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Blackjack Creek Riparian Corridor/Channel Reconstruction Vegetation Management Plan

Prepared for
Gunnedah Shire Council

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Report prepared by Constructive Solutions Pty Ltd

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Table of Contents

Acronyms	iii
1 Introduction	1
2 Locality	2
3 Species Selection and Application	3
4 Revegetation Methods	5
4.1 Long-stem Planting	5
4.2 Hydromulching	6
4.3 Staging and Scheduling	7
5 Maintenance and Monitoring	8
6 Costs	12
7 References	13
Appendix 1: NOW VMP Guidelines	A
Appendix 2: Approval Notice	B
Appendix 3: Site Photographs	C
Appendix 4: Offset Areas Map	D
Appendix 5: Planting List	E
Appendix 6: Monitoring and Maintenance Checklists	F

Acronyms

GSC	Gunnedah Shire Council
NCMA	Namoi Catchment Management Authority
NOW	NSW Office of Water
REF	Review of Environmental Factors
VMP	Vegetation Management Plan
VRZ	Vegetated Riparian Zone

1 Introduction

Gunnedah Shire Council (GSC) is proposing to reconstruct the Blackjack Creek riparian corridor/channel in order to provide for flood mitigation. GSC has completed extensive investigations to date, culminating in the preparation of the Blackjack Creek Riparian Corridor/Channel Reconstruction Concept Design and Feasibility Study (Constructive Solutions 2012).

As part of Stage 3 – Technical Review and Detailed Design – of the Blackjack Creek Riparian Corridor/Channel Reconstruction Concept Design and Feasibility Study, a Review of Environmental Factors (REF) has been prepared. This REF recommends that a Vegetation Management Plan (VMP) be prepared for the Blackjack Creek Riparian Corridor/Channel Reconstruction in accordance with the NSW Office of Water (NOW) *Guidelines for vegetation management plans on waterfront land* (2012) (the ‘NOW Guidelines’).

Although GSC is exempt from requiring a Controlled Activity Approval under the *Water Management Act 2000* (WM Act) through the provisions of the Water Management (General) Regulation 2011, this VMP has been prepared to meet the NOW Guidelines for the preparation of a VMP where a Controlled Activity Approval for disturbance to waterfront land is required. A copy of these Guidelines is provided as **APPENDIX A**.

The Reconstruction was subject to approval under sections 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) for impact to the Koala. Approval 2013/6732 was granted on 22 November 2013. Preparation of a VMP for the Reconstruction is also required as Condition 2 of Approval 2013/6732. A copy of the approval notice is provided as **APPENDIX B**.

The requirements of the NOW Guidelines and Condition 2 of Approval 2013/6732 have been addressed throughout this VMP as detailed in **Table 1**.

Table 1 – Conditions addressed in this VMP

Condition	Requirements	VMP Section
2013/6732 – Condition 2a	Management actions designed to rehabilitate lands disturbed by the action and improve its habitat value to koalas. This must include all lands identified in the map at Schedule 1 of this notice as “Vegetated Riparian Zone”.	Sections 3 & 4
2013/6732 – Condition 2b(i)	Management actions designed to improve koala habitat value, including area and quality, of offset areas identified in the map at Schedule 1 of this notice as “7.29ha unvegetated portion of Wandobah Reserve”. Including: planting of indigenous trees.	Sections 3 & 4
2013/6732 – Condition 2b(ii)	Management actions designed to improve koala habitat value, including area and quality, of offset areas identified in the map at Schedule 1 of this notice as “7.29ha unvegetated portion of Wandobah Reserve”. Including: evidence that the proposed management actions to improve koala habitat are effective at improving koala habitat quality and area.	Sections 3 and 4
2013/6732 – Condition 2b(iii)	Management actions designed to improve koala habitat value, including area and quality, of offset areas identified in the map at Schedule 1 of this notice as “7.29ha unvegetated portion of Wandobah Reserve”. Including: a schedule of koala habitat restoration that compensates for lag time between planting trees and those trees having value as koala habitat.	Sections 3 & 4
2013/6732 – Condition 2c	An ecological monitoring program to monitor the success of management actions in the VMP and define measureable targets and actions, performance indicators, and an adaptive management framework for the duration of the action’s impact on koala habitat.	Section 5

Condition	Requirements	VMP Section
NOW Guidelines	Locality details	Section 2
	Riparian corridor width	
	Maps	
	Site photographs	
	Access arrangements	
	Vegetation composition	Section 3
	Planting layout	
	Planting densities	
	Seed sources	Section 4
	Rehabilitation methods	
	Staging and scheduling	Section 5
	Maintenance and monitoring provisions, both during and post-construction	
	Revegetation costs	Section 6

2 Locality

The Blackjack Creek riparian corridor/channel reconstruction (the Reconstruction) traverses Wandobah Reserve and the agricultural properties 'Fermanagh' and 'Balmoral' in Gunnedah.

