Design and Landscaping Plan

1407 Bodangora Wind Farm

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moir landscape architecture

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1.0 Introduction

1.1 Introduction

Moir Landscape Architecture have been commissioned by Bodangora Wind farm Pty Limited (BWFPL) to undertake a Design and Landscaping Plan (D&LP) for the approved Bodangora Wind Farm. This D&LP specifically addresses the Bodangora Wind Farm Conditions of Approval (CoA) ***C18, C19, C20*** and ***C26*** prepared by the Minister for Planning and Infrastructure.

The D&LP has been undertaken by David Moir, Registered Landscape Architect and Director of Moir Landscape Architecture.

The objectives of the Design and Landscaping Plan for Bodangora Wind Farm are as follows:

- Provide a D&LP that fully addresses the requirements of Condition 26.
- Identify and outline site landscaping treatments that are practical, viable and effective
- Identify development and design measures undertaken to minimise the visual impact of the project.
- Identify materials and finishes of built form.
- Identify proposed lighting requirements and applied methods for reducing visual impact.
- Identify and outline additional measures available for requested landscape works off site within and up to 5km from the wind turbines.
- Identify appropriate species for screen planting.
- Identify appropriate species and seed mixes for stabilisation planting.
- Identify a practical methodology for the programming of landscape works.
- Identify a practical methodology for the ongoing maintenance and monitoring of the landscape works.

This Design and Landscaping Plan provides a reference for the implementation of landscape works for the mitigation of visual impact and for general landscape works associated with the construction of roads and infrastructure for the Bodangora Wind Farm Project

1.2 Project Description

The Bodangora Wind Farm (the project) is an approved renewable energy project located approximately 2 kilometres (km) northeast of Bodangora and 15 km northeast of Wellington, within the Dubbo Regional local government area (see *Figure 1*). The project was approved under delegation by the Planning Assessment Commission on 30 August 2013. A modification application to increase the blade diameter was approved in October 2015. Modification 2 was approved in December 2016 and allowed a realignment of the project's transmission line and relocation of the project substation. Modification 3 which allowed for the relocation of Turbine 28 and Turbine 31 and a realignment of an access road was approved in June 2017. Modification 4 was approved in December 2017 and allowed for greater micro siting flexibility and the use of non matte paint.

The project as currently approved involves:

- construction and operation of up to 33 wind turbines, associated infrastructure and access tracks; and
- a 33/132 kilovolt (kV) substation connecting to TransGrid's existing 132 kV Wellington – Beryl transmission line.

See Figure 1 below.

