installation was completed during dry summer months and included the following:

- Cleared vegetation was stored off the Right of Way (ROW).
- Topsoil (50 to 100mm) was graded to one side of the ROW.
- Trench spoil was stored on the ROW adjacent to the stored topsoil.
- The pipe was layed and the spoil returned to the trench.
- The easement was recontoured to match the surrounding landform.
- Topsoil was respread evenly over the right of way.
- Stored vegetation was spread over the easement.

No additional seed or brush material was added to the rehabilitated easement.
No additional weed management was applied to the easement.

Key Points
The entire process was completed in dry soil conditions allowing for topsoil stored seed and seed on the stored vegetation brush to retain viability and contribute directly to the plant cover on the easement that year.

Wetland vegetation and soils appeared to be more resilient to the disturbance than the dunal environment. This indicates that additional effort will be required in these portions of the easement with respect to active rehabilitation measures.

4.1.4 Tiwest Cooljarloo and Iluka Eneabba Operations Mineral Sands Mines

These sites have been grouped together as they are similar operations in many respects and apply similar processes to rehabilitate the mined areas of their leases.

Rehabilitation Method
Generic rehabilitation processes include:

- Cleared vegetation is mulched and respread directly onto rehabilitated areas where possible. Some of this material is stored for later use.
- Topsoil is removed using scrapers in two separate cuts (1st cut at 50 to 100mm and 2nd cut at 100 to 300mm) and respread directly onto prepared area where possible. The majority of topsoil is stored in topsoil stockpiles until areas become available for rehabilitation.
- Overburden material is stockpiled or used to construct waste dumps for rehabilitation.
- Ore is extracted using scrapers (dry mining) or dredges (wet mining).
- Final landforms are created using overburden material, either by backfilling voids or creating waste dumps.
- Topsoil is respread evenly over the rehabilitated areas at the depths from which it was removed.
- Native seed collected from local indigenous species is spread over the areas.
- Vegetation (mulch) is spread over the rehabilitation at a rate of 1 ha cleared to 1ha spread.

Key Points

Rehabilitation at these operations results in native vegetation establishment over the rehabilitated areas with the relative success of each area dependant on the following key factors:

- Slope angles and soil profiles (erosion is controlled in rehabilitated landforms by creating slopes that do not exceed natural slopes where possible and by ensuring that soil profiles are not susceptible to erosion).
- Timing of earthworks, seeding and mulch application (summer months providing improved rehabilitation performance).
- Freshness of topsoil material (direct return or topsoil stored for less than 12 months providing improved rehabilitation performance).
- Freshness of mulch material (direct spread material providing improved rehabilitation performance).
- Soil and mulch types (topsoil and mulch collected from areas and vegetation types similar to the rehabilitation situation will provide improved rehabilitation performance).

4.2 Approach

Rehabilitation of the Kemerton Lateral Pipeline easement will address the following issues:

- Weed management
- Priority and Rare Flora management
- Resource management (topsoil and vegetation material)
- Soil profile and final landform
- Establishment of native vegetation

The rehabilitation process will include the following key steps:

- Removal of existing invasive weeds on the easement.
- Weed hygiene.
- Protection of existing Declared Rare and Priority flora on the easement where possible.
- Clearing and storing of native vegetation.
- Removal and storage of topsoil.
- Removal and storage of trench spoil.
- Reconstruction of the soil profile following pipe laying.
- Respreading of topsoil.
- Respreading of stored vegetation material.
- Application of native seed.
- Ongoing weed management and monitoring.

The entire project from clearing of native vegetation to respreading of that vegetation on the rehabilitated easement and application of native seed mixes will be conducted during summer months to ensure that the rehabilitation has the optimum chance for success.

5 REHABILITATION METHODS

Rehabilitation of the pipeline easement will be integrated with all project activities and objectives. Studies on the easement have demonstrated the ability of the vegetation systems on the easement to recover from disturbance and this data will be utilised to direct the rehabilitation procedures.

5.1 Weed Management

The invasive weed species *Watsonia meriana* var. *bulbillifera* and *Leptospermum laevigatum* have been recorded on the easement and these will be eradicated prior to clearing of the easement. Weed management is proposed to be conducted in mid spring 2005.

The *Watsonia meriana* var. *bulbillifera* will be removed by hand as it is a small population in a defined area. This will allow removal of the underground corms and limit the potential for it to survive into the rehabilitated environment. Individuals of *Leptospermum laevigatum* will be cut and the stumps poisoned to prevent resprouting. The cut plants will be removed from site entirely to ensure any *in situ* seed is not left in the topsoil.

Weed covers and species will be included in rehabilitation monitoring to facilitate management of weed issues following completion of the rehabilitation. Annual monitoring results will be used to develop weed management programs in consultation with CALM.

Weed hygiene will be implemented during all operations in accordance with the Weed Hygiene Protocol.