Using the Land and Property Information Spatial Information Exchange SIX Viewer it was identified that Blackjack Creek is a 2nd order stream, as per the Strahler classification system. The NOW Guidelines recommends that the Vegetated Riparian Zone (VRZ) width for 2nd order streams should be 20m on each side of the watercourse from the highest point of the bank.

The Reconstruction will result in a 30m channel width for the majority of the Reconstruction length, with a 20m width spanning 'Balmoral'. As such, the Riparian Corridor for the Reconstruction will be approximately 100m encompassing 30m of channel, additional area to the top of the channel banks at an average 1 in 4 slope, and 20m of VRZ on either side of the channel. **Figure 1** illustrates a typical VRZ.

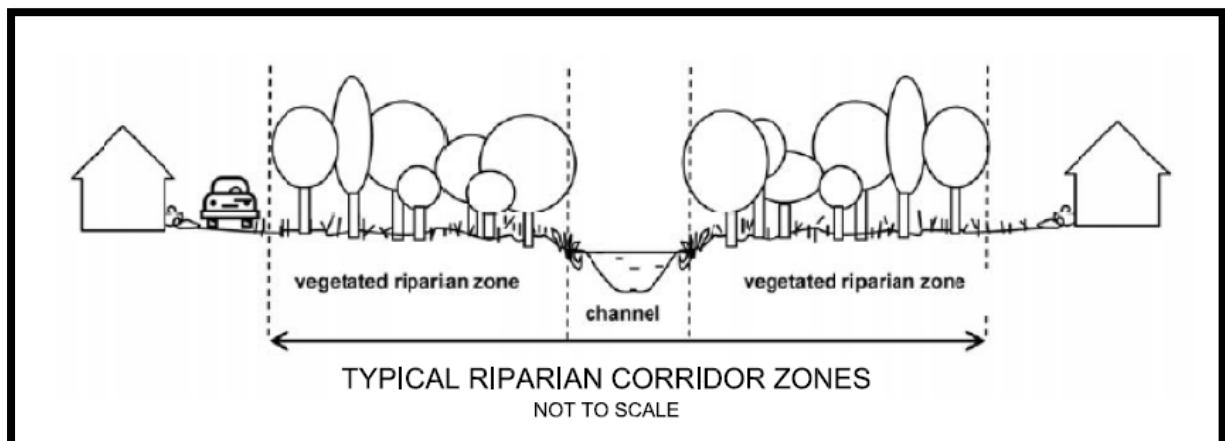


Figure 1 – Typical VRZ (NSW Office of Water 2012)

The Reconstruction location, current conditions, channel width, bank width, and VRZ width of the Reconstruction are illustrated in the *Blackjack Creek Riparian Corridor/Channel Reconstruction Detailed Design* (Constructive Solutions 2012).

Access to Wandobah Reserve can be obtained from Wandobah Road to the east or from unformed tracks off Alford Road to the west. Access to the Reconstruction for 'Fermanagh' and 'Balmoral' can be obtained from the private access tracks within those properties. No long-term measures for preventing access or encroachment to the Reconstruction site for Wandobah Reserve are proposed as it is a public recreational reserve, however the riparian corridor may be fenced within the private properties.

Photographs of the Reconstruction site in its current condition, including coordinates to facilitate ongoing monitoring, are provided in **APPENDIX C**.

3 Species Selection and Application

Revegetation of the Reconstruction is to be carried out in accordance with the NOW Guidelines which delineates the riparian corridor into 4 zones – the stream, toe, middle and upper. These are illustrated in **Figure 2**. As per the guidelines, the main objective is to provide a stable watercourse and riparian zone which will emulate local native vegetation communities.