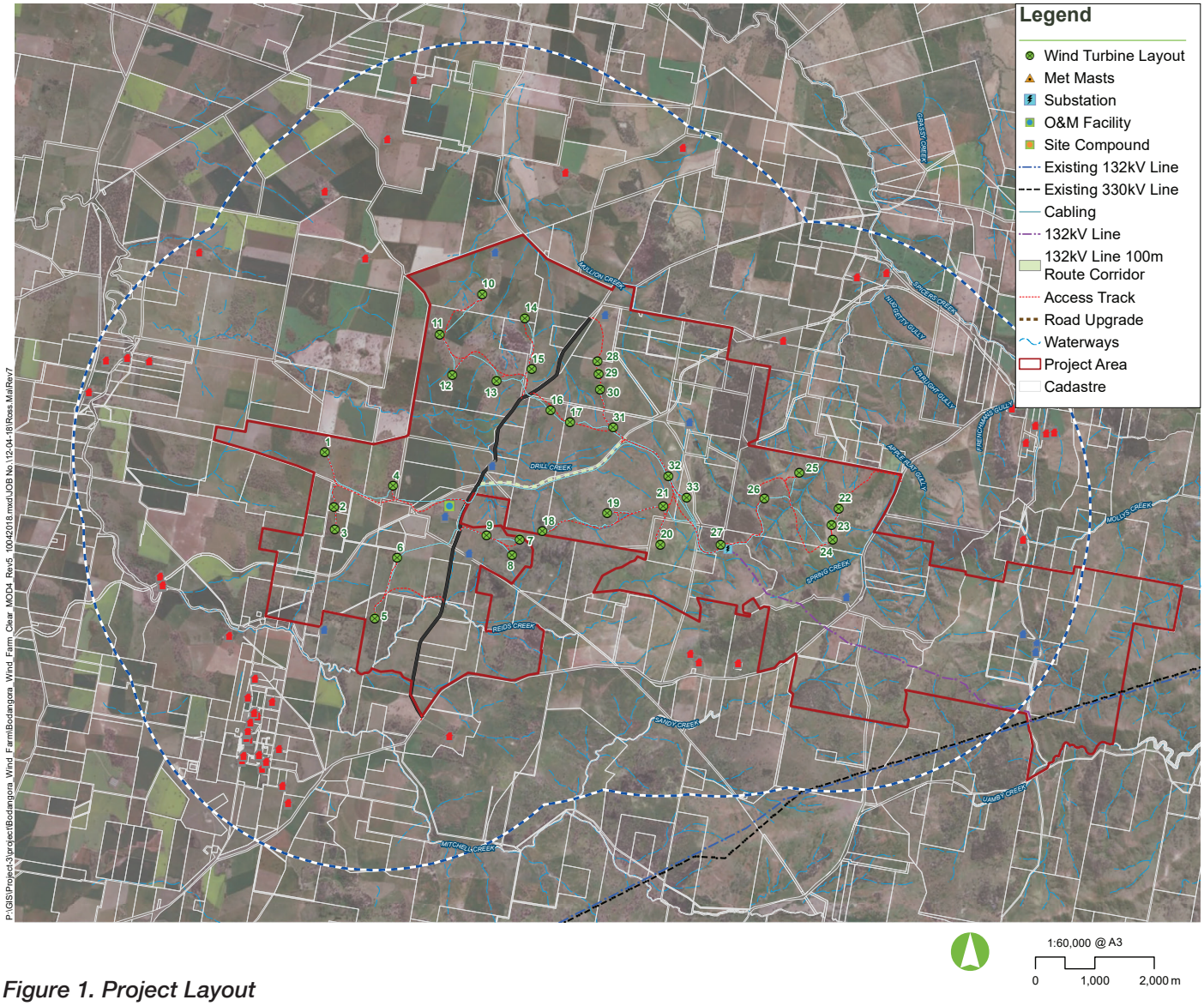

Figure 1. Project Layout

1.3 Conditions of Approval

This D&LP has been prepared in response to the relevant Conditions of Approval *C18*, *C19*, *C20, C25* and *C26* as outlined below.

Visual Amenity

Condition 18: All non-associated receptor's whose dwelling may be subject to moderate to high visual impact, as defined in the EA, shall be consulted regarding impact minimisation measures. The outcomes of this consultation process shall be used to inform the Design and Landscape Plan, required under condition C26.

Condition 19: At the request of any owners of non-associated residential dwellings with views of a turbine(s) located within five kilometres of their dwellings, the Proponent shall provide and bear the full cost of reasonable landscaping treatments to visually screen these dwellings. Such a request may be made in writing by the owner of the dwelling within six months from the commencement of operation of the Project, and landscaping treatments agreed between the parties shall be implemented and completed within 12 months of such an agreement. Should the parties not be able to reach agreement on the scope of landscaping treatments, then either party may refer the matter to the Secretary for resolution. The Secretary's decision on such a referral shall be final and binding on the parties.

Condition 20: Landscaping works to reduce the visual impact of the Project shall generally comprise of indigenous and locally occurring species.

Night Lighting

Condition 25: With the exception of aviation hazard lighting implemented in accordance with the requirements of this condition, no external lighting other than low intensity security night lighting is permitted on site unless otherwise agreed or directed by the Secretary, or required by Civil Aviation Safety Authority.
Prior to the commencement of construction, the Proponent shall consult with the Civil Aviation Safety Authority on the need for aviation hazard lighting in relation to the wind turbines. Any aviation hazard lighting shall be implemented in a manner that minimises visual intrusion to surrounding non-associated residences as far as feasible and reasonable.

Design and Landscaping Plan

Condition 26: A Design and Landscaping Plan shall be prepared to outline measures to ensure appropriate development and maintenance of landscaping on the site to achieve adequate landscape buffers and address the visual impacts arising from the Project, including turbines, site access roads and associated above ground infrastructure, as far as is feasible and reasonable.