5.2 Dieback (*Phytophthora cinnamomi*) Management

The Kemerton Lateral pipeline corridor was assessed for the presence of disease caused by *Phytophthora cinnamomi* in February 2005. The assessment was performed by Mr Evan Brown of Glevan Consulting. Evan is currently accredited by the Department of Conservation and Land Management (CALM) to provide this service.

The entire alignment was inspected for the presence of the disease. At each site where sufficient vegetation free of the disease was detected, this vegetation was demarcated by tying day-glow orange flagging tape across the corridor using a buffer of approximately twenty metres from the active edge of the disease. The knot in the flagging tape always faces the diseased vegetation.

The demarcation lines in the corridor are valid for a period of twelve months. Ordinarily, if any proposed operations are to be conducted beyond February 2006, the demarcation lines and any areas now considered to be free of the disease would need to be re-assessed. However, as the project is proposed to be completed under dry soil conditions over the 2005/2006 summer period this will not be required.

The interpretation identified several small areas of uninfested vegetation on dune tops with the wetland areas being infested with the pathogen. Despite the presence of some small areas of *P. cinnamomi* free vegetation in the pipeline corridor, the interpretation of the corridor indicated that the there are no Protectable areas that would significantly benefit from hygiene operations during construction of the proposed Kemerton Lateral Gas Pipeline (Woodman Environmental Consulting Pty Ltd 2004). Therefore, hygiene management will be in accordance with the Dieback Hygiene Protocol for the project and will include the following provisions:

1. All vehicles and machinery will arrive at the project area in a clean state free from soil, mud, soil slurry and vegetation material.
2. Soil and vegetation stripped from the ROW will be stored immediately adjacent to the site where it originated.
3. No soil or vegetation material will be transported along the corridor.
4. Any material to be imported to the pipeline corridor, eg. Pipe padding, must be certified to be free from *P. cinnamomi* to the satisfaction of CALM.
5. Hydrotest water will not be released to the ROW, but disposed of in a manner acceptable to CALM and in a location that will not compromise the hygiene status of remnant native vegetation.
6. All vehicles and machinery will be cleaned down prior to leaving the project site to prevent the spread of *P. cinnamomi* from the project area to areas of uninfested native vegetation in the region.

5.3 Priority and Rare Flora Management

Management of significant species along the ROW will involve a comprehensive approach consisting of the following steps:

1. Surveys for DRF and Priority flora species will be conducted at the appropriate time during Spring 2005.
2. Locations of all Declared Rare and Priority flora identified on the easement will be mapped and marked in the field.
3. Where practical and in consultation with CALM these plants will be protected from disturbance through the use of fencing and sign-posting on site.
4. Construction personnel will be provided with information on these species and the management practises being implemented at inductions and toolbox meetings.

In the event that DRF or Priority flora can not be avoided and destruction of some plants is necessary to implement the project, the following management steps will be taken:

1. Plants that are required to be impacted will be individually marked in the field.
2. The impact of removal of the plants on the conservation status of the species will be assessed at a local and regional scale by a qualified botanical consultant in consultation with officers of CALM.
3. Options for transplanting of individual plants or salvage of biological material for later propagation will be discussed with key Government stakeholders.

4. An application to take DRF will be prepared and submitted to CALM for approval by the Minister for the Environment in accordance with the Wildlife Conservation Act 1950.

5.4 Resource Management

Native vegetation on the easement is a valuable resource for the rehabilitation process in that it provides seed, carbon material, stabilises the soil surface, cools the soil surface, provides habitat for fauna and provides micro habitats for capturing additional seed dispersing from adjacent vegetation. In addition, where trees can be retained on the easement they will provide habitat, cover and structure.

Vegetation will be cleared and stored in a windrow adjacent to the ROW immediately adjacent to where it was cleared from. This will ensure that respread vegetation will be located in the appropriate vegetation type and position in the landscape to make best use of any remaining seed stored on the stems.

Topsoil is an essential component of a successful rehabilitation program as it contains the majority of the naturally stored seed for the existing vegetation that propagate using seed as their prime strategy. Topsoil will be removed using a grader that will cut the top 50 to 100mm of soil and store it in a windrow on the easement edge immediately adjacent to where it was removed from. Similarly to vegetation, this will ensure that topsoil is respread within the appropriate position in the landscape and vegetation type. Topsoil will not be picked up and moved along the easement. Topsoil will not be used for padding in the pipe trench. Topsoil will not be driven on or disturbed in any way prior to being respread on the ROW.

5.5 Soil Profile and Landform

Trench spoil will be removed and stored in a windrow adjacent to the trench. Following installation of the pipe, the trench will be backfilled and compacted. The surface of the ROW will then be graded to original surface contours and lightly ripped to a depth of 40cm to alleviate any compaction from vehicle and machinery movement. Ripping on contour will not be possible due to the constrained width of the ROW, however shallow ripping with narrow tines should not result in the generation of deep furrows and a light drag bar will be utilised behind the machine to smooth the final surface.

Topsoil will be graded evenly back over the ROW following ripping, ensuring that topsoil is not transported along the easement.