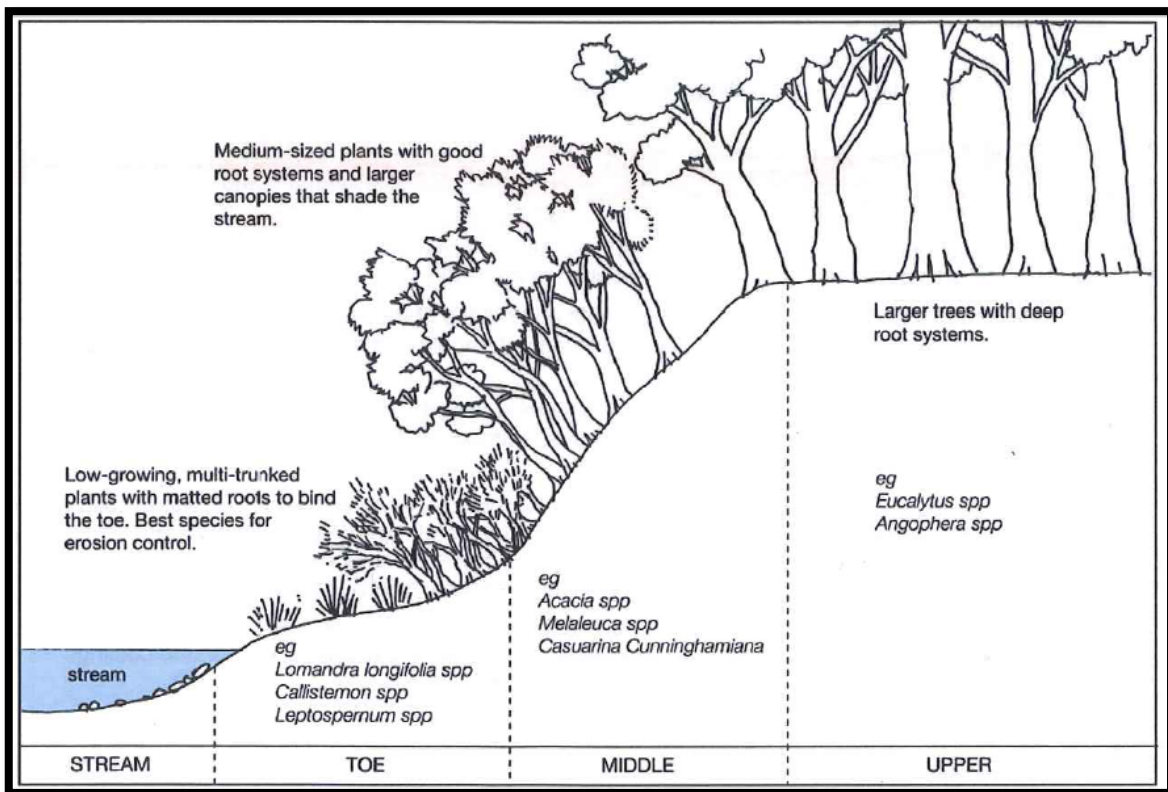


Figure 2 – Typical riparian cross section (NOW 2012)

For the Reconstruction, the widths of the 4 riparian corridor zones will generally be:

- Stream – 30m;
- Toe – 10m (5m on either side of the stream on the inner bank);
- Middle – 20m (10m on either side of the stream on the inner bank); and
- Upper or VRZ – 40m (20m on either side of the stream from the top of the bank).

As the Reconstruction site has been identified as Core Koala Habitat, offsets for area of habitat and number of habitat trees have been determined using the EPBC Act Offsets Assessment Guide. This determined that an effective and appropriate area offset can be achieved through the following:

- Revegetation within the 40m width of VRZ within Wandobah Reserve, as this area is not within the impact area. A 40m width for a length of 941m results in an offset area of 3.764ha;
- Revegetation within the 40m width of VRZ for the remainder of the Reconstruction length. A 40m length for a length of 1021m results in an offset area of 4.084ha; and
- Additional revegetation within the remaining unvegetated portion of Wandobah Reserve. Wandobah Reserve is 33.9ha in size. After subtracting the 9.41ha that comprise of the 5.646ha impact area and the 3.764ha VRZ revegetation area, and the 17.2ha that comprises the remaining vegetated portion, an unvegetated area of 7.29ha remains.

This results in a total offset area of 15.138ha. The offset areas are delineated on the map provided in **APPENDIX D** of this report.

In order to achieve an effective and appropriate offset for the 37 Koala habitat trees which will be removed by the Reconstruction at least 444 of the 555 trees to be planted in the VRZ will be preferred Koala habitat tree species. This figure comprises an additional 74 Koala habitat trees or 20% more than the 370 Koala habitat trees originally proposed in the previous approved VMP (Issue 2, Revision 5, 15 December 2016). In addition, 200 trees were planted in Wandobah Reserve in September 2013 of which comprise 75 Koala habitat tree species.

In order to emulate local native vegetation communities, the Namoi Catchment Management Authority (NCMA) guide *Native Plants for Creek and Rivers in the Namoi* (2012) (the 'NCMA guide') was used for species selection. This guide is provided in **APPENDIX E**. Blackjack Creek is located in the Alluvial Plains of Area C in the Namoi Catchment and is classified as a riparian area. The NCMA reviewed the VMP and recommended that, while the above mentioned guide is a useful basis, a reference site will be used in the development of a planting list to provide 'local context'.

During the preparation of the REF a detailed ecological assessment of the Reconstruction site was undertaken. This included assessment of the remnant vegetation within Wandobah Reserve which is outside the footprint of the VRZ and the compilation of a species list. The ecological assessment determined that the remnant vegetation within Wandobah Reserve is consistent with the Biometric vegetation ID NA185 '*Poplar Box grassy woodland on alluvial heavy clay soils in the Brigalow Belt South Bioregion (Benson 101)*' and with the RVC 80 '*Poplar Box grassy woodland on alluvial clay soils, Brigalow Belt South and Nandewar*'.

The remnant vegetation within Wandobah Reserve acts as a local reference site for the development of a planting list. A list of the 44 native species recorded in Wandobah Reserve is provided in **APPENDIX E**. The planting of native remnant species identified in **APPENDIX E** will improve the continuity of vegetation classes throughout Wandobah Reserve and the VRZ. The NCMA guide will provide guidance on suitable propagation methods for many of the identified species.

