

**KEYSBROOK MINERAL SAND PROJECT,  
KEYSBROOK, WESTERN AUSTRALIA:**

**VEGETATION MANAGEMENT PLAN**

**MAY 2006**

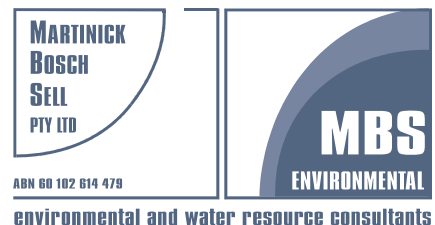
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# 1. INTRODUCTION

## 1.1 VEGETATION MANAGEMENT PLAN

The mining of the Keysbrook mineral sand deposit involves the clearing of some remnant native vegetation in a predominantly pastoral landscape. The Vegetation Management Plan (VMP) outlines the process to minimise impact on vegetation.

The plan will include details of the following actions required to be implemented during the life of mine:

- Recording areas of vegetation cleared.
- A schedule of any surveys and monitoring to be undertaken.
- The preparation of a rehabilitation plan that includes recording local seed collection, species used in rehabilitation, trials undertaken, plant relocation, fencing and weed control.
- A reporting and review schedule for the plan.

## 1.2 VEGETATION MANAGEMENT OBJECTIVE

The objective of this Management Plan is to maintain the abundance, diversity, geographic distribution and productivity of flora and fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement of knowledge.

## 1.3 CLEARING OF NATIVE VEGETATION

The mine area is 1,234 hectares. Of this, 930 hectares (75%) is open pasture and 304 hectares (25%) is remnant native vegetation in a range of conditions. The 304 hectares can be further divided into 244 hectares in a parkland cleared condition, scoring a rating of category 6: completely degraded in the WAPC (2000) Bush Forever rating scale and 60 hectares in generally good condition, ranging from category 3 to 5. This is summarised in Table 1.

**Table 1: Areas within the Mine Area**

	Area (ha)	Area (ha)	Percentage
Total cleared	930		75.40%
Total remnant vegetation:	304		24.60%
• Parkland cleared		244	19.79%
• Good condition		60	4.81%
Total	1,234	304	100.00%

## 2. BASELINE VEGETATION STUDIES

### 2.1 INITIAL SURVEY

MBS Environmental (2004) undertook a vegetation and fauna assessment between 19 and 20 May 2004. The assessment was conducted at the level of reconnaissance survey as specified in Environmental Protection Authority Guideline 51, targeting the areas of remnant native vegetation on the properties of interest (EPA 2004).

No Declared Rare or Priority flora was located during this survey.

### 2.2 DETAILED SURVEY

Bennett Environmental Consulting Pty Ltd (2004) undertook a more detailed survey over the mine area in October 2004. A total of 21 quadrats and three releves were surveyed that identified nine different vegetation units representing six inferred Floristic Community Types (FCT) following Gibson *et al.* (1994).

No Declared Rare or Priority flora was located during this survey.

A total of 40 vascular plant families, 119 genera and 169 taxa were recorded in the survey. The dominant plant families were Poaceae (21 taxa), Myrtaceae (13 taxa), Asteraceae (12 taxa), Cyperaceae and Papilionaceae (11 taxa). These five families represent 43% of the total number of taxa surveyed.

In total there is approximately 304 hectares of native vegetation remaining. Of this, about 244 hectares has been parkland cleared, assessed to have a vegetation condition rating of 6: completely degraded. The remaining 60 hectares has been assessed as remnant vegetation with native understorey in a range of conditions. Only two of the 21 quadrats surveyed scored a condition rating of 3: very good or above.

Three of the vegetation units located during the Bennett Environmental Consulting Pty Ltd (2004) survey were inferred to be potential threatened ecological communities (TEC's). These are shown in Table 2.