5.6 Establishment of Native Vegetation in Woodland Areas

Native vegetation will be established on the easement utilising the following methods:

1. From the topsoil seedbank (geospores).
2. From plant stored seed (bradyspores).
3. From applied seed.

Points 1 and 2 above have been addressed in the previous section. Studies on the existing easement have shown that woodland areas on dunes do not appear to recover from disturbance as well as the wetland heath communities. In this situation active rehabilitation in the form of an applied seedmix to increase the establishment of native species is considered necessary.

Species lists have been compiled from the easement studies to generate seedmixes for application to the woodland sections of the easement. Trees are considered a threat to the integrity of the pipeline and only those understorey species that are known to produce viable seed have been selected for the rehabilitation mix.

Recovery of the wetland sections of the easement from *in situ* plant propagules is highly probable, therefore the application of seed to these areas is not considered necessary.

The proposed seed mix for woodland areas is presented in Appendix A. The seed mix will be applied at a rate of 3kg/ha to promote a high initial establishment rate.

6 COMPLETION CRITERIA

Table 1 presents the completion criteria for the Kemerton Lateral Pipeline Project including the rehabilitation specific criteria. The completion criteria do not apply to the vehicle access track and line of site between pipeline signs as these areas must remain accessible as required by the *Petroleum Pipelines Act* 1969.

Table 1: Completion Criteria for the Kemerton Lateral Pipeline Project

Aspect	Objective	Criteria	Assessment method
Operations	To ensure that the key commitments that will influence recovery of the pipeline easement are implemented during field operations	Weeds are eradicated prior to the commencement of clear and grade and 100% compliance with the weed hygiene protocol.	Audit during the operation
		100% compliance with the dieback hygiene protocol	Audit during the operation
		Vegetation and topsoil is cleared and stored in accordance with the EMP.	Audit during the operation
		Significant plant species are protected in accordance with the plan.	Audit during the operation
Decommissioning	To ensure that all visual disturbances are removed by immediate remedial action to the greatest extent practicable	All equipment, materials and litter are removed from the ROW	Visual inspection of ROW
Landform	To reinstate the land to provide suitable conditions for natural recolonisation of native vegetation and support natural surface water movement	Natural contours should be re-instated to pre-disturbance conditions	Visual inspection of ROW
		There should be no active erosion rills greater than 10m x 0.1m	GPS record and physical measurement of any points of erosion

Aspect	Objective	Criteria	Assessment method
Vegetation	To facilitate the establishment of indigenous plant species within each vegetation type on the ROW	There should be no bare patches longer than 10 m after 12 & 24 months	Visual assessment, with particular emphasis in erosion prone areas
		The foliage cover of declared and environmental weeds on the ROW should be no greater to surrounding undisturbed areas at 12 & 24 months	Assessment of a representative number quadrats within each vegetation type
		A minimum of 2 native plants per square metre when averaged over the entire area rehabilitated at 12 months	Assessment of a representative number quadrats within each vegetation type
		Percentage foliage cover of native species indigenous to each plant community is greater than or equal to 50% of foliage cover of similar vegetation types outside the easement at 24 months	Assessment of a representative number quadrats within each vegetation type
		Species richness greater or equal to 50% of richness of similar vegetation types outside the easement at 24 months	Assessment of a representative number quadrats within each vegetation type

If the monitoring occasions note areas that do not meet these criteria then discussions will be held with CALM regarding recommended remedial action. It is expected that failed areas will be actively reinstated with planting of appropriate species in failed areas during autumn 2007 in consultation with an appropriately qualified botanical consultant and CALM. Any areas of high weed cover will be treated with an appropriate program in consultation with CALM.

The monitoring will be based on permanent quadrats established following rehabilitation, in addition to a foot reconnaissance of the entire rehabilitated easement to survey for bare areas and weed infestation. Monitoring plots will be monitored annually in spring until the rehabilitated areas have regenerated to a stable condition, to the satisfaction of CALM and DoE.

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Appendix A Proposed Species for Seeding of Woodland Communities

Kunzea glabrescens
Calytrix fraseri
Leptospermum spinescens
Adenanthos meisneri
Macrozamia reidlei
Dasypogon bromeliifolius
Leucopogon conostephioides
Xanthorrhoea preissii
Acacia pulchella
Jacksonia sternbergiana
Hibbertia hypericoides
Lyginia imberbis
Stirlingia latifolia
Bossiaea eriocarpa
Jacksonia furcellata
Lepidosperma squamatum
Acacia semitrullata
Acacia extensa
Calothamnus quadrifidus
Gompholobium tomentosum
Conostylis juncea
Conostephium preissii
Hibbertia vaginata
Hovea trisperma
Pericalymma ellipticum
Philotheca spicata
Gompholobium confertum
Tetratheca hirsuta
Xanthosia huegelii
Comesperma calymega
Hemiandra pungens
Dampiera linearis

The above species list was compiled from species recorded in the dunal woodland communities along the easement and adjacent vegetation as well as the addition of some species found locally that respond well in rehabilitation. Seed for all species on this list may not be available. The species have been ordered from those that were recorded with the highest cover to lowest cover.