The species listed in **APPENDIX E** will be adhered to as closely as possible, with the potential for some species inclusions and/or exclusions to occur based on seed and/or seedling availability. Anticipated planting densities are provided in **Table 2**.

Table 2 – Anticipated planting densities for the Riparian Corridor

VRZ Zone	Area	Vegetation Type	Density	Total to be Planted
Upper	80,000m ²	Trees	1 per 144m ²	555
Entire Riparian Corridor	200,000m ²	Grasses	15kg per ha	300kg

Planting layout will be dictated by the riparian zone location, with all planting to occur in an irregular fashion in order to mimic the natural growth of plants rather than in lines.

In order to facilitate the timely establishment of Koala habitat trees in Wandobah Reserve, 200 trees were planted in the 7.29ha unvegetated portion of Wandobah Reserve in September 2013. Allowing time for land acquisition and engagement of a construction contractor, work is not anticipated to commence until early 2016.

It should be noted that the above anticipated planting densities are based on open space with no existing vegetation. As there is extensive existing vegetation within Wandobah Reserve, the overall densities will be significantly higher than those indicated in the table. These higher densities will contribute to the overall function of the Reconstruction as a riparian corridor.

No trees will be planted in the proximity of above or underground services that may impact on these services as the tree establishes or at maturity.

GSC currently sources seed and seedlings from Gunnedah Forestry Nursery and Fields Native Nursery in Uralla. The volumes required for the Reconstruction may result in the need to source additional volumes elsewhere. GSC will endeavour to ensure that seed and tubestock sources are located as close to Gunnedah as possible in order to provide for seed provenance. All seed sources will be notified of the volumes required at least 6 months in advance to ensure stock availability.

4 Revegetation Methods

Revegetation will be undertaken utilising hydromulching and long-stem planting, depending on the requirements. Examples of these are provided in **Table 3**.

Table 3 – Revegetation methods

Vegetation Type	Revegetation Method	Common Zones
Grasses	Hydromulching	Stream, toe, middle and upper
Trees	Long-stem planting	Upper

Appropriate site preparation, including eradication of noxious weeds, is to be undertaken prior to commencement of revegetation.

4.1 Long-stem Planting

Long-stem planting requires the planting of seedlings which have been matured for longer than conventional seedlings to three-quarters of their length below the soil surface, with the buried stem and leaf nodes developing roots. The benefits of long-stem planting include:

- The creation of an older, stronger seedling for planting due to the consistent nutrients and water provided in the longer nursery period;
- Insulation of the deeply planted root ball from changes in soil temperature and moisture;
- Increased chance of survival in hotter and drier environments, with the root ball located further away from these influences;
- Greater stability of newly planted seedlings in comparison to conventional planting;
- Greater ability to withstand effects of moving water such as flood conditions in riparian zones;
- Limited watering during planting, with no further watering required post-planting; and
- Reduced loss from vandalism as it is harder to pull up a deeply planted root ball.

Long-stem planting for the Reconstruction will generally follow the auspices of *The Long-stem Planting Guide* (The Australian Plants Society, NSW 2010).

4.2 Hydromulching

Hydromulching is a one-step process where seed, fertiliser, mulch and a binder are combined in water, with the resulting slurry directly sprayed onto the soil surface providing a wood fibre, interlocked mat which provides moisture and protection for seed germination. Hydromulching is more expensive than other forms of direct seeding, however it provides for greater soil stability and protection of seed. Hydromulching with native seed has been used successfully in the rehabilitation of mine overburden (Spraygrass, 2009).



Figure 3 – Hydromulch application (Spraygrass 2009)

A hydromulch mix will be applied to the whole riparian corridor as part of the revegetation of the Reconstruction. In preparation for the hydromulch mix the riparian corridor will be ripped, up to 200mm deep, and topsoiled. Where possible, weed growth, large stones and other debris will be removed. The application of the hydromulching native seed will commence immediately after surface preparations have been completed. Table 4 provides the recommended hydromulch mix for the Reconstruction.

Table 4 – Hydromulching application rates for native grass seed

Zone	Area	Item	Application Rate	Total to be Applied
Entire riparian corridor	20 ha	Native Seed Mix	15kg per ha	300kg
		Cover Crop Seed (Couch)	35kg per ha	700kg
		Fertiliser*	150kg per ha	3,000kg
		Wood Fibre Mulch	2.5t per ha	50t
		Binder	250L per ha	5,000L

* Fertiliser rates and type are to be determined by soil testing during the preparation stage.

The above items shall be thoroughly mixed together to form a slurry and then applied under pressure onto the riparian corridor by means of hydromulching equipment specifically designed for the purpose by operators trained in the use of this equipment.

Watering of the riparian corridor will be carried out in order to keep the wood-fibre moist until satisfactory germination occurs. Post-germination, limited watering will be carried out as necessary to ensure to native grasses reach a stage where they are self-sufficient.