The Plan shall be prepared by a qualified landscape architect and where relevant meet any requirements of Council. The Plan shall include design treatments for the turbines and ancillary infrastructure, including, but not necessarily limited to:
(a) the landscape screening measures at non-associated residences in close proximity to the Project site and along nearby roadsides to screen potential moderate to significant views of the Project, including an outline of additional measures available for requested landscaping treatments;
(b) landscape elements and built elements, including proposed treatments, finishes and materials of exposed surfaces (including colour specifications);
(c) lighting;
(d) a schedule of species to be used in landscaping;
(e) details of the timing and progressive implementation of landscape works; and
(f) procedures and methods to monitor and maintain landscaped areas.

The Plan shall be submitted for the approval of the Secretary prior to the commencement of permanent built works and / or landscaping, unless otherwise agreed by the Secretary. The Plan may be submitted in stages to suit the staged construction program of the Project.

2.0 Off Site Landscaping Works

2.1 Non-associated dwellings subject to moderate to high visual impact

Condition 18 of the Conditions of Approval all non-associated receptors whose dwelling may be subject to a moderate to high visual impact shall be consulted regarding impact mitigation methods.

In the preparation of the Landscape and Visual Impact Assessment (LVIA) for the Bodangora Wind Farm, three (3) properties were assessed as having a moderate to high visual impact. Two (2) of these properties were identified as associated, leaving one (1) non-associated property with which to consult. The non-associated property referred to as House 11 in the report was within 2km of proposed Turbine 40. Turbine 40 was removed in the final site layout hence there are no medium to high impact non-associated residences.

2.2 Non-associated dwellings within 5 kilometres

Condition 19 states non-associated dwellings within 5 kilometres with views of the proposed wind turbines may request the Proponent provide and bear the full cost of reasonable landscaping treatments to visually screen these dwellings. At the time of preparation of this report no requests for impact mitigation work on properties within 5 kilometres have been received.

2.2.1 Timing and Implementation

The following provides an overview of the timing and implementation of off site landscaping works for non-associated residences within 5kms.

Within three months of turbine tower installation commencing:

- Write a letter to non associated residences within 5km of a wind turbine who's residence may be subject to a moderate to high visual impact, informing them of: 1) Their rights under the Project Approval for landscaping to reduce the visual ammenity impact of the wind farm, and 2) the timeing of the landscape works to be completed.

In accordance with Condition B9, BWFPL will notify the DoPE in writing of the commencement of operation. Following notification the following will be undertaken:

Within one month from the commencement of operation:

- Write a letter to non associated residences within 5 km of a wind turbine who's residence may be subject to a moderate to high visual impact, reminding them of their rights under the Project Approval for landscaping.

Within six months from the commencement of the operation:

- For those non associated residences seeking landscaping, arrange a meeting at their residence to discuss landscaping options.
- Prepare a landscape plan for the property.
- Obtain approval from landowner.

Within 12 months of an agreement:

- Implement and complete agreed works.

2.2.2 Landscape Design Principles

- The landscape design should be prepared in consultation with the landowner.
- The design should be focused on the objective of mitigating visual impact of the development.
- Species and planting densities should be in keeping with the landscape character of the residence and the surrounding landscape, but will generally comprise endemic species.

The following table outlines the process, timing and responsibilities for off site landscape works.

3.0 Development & Design Measures for Visual Impact Mitigation

3.1 Materials and Finishes of Built Form.

Item (b) of Condition 26 requires that this plan include the proposed treatments, materials and finishes of exposed surfaces for the turbines and ancillary infrastructure.

The following table identifies a list of design responses undertaken to mitigate the visual impact of the built form elements of the project in line with the recommendations of the LVIA and in accordance with Condition 26 Item (b) of the approval.

Wind Farm Built Form Elements			
Infrastructure	Structure Elements	Design Input	Mitigation Outcome
Wind Turbines	Tower: Tapered tubular steel. Blades: Composite glass fibre Nacelle: Fibre glass	Finish with off white / light grey paint. No advertising or logos.	Low contrast surface finish. No contrasting marks on turbine or nacelle surface.
132 kV Transmission Line	132kV Overhead Transmission Line Poles. Poles constructed from concrete	Concrete surface of poles is a consistent light grey and dull finish.	Neutral colour and low reflectivity of surface reduces presence in the landscape.
Substation and 33 kV Switch Room	Buildings and associated infrastructure. Transformer Bay. Building lighting	The substation is located out of view from residences and public roads. Substation buildings are single story and in keeping with the rural vernacular. External finish is Colorbond Surf Mist. Transformer concrete bund is a matte non reflective finish. Design to AS 4282-1997	Buildings will not be visible from residences or public roads. Buildings are consistent with typical farm buildings. Material and colour is low contrast to surrounding landscape. Transformer bund is non reflective and low contrast. Lighting impact is reduced.
Site Compound, Operations and Maintenance Facility	Building Building lighting	Building is single story and in keeping with the rural vernacular. External finish is Colorbond Surf Mist. Design to AS 4282-1997	Buildings are of height, bulk and scale consistent with typical farm buildings. Material and colour is low contrast to surrounding landscape. Lighting impact is reduced.
Wind Monitoring Towers	Met mast structure and guy wires.	Latticed galvanised steel and steel guy wires.	Lightweight structures with dull finish. Transparent nature allows background colours to remain visible reducing contrast.