**Table 2: Potential TEC's Located During the Survey**

Community Identity	General Description	Project Site Survey Description	WA Criteria	EPBC Act
20b	<i>Banksia attenuata</i> and/or <i>Eucalyptus marginata</i> woodlands of the eastern side of the Swan Coastal Plain	Low closed forest of <i>Banksia attenuata</i> with scattered <i>Banksia menziesii</i> and <i>Eucalyptus marginata</i> subsp. <i>marginata</i> over shrubland of <i>Xanthorrhoea brunonis</i> over open low heath dominated by <i>Hibbertia hypericoides</i> .	EN B)i), EN B)ii)	Not listed
3a	<i>Corymbia calophylla</i> –	Open forest of <i>Corymbia calophylla</i>	CR B)ii)	EN

Community Identity	General Description	Project Site Survey Description	WA Criteria	EPBC Act
	<i>Kingia australis</i> woodlands on heavy soils, Swan Coastal Plain	over tall open shrubland of <i>Kingia australis</i> over closed grassland of weeds.		
3c	<i>Corymbia calophylla</i> – <i>Xanthorrhoea preissii</i> woodlands and shrublands, Swan Coastal Plain	Tall closed forest of <i>Corymbia calophylla</i> or occasionally <i>Eucalyptus patens</i> over tall shrubland of <i>Xanthorrhoea preissii</i> over weeds and bare ground.	CR B)ii)	EN

Bennett Environmental Consulting Pty Ltd (2004) concluded the vegetation condition of FCT 3a and 3c (quadrats 11, 7 and 8) were recorded as mainly degraded to completely degraded and are not considered worthy of conservation. FCT 20b, quadrats 1, 2, 9, 10, 12 and 16 varied in vegetation condition from very good to completely degraded. Where the vegetation was recorded as very good the area was small and surrounded by degraded vegetation or pasture.

In order to further quantify the inferred status of the FCT 20b, statistical analysis of the six quadrats was undertaken to compare the surveyed results with the data from Gibson *et al.* (1994). The analysis concluded that the quadrats are somewhat similar to the Swan Coastal Plain (SCP) “low” group of sites, many of which are attributed to FCT 21a or 21c. It is possible that they belong to FCT 20b but it is more likely they belong to FCT 21a or 21c.

Vegetation type 21c was also inferred in the survey from quadrats 18 and 19.

## 2.3 ADDITIONAL SURVEY

An additional survey was undertaken on 27 October 2005 to two properties not visited the previous year. Lot 3 is located at the northern end of the mine area, immediately west of Lot 56. The second property, Lot 506, is located outside the southern extent of the mine area and includes mapped wetlands that have been listed in the *Revised Draft Environmental Protection (Swan Coastal Plain Wetlands) Policy and Regulations 2004*.

The vegetation of Lot 3 was the same as that described for the adjoining property but in a more degraded condition, scoring a rating of 4-5. Most of the surrounding area has an understorey of weeds and therefore a vegetation condition of 5. Cattle and sheep graze the area. No Declared Rare or Priority flora was recorded from the site.

A detailed survey was not undertaken on Lot 506, only a walk through the area to note the dominant vegetation of the property. This lot is outside the mine area but contains a listed Environmental Protection Policy (EPP) wetland. The vegetation consisted of a Tall Open Scrub dominated by *Kunzea glabrescens* with scattered trees of *Banksia ilicifolia* over scattered low shrubs and sedges. The condition varied between good and very good. The area represents the transition zone between the wetland (on an adjoining property to the south) and the higher ground of the *Banksia* species Woodland.

Bennet Environmental Consulting Pty Ltd (2004) identified a total of 34 weed species in the survey. Only weeds recorded in the quadrats and levees were noted. The list does not include all pasture species. The weeds were rated on the CALM (1999) scale, which is based on three criteria:

Invasiveness	Ability to invade natural bushland in good to excellent condition or ability to invade waterways.
Distribution	Wide current or potential distribution including consideration of known history of wide spread distribution elsewhere in the world.
Environmental impacts	Ability to change the structure, composition and function of ecosystems. In particular, an ability to form a monoculture in a vegetation community.

The rating scale for the weeds is:

High	Weed is prioritised for control and /or research.
Moderate	Weed should have control or research effort directed to it, however, it should be monitored.
Mild.	Monitoring of the weed and control where appropriate.
Low	A low level of monitoring required.

Four weeds were rated as high. These are \**Bromus diandrus* (Great Brome), \**Ehrharta calycina* (Perennial Veldt Grass), \**Leptospermum laevigatum* (Victorian Teatree) and \**Romulea rosea* (Guildford Grass).

A list of weed species recorded in the flora survey of the Keysbrook project area is provided in Appendix 1.