If, during the construction tendering process, it is determined that an alternative method of establishing grasses (e.g. direct seeding) is preferred, this VMP will be updated to reflect the application and monitoring requirements of the alternative method.

4.3 Staging and Scheduling

The planting of 200 trees in the 7.29ha offset area discussed in Section 3 and delineated in the mapping provided in **APPENDIX D** was completed in September 2013. Construction is not anticipated to commence until at least 17 months following these plantings, thus allowing time for establishment.

Revegetation of the riparian corridor will occur immediately following construction of the Blackjack Creek Reconstruction, with staging of construction allowing for staging of revegetation. This staging shall be undertaken in a manner so as to ensure that an area no greater than half the length and width of the Reconstruction is to be disturbed at any one time.

All earthworks activities within the Reconstruction will be scheduled so as to facilitate the preparation of the Reconstruction site for revegetation immediately following the placement of topsoil.

5 Maintenance and Monitoring

Table 5 lists the anticipated risks to the revegetation of the Reconstruction site and provides details of the maintenance and monitoring measures which will be utilised by GSC to ensure the establishment and ongoing efficacy of revegetation at the Reconstruction site.

The ongoing management of the Reconstruction will be the responsibility of GSC Parks and Gardens once construction is complete. As such, the Reconstruction will be integrated into the ongoing management of Wandobah Reserve as a whole under GSC's parks and gardens maintenance program. This integration will provide the necessary flexibility for adaptive management as the need arises (e.g. following a flood event or during a drought).

Table 5 – Risks to revegetation success and monitoring and maintenance measures

Risk	Maintenance and Monitoring Measures	Timing	Responsibility
Lack of suppliers to meet demand for required plants	<ul style="list-style-type: none"> Gunnedah Forestry Nursery & Fields Native Nursery Uralla to be informed of required plant numbers prior to commencement of Reconstruction to facilitate forward planning. 	Prior to commencement of Reconstruction, with subsequent follow-up as needed during the Reconstruction, to ensure ongoing supply.	GSC Project Manager & Revegetation Contractor
	<ul style="list-style-type: none"> If preliminary discussions with the above determine a short-fall in plant availability, other local nurseries will be contacted. 	Prior to commencement of Reconstruction, with subsequent follow-up as needed during the Reconstruction to ensure ongoing supply.	GSC Project Manager & Revegetation Contractor
Failure of plants to establish	<ul style="list-style-type: none"> Use of long-stem planting technique, as outlined in Section 4.2. 	During planting	GSC Project Manager & Revegetation Contractor
	<ul style="list-style-type: none"> Use of established nurseries to supply plants, ensuring plant quality (as advised by GSC Project Manager). 	During planting	GSC Project Manager & Revegetation Contractor
	<ul style="list-style-type: none"> Environmental Management Plan including Erosion & Sediment Control Plan for the to include provisions to strip, protect and replace topsoil, and to ensure surface 'roughness' to facilitate plant establishment. 	Prior to and during the Reconstruction	GSC Project Manager & Construction Contractor
	<ul style="list-style-type: none"> Regular watering of plants to ensure establishment/germination. 	Weekly during construction	Revegetation Contractor

Risk	Maintenance and Monitoring Measures	Timing	Responsibility
		Fortnightly for up to 12 months following construction, or until plants are established, whichever is first	GSC Parks and Gardens following construction
	<ul style="list-style-type: none"> Use of infill planting to replace plants which do not successfully establish 	Post-construction as required	Revegetation Contractor as per contract requirements & GSC Parks and Gardens thereafter
	<ul style="list-style-type: none"> Employment/engagement of suitably qualified employees/contractors to undertake the revegetation, particularly with regards to grass establishment. 	Prior to construction	GSC Project Manager
Drought causing plant mortality	<ul style="list-style-type: none"> Regular monitoring of climatic conditions & soil surface moisture at the Reconstruction site post-establishment of revegetation, with watering to be provided should it be needed. 	Post-construction as required	Revegetation Contractor as per contract requirements & GSC Parks and Gardens thereafter
Flood damage to plants	<ul style="list-style-type: none"> Site inspection following any flood event in Blackjack Creek, with any damaged plants to be monitored &, if mortality occurs, replaced. 	Post-construction as required	Revegetation Contractor as per contract requirements & GSC Parks and Gardens thereafter
Severe storm damage to plants	<ul style="list-style-type: none"> Site inspection following any severe storm event in Gunnedah, with any damaged plants to be monitored &, if mortality occurs, replaced. 	Post-construction as required	Revegetation Contractor as per contract requirements & GSC Parks and Gardens thereafter
Bushfire	<ul style="list-style-type: none"> In the event that a bushfire occurs in the Reconstruction site, it will be dealt with by the Fire Brigade. Site inspections will be undertaken following any bushfire event affecting the Reconstruction, with any damaged plants 	Post-construction as required, with post-bushfire inspections to occur monthly to ensure regeneration or replacement of affected plants	Revegetation Contractor as per contract requirements & GSC Parks and Gardens thereafter