Table 2. Wind Farm Infrastructure Mitigation Methods

Off-Site Landscape Design Process		
PHASE	TASK	TIMING
1. Request for Landscape	Inform residences of their rights for landscaping under the Project Conditions of Consent. Resident within a 5km distance of the nearest turbine may request landscape works for the purpose of mitigating any visual impact.	Within 3 months of turbine tower installation and again within one month of operation. Requests must be made within 6 months of commencement of operation of the development.
2. Site Analysis & Consultation	On receipt of a request BWFPL will arrange an on site meeting with the resident owner to discuss the issue. The site inspection will be attended by a representative of BWFPL and may include an appropriately qualified Landscape Architect appointed by BWFPL. The purpose of the site inspection is to: • Determine the extent of visual impact. • Record the existing landscape character of the site • Discuss options for screening views to the development. If it is determined that the development is not visible from the property then the resident will not be eligible for off site landscape works.	Meeting to be arranged by BWFPL within 4 weeks of receipt of request.
3. Landscape Plan	A draft landscape plan shall be prepared that specifically addresses the issue of visual impact. The draft shall be issued to the resident for comment. A final landscape plan will be prepared incorporating comments from all stakeholders. The plan will identifiy species, locations, quantities and stock sizes and a specification for installation and an outcome based approach for establishment and completion as agreed with the landowner.	Within 4 weeks of site visit. All comments are to be returned within 4 weeks of issue of landscape plan. Final Landscape Plan: The final landscape plan is to be issued within 4 weeks of receipt of comments.
4. Implementation	The landscape is to be installed as per the landscape plan by an experienced landscape contractor appointed by BWFPL. Once complete the landscape is to be inspected by the BWFPL appointed Landscape Architect. The landowner may negotiate to install the landscape themselves at an agreed cost. If the landowner choses to install the landscape then BWFPL is released from all future obligations relating to maintenance and monitoring.	Installation: Within 6 months of completion of Final Landscape Plan. Inspection: Within 2 weeks of completion
5. Maintenance	BWFPL are to maintain the on site and off site landscape for an establishment period of 24 months. Maintenance will include removing weeds and replacing all dead and dying plants. A final inspection by the appointed Landscape Architect is to be undertaken at the end of the maintenance period to certify that the landscape is succesfully established. The landholder may elect to maintain the landscape at an agreed cost releasing BWFPL from all future obligations.	Inspection: Within 2 weeks of completion of maintenance period. Landscape works will be inspected every 6 months during the maintenance period to monitor maintenance and progress.

Table 1. Process for Off Site Landscape Design & Implementation

3.2 Lighting

Item (c) of Condition 26 requires that any visual impacts associated with lighting of the turbines or any of the associated infrastructure be addressed in this report.

Condition 25 also addresses the issue of lighting. As aviation lighting is not required on the turbines all other external lighting will be low level and generally associated with the the operations building and substation. Any lighting installed will be in accordance with *AS 4282-1997 - Control of obtrusive effects of outdoor lighting*.

The following table identifies the lighting requirements for the development.

Wind Farm Lighting Requirements	
Structure	Lighting Requirements
Wind Turbine	No aviation lighting required. No permanent personnel lighting required. Lighting will be used as necessary during maintenance.
Wind Turbine Access	No permanent lighting required. Lighting will be used as necessary during maintenance.
Transgrid Substation	Low intensity security lighting and personnel lighting will be required. (Note: Site is not visible from residences or public roads)
33kv Farm Substation	Personnel lighting will be required.
Access Roads	No lighting required
Site Compound, Operations and Maintenance Facility	Personnel lighting will be required. Generally not occupied at night. Lighting design to AS 4282-1997 - Control of obtrusive effects of outdoor lighting.
Wind Monitoring Towers	No lighting required.
Transmission Lines	No lighting required

Table 3. Lighting Requirements

4.0 On Site Landscaping Works

4.1 Overview of On Site Landscaping Works

Due to the scale of elements associated with the proposed Wind Farm, there are limited opportunities to provide feasible mitigation of visual impacts through on-site landscaping works. The following provides an overview of key infrastructure and elements associated with the proposal and landscape screening options.