### 3. LAND CLEARING

#### 3.1 ANNUAL PLAN AND SCHEDULE

The mining operation is a continuous process, with the rate of extension dependent on the depth of the orebody in a particular location. At an average pit depth of two metres, the mine will advance at approximately 12 hectares per month.

With 75% of the mine area in existing cleared paddocks, much of the pre-mining preparation work will only involve stripping of pasture and topsoil off the area to be mined.

As a normal part of mine management, a detailed annual mine plan will need to be prepared. The annual plan is required in order to:

- Detail the location of orebodies, anticipated tonnes and grade, to establish production targets for the year.
- Plan and schedule the extension and relocation of infrastructure required to support the mine extensions.
- Liaise with relevant landowners on the location of activity on individual properties.
- Co-ordinate and schedule other supporting activities and contractors that will include items as shown in Table 3.

**Table 3: Action Plan Summary**

Action	Tasks	Outcome
Flora surveys.	Undertake any surveys that are required.	Conduct surveys and implement actions as required.
Clearing in advance of mining.	Salvage timber.	Areas prepared in advance of mining with maximum use/ recycling of material.
Rehabilitation activities.	Seed collection. Plant propagation. Fencing.	Local seed collected for use in rehabilitation. Seedlings grown for planting in May-June. Fences constructed at appropriate times.
Drainage diversion works.	Obtain appropriate permits to divert watercourses. Construct drains and bunds.	Diversions constructed and stabilised in advance of mining.
Seasonal dependent activities.	Selectively remove any large mature trees within the annual mine plan that contain potential cockatoo nesting sites during the period December to July (i.e. outside the breeding season).	Avoid harm to cockatoo hatchlings during the nesting period.
Monitoring activities.	Noise. Dust. Other	Compliance with Regulations. Compliance with standards.



### 3.2 APPROVALS AND PERMITS

All land clearing on site shall be approved with an internal Permit to Clear form prior to the commencement of earthworks (Form 01). Each land clearing approval permit shall be authorised by the Mine Manager.

The person requesting the Permit shall provide appropriate details on the form of the location (including a map), purpose of clearing, date clearing is to be completed, area of clearing required (ensuring area required to stockpile vegetation and topsoil adjacent to the cleared area, if required, is included).

Conditions for the removal and stockpiling or re-use of topsoil and vegetation shall be documented on the Permit by the Mine Manager. A copy of the permit and conditions shall be provided to the person requesting the clearing (the Project Manager). The Project Manager shall then be responsible for ensuring earthworks operators are informed of the conditions and comply with all requirements of the permit.

The location, purpose and area of land cleared shall be entered into the electronic database Land Clearing and Rehabilitation Register by the Mine Manager. The register shall record the location of land clearing, surface area, and volume of topsoil removed and where it was stockpiled. The total area of land cleared shall be reported in the Annual Environmental Report (AER).

### 3.3 MINIMISATION OF LAND CLEARED

The Project Manager shall be responsible for ensuring the area to be cleared is clearly marked and earthworks operators informed such that only the area proposed for clearing is disturbed.

The Project will be designed, constructed and operated to minimise the impacts on remnant vegetation by:

- Defining the area to be cleared on maps and supervising clearing activities.
- Confining temporary work areas to previously disturbed areas or cleared pasture areas where possible.
- Parking vehicles and machinery in designated areas.
- Ensuring that effective dust control measures are implemented.
- Retaining topsoil and cleared vegetation in designated areas for use in rehabilitation.
- Progressively rehabilitate and monitor disturbed areas.

### 3.4 CLEARING METHODOLOGY

1. All areas for land clearing shall be clearly demarked in the field with survey pegs and flagging.

2. The Project Manager shall inform the earthworks operators in person of any clearing conditions (including topsoil and vegetation removal requirements) prior to commencing work.
3. All vegetation shall be removed from the area and stockpiled adjacent to the clearing. Topsoil, to the depth instructed on the Permit to Clear, shall be recovered and stockpiled separately from vegetation, or where possible placed immediately on completed areas ready for rehabilitation. Topsoil stockpiles shall be no greater than two metres high, and located where they shall not be impacted by water inundation or vehicle traffic.
4. A register of topsoil stockpiles shall be maintained.
5. Millable and firewood timber will be removed from site for use.
6. Quantities of mulched or chipped material required for use in rehabilitation will be sourced from the cleared vegetation.
7. Native species such as grasstrees and *Kingia*'s will be salvaged where possible.
8. Material that cannot be milled, mulched or chipped due to excessive sand, rock or other impediment, will be stacked and burnt.