Risk	Maintenance and Monitoring Measures	Timing	Responsibility
	<p>to be monitored and, if mortality occurs, replaced.</p> <ul style="list-style-type: none"> Controlled hazard reduction burns may be required to prevent vegetation build up & to provide asset protection. Controlled burns will also assist in the natural regeneration process of native species. 	<p>Post-construction as required</p>	<p>GSC Project Manager upon advice from NSW Rural Fire Service and if required, from NSW Fire and Rescue</p>
<p>Vandalism to plants</p>	<ul style="list-style-type: none"> Community members may be encouraged to participate in the revegetation to assist in developing a sense of community ownership, as per the REF. 	<p>During construction</p>	<p>GSC Project Manager and GSC community relations</p>
	<ul style="list-style-type: none"> Site inspection following mowing events in Wandobah Reserve or following a community complaint, with any damaged plants to be monitored and, if mortality occurs, replaced. 	<p>Post-construction as required (with mowing anticipated to occur 6 times per annum)</p>	<p>Revegetation Contractor as per contract requirements & GSC Parks and Gardens thereafter</p>
<p>Damage to revegetation as a result of GSC maintenance activities</p>	<ul style="list-style-type: none"> Mowing only to occur for grasses with heights >10cm and mowing debris will not be allowed to accumulate around shrubs and trees in a manner that they are suffocated. 	<p>Post-construction as required (with mowing anticipated to occur 6 times per annum)</p>	<p>GSC Parks and Gardens</p>
	<ul style="list-style-type: none"> In conjunction with the maintenance plan, use of non-selective herbicide (e.g. Roundup) to minimise vegetation build up & prevent any damage for planted trees & shrubs from equipment. For the suppression of weed species within the toe & middle riparian zones, specific care is to be taken for any use of chemical control. Any such program requires a strategic & targeted approach & sound operational planning. 	<p>Post-construction as required</p>	<p>GSC Parks and Gardens</p>

Risk	Maintenance and Monitoring Measures	Timing	Responsibility
	<ul style="list-style-type: none"> Any pruning of vegetation to maintain clearance from infrastructure (e.g. electricity lines) to be undertaken carefully so as not to damage the functionality of the vegetation. 	Post-construction as required, with liaison with necessary stakeholders (e.g. Essential Energy) as required	GSC Parks and Gardens

APPENDIX F provides the monitoring and maintenance checklists for the revegetation of the Reconstruction.

6 Costs

Table 6 provides the anticipated revegetation costs for the Reconstruction. The unit costs have been derived from *The cost of revegetation* (Schirmer and Field, 2000), with unit costs checked against current supplier prices to ensure accuracy.

Table 6 – Anticipated revegetation costs

Item	Volume	Unit Cost	Total Cost
Tree seedlings (tubestock)	555	\$2.50	\$1,387.50
Plastic sleeve guards, stakes & weed matting for trees	555	\$1.50	\$832.50
Contractor cost to plant tree seedlings, including placement of plastic sleeves, stakes, & weed matting	555	\$5.00	\$2,775.00
Hydromulch native grass	20ha	\$11,500/ha	\$230,000.00
Total Revegetation Cost			\$234,995.00

While it is likely that contractors will be used to undertake the revegetation, as per the table above, there is some potential for GSC to reduce rehabilitation costs through the involvement of volunteers in the planting of the seedlings; however, this will result in a cost resulting from the need to provide supervision, equipment and refreshments to any such volunteers. *The cost of revegetation* (Schirmer and Field 2000) estimates that an inexperienced volunteer would need 43 hours to plant 1000 seedlings with tree guards and that refreshment for volunteers would cost \$20 per hectare. If 5 volunteers were utilised, with GSC supervision at a cost of \$50 per hour and provision of refreshments, the planting component of the revegetation of Blackjack Creek would take approximately 1-2 days, at a cost of \$500-\$1000 for supervision and \$50-\$100 for refreshments.

This represents a significant saving over the use of contractors for planting and provides a realistic opportunity for GSC since:

- At the above calculated rate, and working for 6-8 hours each day, revegetation of the Reconstruction would take approximately 1-2 days;
- Recruiting sufficient volunteers with adequate amount of available time would be a possibility since only a 1-2 day commitment would be required; and

Ongoing maintenance costs have been derived from *The cost of revegetation* (Schirmer and Field 2000), with GSC labour and plant hire rates incorporated into this. **Table 7** provides the anticipated maintenance costs for revegetation of the Reconstruction.

Table 7 – Anticipated annual maintenance costs

Item	Volume	Unit Cost	Total Cost
Monitoring (2 hours, 12 times per annum)	24hrs	\$60 per hour	\$1,440.00
Refill/infill planting*	n/a	10% of original cost	\$500
Watering (6 hours, 2 times per month, 3 months per annum)	36hrs	\$85 per hour	\$3,060.00
Mowing (16 hours, 6 times per annum)	96hrs	\$135 per hour	\$12,960.00
Total Annual Maintenance Cost			\$17,960.00

* Refill/infill planting costs will decrease over time and only apply to trees. Figures are exclusive of corporate recharge costs.