Landscape Options for Key Infrastructure Elements		
Infrastructure	On-Site Screening Opportunities	Details
Wind Turbines	N/A	Due to the large vertical scale of the proposed wind turbines, there are no feasible landscaping options to mitigate visual impacts of the proposed wind turbines on site. Land affected by construction works associated with the wind turbines (ie embankments) shall be rehabilitated as necessary.
Wind Monitoring Tower	N/A	Due to the large vertical scale of the proposed wind monitoring towers, there are no feasible landscaping options to mitigate visual impacts on site.
Transmission Line	N/A	Due to the large vertical scale of the transmission lines, there are no feasible mitigation methods to reduce the visual impact using on-site landscaping. Mitigation has been largely addressed in the design with the transmission line route located away from residences.
Access Roads	Landscaping	Landscape works will be undertaken to road edges, associated swales and embankments for the purpose of soil stabilisation. Planting will primarily consist of pasture grasses. This planting will contribute to mitigating any potential visual impact of access roads. Specific issues can be addressed during construction.
Substation	N/A	The substation is situated amongst established vegetation and is not visible from nearby residences or public roads. No additional screen planting is required around the substation for the purpose of mitigating visual impact.
Site Compound, Operations and Maintenance Facility	Landscaping	The site compound, operations and maintenance facility is situated adjacent to public roads.
Wind Farm 33kV electricity reticulation system to the substation	N/A	33kV network is underground. No mitigation required.
Hardstand Areas	Landscaping	Embankments associated with cut and fill in the formation of the hardstand areas will be treated with pasture grasses.
Council roads: South side Driell Creek Rd South side Wandrona Lane North side Mudgee Rd	N/A	Dubbo Regional Council has advised no landscaping is required given the visual amenity of the wind farm is considered a positive for the local area.

Table 4. Landscape Options for Key Infrastructure Elements

4.2 Landscaping Treatments

Generally there are two key types of landscape treatments that may be undertaken;

- Off Site Landscaping: Screen planting for the purpose of mitigating visual impact of wind farm infrastructure. This planting will generally consist of a mixture of locally occuring trees, shrubs and groundcovers to ensure visual integration

with the surrounding landscape. Planting techniques may include direct seeding, hydroseeding, ripline planting and tubestock planting or combination of several of these methods.

- On Site Landscaping: Earthworks planting for the purpose of stabilising embankments and cleared areas to prevent erosion. This planting will generally consist of locally occuring native pasture grass species. A species list is provided as part of this report however the contractor may consult directly with the landowner to ensure that pasture species applied are appropriate and in keeping with the properties pasture management for the purposes of grazing or weed control.

4.3 Timing of Landscape Implementation

Timing of the landscape works is to be generally in accordance with the projects construction programme. Final landscape works are to be undertaken directly after completion of earthworks and construction of built elements to minimise the risk of erosion and to prevent soils from drying out excessively. Landscape works are not to be undertaken in areas where further earthworks or construction are likely to occur.

Ideally planting should be undertaken in early Spring (September/October) however this may not always align with the project construction programme therefore the following principles for the timing of implementation should be applied;

- Planting should not occur in periods of extreme weather. Either extended periods of hot weather or frost can result in the loss of newly planted trees, shrubs and groundcovers.
- Planting should not occur if site soils are excessively wet or overly dry and hard. Poor soils conditions can result in failure of plantings as wet soils can cause the plants to rot in the ground whilst overly dry soils can become hydrophobic preventing the transfer of moisture to the plants roots.
- Planting should be planned around the landholders pasture rotation to prevent grazing of newly planted trees, shrubs and groundcovers. The landholder should be consulted on the likely timing of landscape works early in the construction programme to avoid conflict.