#### **4. REHABILITATION MANAGEMENT PLAN**

A separate Rehabilitation Management Plan (RMP) has been prepared as part of the Public Environmental Report (PER) assessment process.

The RMP is to be reviewed in consultation with regulatory agencies (DoE, CALM, DoA) and other stakeholders (landowners, LCDCs) and implemented by Olympia.

#### **5. DIEBACK MANAGEMENT**

The soil borne fungus disease *Phytophthora cinnamomi* (commonly called 'Jarrah dieback' or just 'dieback') has been positively identified in some upland remnant vegetation communities on the site. Management actions to mitigate against the spread of dieback are proposed in the PER and reproduced in Table 4.

**Table 4: Dieback Management Measures**

	Management Measures	Result	Outcome
1	The site induction programme is to include a section on dieback and the management measures being implemented to minimise its impact in the mine area.	Educate the workforce on dieback and management practices that need to be implemented.	No access to remnant vegetation areas that are outside the current mine envelope, to minimise the risk of introducing or spreading the fungus.  Topsoil handling methods to maintain the dieback-free status of topsoil to be used on upland sites.
2	Isolation of remnant areas not to be impacted by mining.	No mining-related activity within native remnant areas that are excluded from the mine area; to minimise the risk of introducing the fungus or contributing to its spread.	Selected native vegetation areas remain disease free or if already infected, the rate of spread of the disease is based on the growth of the fungus.
3	Screened oversize returned to the pit floor.	Any infected root material that is the source of inoculum, is placed in low-lying landscapes during the recontouring and rehabilitation process. The upland locations remain free from introduction of the fungus from this source.	Minimise the risk of introduction of the fungus to upland rehabilitation sites.
4	Topsoil used on upland locations to come from dieback-free areas.	The dieback status of remnant vegetation areas is to be assessed for visual expression of disease symptoms by the death of susceptible species (if present). Topsoil stockpiles, or topsoil being directly returned to upland locations, are to be sourced from dieback-free areas wherever possible.	Use of dieback-free topsoil will avoid the risk of dieback being introduced on upland sites from this source.
5	Planting and seeding of susceptible species only on upland sites that are freely draining.	The main susceptible species used in rehabilitation will be <i>Eucalyptus marginata</i> , <i>Xanthorrhoea priessii</i> , <i>Kingia australis</i> , <i>Banksia attenuata</i> , <i>B. menziesii</i> , <i>B. grandis</i> and <i>B. ilicifolia</i> . These susceptible species will be interspersed with dieback-resistant species such as <i>Corymbia calophylla</i> and <i>Allocasuarina fraseriana</i> .	Maximise the chance of survival of susceptible species in the longer-term.
6	Trial the use of phosphite fungicide as a spray or stem injection on susceptible species in rehabilitated areas.	Increase the resistance of dieback infection for susceptible species.	Maximise the chance of survival of susceptible species in the longer-term.

## 6. WEED MANAGEMENT

All mobile equipment shall be washed down and clean of mud, earth and seeds prior to entry to site. It is the responsibility of the Mine Manager to inform all earthworks contractors of the requirement to thoroughly wash their equipment prior to it arriving on site.

The Mine Manager is also responsible for ensuring all earthworks equipment is inspected prior to commencement of work to ensure that appropriate safety equipment is fitted and operating and the equipment is cleaned down. The inspection shall be documented on Form 02 Vehicle Inspection checklist and a copy filed in the vehicle inspection register.

The active mine area and rehabilitation areas shall be regularly inspected for invasive weed species. Locations of any populations shall be recorded in the Weed Control Form (Form 03). Advice on the most effective control means for weed species may be sought from DoA. All weed control activities shall be recorded in the Weed Control Form, including the weed species, location, date and the type of control methods used.

## **7. MISCELLANEOUS LAND DISTURBANCE**

### **7.1 ACCESS TRACKS AND OFF ROAD TRAVEL**

All employees shall only drive on existing tracks, access roads, firebreaks, and service corridors. No travel outside designated access routes shall occur without the approval of the Mine Manager.