7 References

- Constructive Solutions 2012, Blackjack Creek Riparian Corridor/Channel Reconstruction Concept Design and Feasibility Study.
- Constructive Solutions 2012, Blackjack Creek Riparian Corridor/Channel Reconstruction Detailed Design.
- Land and Property Information 2012, SIX Maps. Retrieved from <http://maps.six.nsw.gov.au/>
- Namoi Catchment Management Authority 2012, Native Plants for Creeks and Rivers in the Namoi.
- NSW Office of Water 2012, Guidelines for riparian corridors on waterfront land.
- NSW Office of Water 2012, Guidelines for vegetation management plans on waterfront land.
- Schirmer, J. and Field, J. 2000, The cost of revegetation. Prepared by ANU Forestry, FORTECH and the Natural Heritage Trust.
- Spraygrass 2009, Hydromulching. Retrieved from <http://www.spraygrass.com.au/hydromulching.html>
- The Australian Plants Society NSW 2010, The Long-stem planting guide. Prepared in conjunction with Gosford City Council and the NSW Environmental Trust.
- Water Management Act 2000.
- Water Management (General) Regulation 2011.

Appendix 1: NOW VMP Guidelines

CONTROLLED ACTIVITIES ON WATERFRONT LAND

Guidelines for vegetation management plans on waterfront land

Controlled activities carried out in, on or under waterfront land are regulated by the *Water Management Act 2000* (WM Act). The NSW Office of Water administers the WM Act and is required to assess the impact of any proposed controlled activity to ensure that no more than minimal harm will be done to waterfront land.

Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40 metres of the highest bank of the river, lake or estuary.

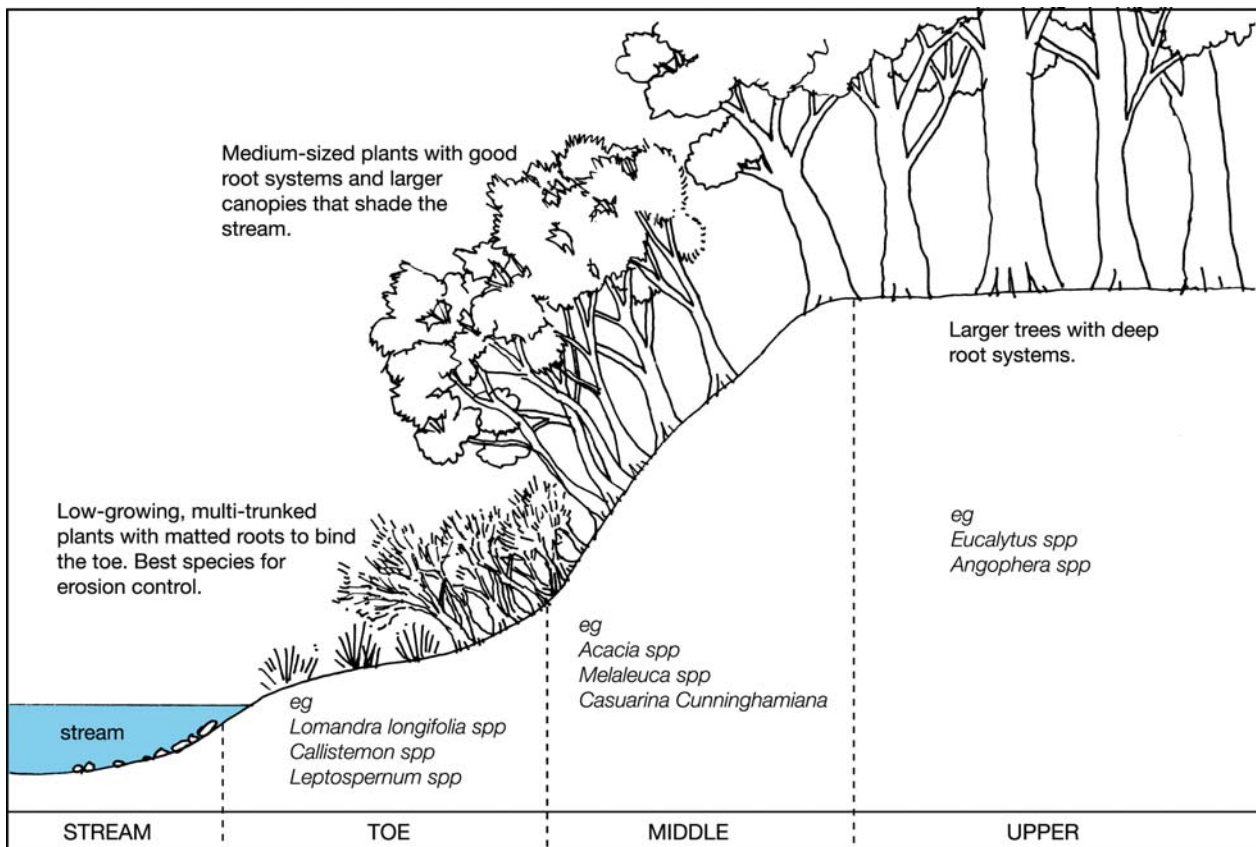
This means that a controlled activity approval must be obtained from the NSW Office of Water before commencing the controlled activity.