4.4 Maintenance & Monitoring

All areas of on site landscaping are to be maintained for a period of ***24 months*** to ensure successful plant establishment and growth. During plant establishment of the proposed landscape works and regeneration areas should be checked regularly for plant health and weed invasion. Regular inspections will reduce the potential for minor infestations becoming major problems.

The landscape contractor shall undertake the following:

- Monitoring of plant establishment and growth once per month for the first 6 months, and every 6 months for the remaining 18 month period.
- On-site watering: where and when necessary; Off-site watering: by the non associated landowner.
- Weed control on a monthly basis for the first 6 months, and every 6 months thereafter for the remaining 18 months period.
- Replace any dead or dying plants within this period.
- Mulching and other activities as required to promote healthy growth.
- Inspections of plant health every 6 months for the 24 month period. Report to be prepared every 6 months and issued to DPE to including photographic documentaiton of the landscape progress.

The landscape areas should also be monitored regularly at *3 monthly intervals* to document such things as growth rates, success and failures. Monitoring of the growth, root distribution and transpiration rates of establishing species will help identify species that are successful and suitable for use in future stages or as replacement plantings.

A final report shall be provided to the DoPE at the end of the 24 month period certifying the succesful establsihment of the landscape.

5.0 Plant Species

A schedule of suitable plant species has been complied with reference to the Flora and Fauna Report prepared by Kevin Mills & Associates for the Bodangora Wind Farm (see ***Table 2***). Species listed are native to the site, commercially available (in accordance with ***Condition 20***). The planting scheme aims to achieve structural diversity and a random distribution of plants. This provides a variety of growth forms and ensures against plant failures.

5.1 Screen Planting Species

The following table identifies locally occuring species appropriate for screen planting.

Species Schedule for Screen Planting		
Botanical Name	***Common Name***	***Mature Height***
Tree Species		
Acacia implexa	Hickory Wattle	Up to 12 metres
Angophora floribunda	Rough-barked Apple	Up to 20 metres
Callitris endlicheri	Black Cypress Pine	Up to 10 metres
C. glaucophylla	White Cypress Pine	Up to 12 metres
Eucalyptus albens	White Box	Up to 25 metres
E. blakelyi	Blakely's Red Gum	Up to 25 metres
E. bridgesiana	Apple Box	Up to 25 metres
E. conica	Fuzzy Box	Up to 20 metres
E. dealbata	Tumbledown Gum	Up to 15 metres
E. goniocalyx	Bundy	Up to 20 metres
E. macrorhyncha	Red Stringybark	Up to 30 metres
E. melliodora	Yellow Box	Up to 15 metres
E. nortonii	Long-leaved Box	Up to 15 metres
E. polyanthemos	Red Box	Up to 10 metres
E. sideroxylon	Mugga Ironbark	Up to 15 metres
Pittosporum phyllireoides	Weeping Pittosporum	Up to 10 metres
Small Tree / Shrub Species		
Acacia decora	Western Silver Wattle	Up to 5 metres
A. doratoxylon	Spearwood	Up to 6 metres
A. leucoclada	Silver Wattle	Up to 20 metres
A. spectabilis	Mudgee Wattle	Up to 6 metres
Acacia vestita	Hairy Wattle	Up to 4 metres
Dodonaea viscosa ssp. spatulata	Hop-bush	Up to 2 - 6 metres
Exocarpos cupressiformis	Native Cherry	Up to 3 - 8 metres
Grasses / Groundcovers		
Carex appressa	Tall Sedge	Up to 1 metre
Dianella longifolia	Blue Flax Lilly	Up to 0.8 metre
Lomandra filiformis	Wattle Mat Rush	Up to 0.5 metre
Themeda australis	Kangaroo Grass	Up to 0.7 metre

Table 5. Screening Species Schedule

5.2 Pasture Planting Species for Soil Stabilisation

The following table identifies species appropriate for pasture planting in areas where existing vegetation has been cleared. This list is not exhaustive and the landholder should be consulted prior to seeding to confirm species and seeding rates.

Species Schedule for Pasture Planting	
Botanical Name	***Common Name***
Native	
Eragrostis leptostachya	Paddock Lovegrass
Panicum decompositum	Native Millet
Poa labillardierie	Tussock Grass
Themeda triandra	Kangaroo Grass
Introduced	
Dactylis glomerata	Cocksfoot
Phalaris aquatica	Phalaris
Trifolium subterraneum	Sub Clover

Table 6. Pasture Species Schedule