### **7.2 SURFACE WATER DRAINAGE**

Where surface water drainage requires diversion away from operational areas, roads and other areas, the diversion shall be managed such that surrounding vegetation is protected from long-term inundation.

### **7.3 FIRE MANAGEMENT**

Firebreaks shall be maintained and constructed in compliance with statutory requirements.

## 8. MONITORING

### 8.1 REHABILITATION

Details of the rehabilitation program are included in the RMP. Rehabilitated areas will be monitored to ensure the success of the rehabilitation programme. Monitoring will be carried out on a regular basis to assess:

- The physical stability of the landform of rehabilitated areas.
- The establishment of the vegetation in rehabilitated areas.

Monitoring the rehabilitated areas will ensure that any areas requiring remedial work are identified. Maintenance procedures will be carried out where necessary and may include:

- Replanting areas that may not have regenerated.
- Repairing any erosion problems.
- Weed control.
- Amelioration of soil.

The frequency of monitoring will decrease as rehabilitation progresses and will cease when the rehabilitation objectives and completion criteria have been achieved. The results of these management and monitoring activities will be detailed in the AER.

### 8.2 VEGETATION SURVEYS

During the scheduled review of the VMP, the requirement for any additional flora surveys is to be identified well in advance of mining operations. This will allow surveys to be conducted in the optimum season, reports to be prepared and any management actions implemented in a timely manner, prior to mining occurring in the specified location.

## **9. REPORTING AND REVIEW**

### **9.1 NON-COMPLIANCE REPORTING**

Any unapproved land clearing, or disturbance of environmentally significant sites shall be immediately reported on the project's Accident/Incident Report form by the Mine Manager.

Copies of all documentation relating to non-compliances are to be maintained in the Accident/Incident Register.

### **9.2 ANNUAL ENVIRONMENT REPORT**

The following land management information shall be reported in the AER:

- Total land cleared against the DoE Permit approved total.
- Total disturbed areas rehabilitated.
- Rehabilitation monitoring results.
- Weed control activities.
- Any non-compliance with respect to land management.

### **9.3 MANAGEMENT PLAN REVIEW**

The VMP is to be reviewed every second year from the commencement of operations, to ensure it remains current with the mine plan and legislative requirements.

## 10. VEGETATION MANAGEMENT PLAN DOCUMENTATION

Records relevant to the VMP that shall be maintained include items listed in Table 5.

**Table 5: Vegetation Management Plan Relevant Documentation**

Document Type	Document Title	Link
Procedure	Rehabilitation Monitoring	Pending
Form 01.	Internal Land Clearing Permit	<a href="#">Permit to Clear form.doc</a>
Form 02.	Vehicle inspection checklist	<a href="#">Machinery inspection checklist.doc</a>
Form 03.	Weed control activities	<a href="#">Weed control form.doc</a>
Form 04	Accident/Incident Report form	To be completed
Register	Land Clearing and Rehabilitation Register	<a href="#">..\Permits and Procedures\Land clearing and rehabilitation register.xls</a>



## 11. TRAINING AND AWARENESS

The following information shall be provided to all employees and contractors in the environmental component of the General Site Induction:

- The project's objectives and targets with respect to land, flora and fauna management.
- The Site permitting forms and procedures for approval to clear or disturb land.
- Requirements for all personnel to use existing tracks and roads and not to drive off road unless absolutely necessary.
- Description and location of any environmentally significant sites to be avoided by personnel.
- Requirements for all earthworks equipment to be washed before arrival to site, and to be inspected and approved by the Mine Manager.

## **12. RESPONSIBILITIES**

### **12.1 OPERATIONS MANAGER**

The Mine Manager is responsible for the following:

- Ensuring land clearing is planned and appropriate documentation is maintained.
- Ensuring non-compliance with this Management Plan are rectified and reported to the relevant authorities.
- Reviewing and approving environmental management information presented in the AER.
- Ensuring the project has adequate resources to meet the requirements of this Management Plan.
- Reviewing and approving this Management Plan on a biannual basis.

### **12.2 PROJECT MANAGER**

The Project Manager is responsible for the following:

- Ensure appropriate project approvals to clear or disturb land are obtained in advance of clearing.
- Regularly inspect clearing activities to ensure the conditions outlined in the permit to clear or disturb land are complied with.
- Ensuring earthworks operators are appropriately trained and competent to operate the machinery, and have been informed of the conditions of clearing and locations of any environmentally significant sites.
- Immediately report any non-compliance with the permit conditions or unapproved land clearing to the Mine Manager.

### **12.3 ALL EMPLOYEES AND CONTRACTORS**

All employees and contractors are responsible for the following:

- Not clearing or disturbing land without sighting an approved Permit to Clear and understanding any conditions of the permit.
- Immediately reporting environmental incidents with respect to land, flora or fauna management.
- Reporting sightings of invasive weed species to the Mine Manager.

### 13. REFERENCES

- Bennett Environmental Consulting Pty Ltd (2004). Vegetation and Flora of Exploration Licence 70/2407, Keysbrook, Western Australia. Report prepared for MBS Environmental.
- Department of Conservation and Land Management (1999). Environmental Weed Strategy for Western Australia. Department of Conservation and Land Management, Western Australia.
- Environmental Protection Authority (2004). Terrestrial Flora and Vegetation Surveys for Environmental Impact in Western Australia. Guidance for the Assessment of Environmental Factors (in accordance with the *Environmental Protection Act 1986*), No. 51.
- Gibson, N., Keighery, B.J., Keighery, G.J., Burbidge, A.H., Lyons, M.N. (1994). A Floristic Survey of the southern Swan Coastal Plain. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.).
- MBS Environmental (2004). Vegetation and Fauna Assessment of Exploration Licence 70/2407, Keysbrook. Report prepared for Olympia Resources Limited.

# APPENDIX 1

**Weeds recorded during the survey classified according to Department of Conservation  
and Land Management (1999)**

Scientific Name	Common Name	CALM Rating	Invasiveness	Impacts
* <i>Bromus diandrus</i>	Great brome	High	1	1
* <i>Ehrhata calycina</i>	Perennial veldt grass	High	1	1
* <i>Leptospermum laevigatum</i>	Victorian teatree	High	1	1
* <i>Romulea rosea</i>	Guildford Grass	High	1	1
* <i>Aira caryophylla</i>	Silvery Hairgrass	Moderate	1	
* <i>Aira cupaniana</i>	Hairgrass	Moderate	1	
* <i>Arctotheca calendula</i>	Cape Weed	Moderate	1	
* <i>Avena barbata</i>	Bearded Oat	Moderate	1	
* <i>Briza maxima</i>	Blowfly grass	Moderate	1	
* <i>Briza minor</i>	Shivery Grass	Moderate	1	
* <i>Callitriche stagnalis</i>	Common starwort	Moderate	1	
* <i>Carduus pycnocephalus</i>	Slender thistle	Moderate	1	
* <i>Cynoden dactylon</i>	Couch grass	Moderate	1	
* <i>Cyperus tenellus</i>	Tiny flat sedge	Moderate	1	
* <i>Disa bracteata</i>	South African orchid	Moderate	1	
* <i>Ehrharta longiflora</i>	Annual Veldt grass	Moderate	1	
* <i>Hordeum leporinum</i>	Barley grass	Moderate	1	
* <i>Hypochaeris glabra</i>	Flat weed	Moderate	1	
* <i>Juncus bufonius</i>	Toad rush	Moderate	1	
* <i>Juncus capitatus</i>		Moderate	1	
* <i>Lolium rigidum</i>	Annual ryegrass	Moderate	1	
* <i>Orobanche minor</i>	Lesser broom rape	Moderate	1	
* <i>Parentucellia Latifolia</i>	Red bartsia	Moderate	1	
* <i>Solanum nigrum</i>	Black berry nightshade	Moderate	1	
* <i>Trifolium campestre</i>	Hop clover	Moderate	1	
* <i>Ursinia anthemoides</i>	Ursinia	Moderate	1	
Scientific Name	Common Name	CALM	Invasiveness	Impacts

		<b>Rating</b>		
*Vulpia Bromoides	Squirrels tail fescue	Moderate	1	
*Vulpia myuros	Silvery grass	Moderate	1	
*Rumex crispus	Curled dock	Mild		
*Aira praecox	Early hairgrass	Low		
*Bromus hordeaceus	Soft brome	Low		
*Lotus suaveolens	Hairy birdsfoot trefoil	Low		
*Ornithopus pinnatus	Slender serradella	Low		
Trifolium hirtum	Rose Clover	Low		