Why is a vegetation plan required?

When a proposed controlled activity disturbs or substantially modifies the riparian corridor, its restoration or rehabilitation will be a requirement of the controlled activity approval. A vegetation management plan (VMP) details how the restoration or rehabilitation will be carried out.

The main objective of a VMP is to provide a stable watercourse and riparian corridor which will emulate local native vegetation communities.

Figure 1. Typical riparian cross section - Adapted from Rivercare: Guidelines for Ecological Sustainable Management of Rivers and Riparian Vegetation: Raine, A.W & Gardiner, J.N, (1995), Land and Water Resources Research and Development Corporation, Canberra.



How should a vegetation management plan be prepared?

A VMP should be prepared by a suitably qualified person and should clearly address the following criteria.

- An appropriate width for the riparian corridor should be identified by consulting either the development consent, the relevant environmental planning instrument or the NSW Office of Water guidelines for riparian corridors. The VMP should consider the full width of the riparian corridor and its functions including accommodating fully structured native vegetation.
- Maps or diagrams which clearly identify the riparian corridor; the existing vegetation; the vegetation to be retained; the vegetation to be cleared; the footprint of construction activities; and areas of proposed revegetation etc. should be prepared.
- The location of the bed and banks or foreshore of waterfront land and the footprint of the riparian corridor should be clearly identified. Vegetated riparian zones must be indicated.
- Photographs of the site should be supplied and photo points should be identified. To assist with future monitoring and reporting requirements, the photo points should be identified by GPS coordinates or by survey. This is particularly important for large scale earthworks or extractive industries.
- Measures for controlling long term access and encroachments (bollards, fences, etc.) into the riparian corridor should be identified.
- Vegetation species composition, planting layout and densities should be identified. The required mix of plant species relates to the actual community to be emulated and the size of the area or areas to be rehabilitated but mature vegetation communities are generally well structured, comprising trees, shrubs and groundcovers species. Planting densities should achieve quick vegetative cover and root mass to maximise bed and bank stability along the subject watercourse.
- Costs associated with high density planting will be recovered through reduced maintenance costs for weeding or replacement planting in the maintenance period specified in the controlled activity approval (CAA).
- Seed or plant sources should be identified. Where possible, native plants and seed sources of local provenance should be used.
- Exotic vegetation should be avoided. The use of exotic species for temporary soil stabilisation is permitted provided they are sterile, non-invasive and easily eradicated when permanent vegetation is established.
- Details of the planting program, rehabilitation methods and staging should be provided. Techniques such as hydro-seeding, direct seeding, brush matting or assisted natural regeneration may be considered.
- Maintenance requirements should extend for a minimum of two years after the completion of works or until such time as a minimum 80 per cent survival rate of each species planted and a maximum 5 per cent weed cover for the treated riparian corridor controlled activity is achieved.
- Project tasks should be defined and described, including a schedule detailing the sequence and duration of works necessary for the implementation of the VMP.
- Costings for the implementation of all components and stages of the work including materials, labour, watering, maintenance which includes plant replacement, monitoring and reporting should be prepared.
- Processes for monitoring and review, including a method of performance evaluation should be identified. This should include replacing plant losses, addressing deficiencies, problems, climatic conditions and successful completion of works.
- Regular reporting on the implementation and status of works covering progress, success or failures and completion should be provided. The number and duration of reporting periods will be identified in the CAA. Works as executed plans and reports detailing how the components of the VMP have been implemented will be required prior to the release of any security held by the NSW Office of Water.
- Security such as bank guarantees may be required before a controlled activity involving the implementation of a VMP is commenced. The amount of security is usually based on the costings provided.

Where do I go for additional information?

Find out more about controlled activities at the Office of Water website www.water.nsw.gov.au.

Contact us

Contact a water regulatory officer as listed on the Office of Water website www.water.nsw.gov.au, free call the licensing information on 1800 353 104 or email information@water.nsw.gov.au.

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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (June 2012). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of the Department of Primary Industries or the user's independent adviser.

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Appendix 2: Approval Notice



Australian Government
Department of the Environment

Approval

Blackjack Creek, riparian corridor and channel reconstruction, Gunnedah, NSW (2013/6732).

This decision is made under sections 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999*.

Proposed action

person to whom the approval is granted

Gunnedah Council

proponent's ABN

ABN 80 183 655 793

proposed action

To dredge, widen and realign a 2km section of the Blackjack Creek Gunnedah as described in the referral documentation received by the department for this proposal on 25 January 2013 (EPBC Act referral 2013/6732).

DECISION to approve:

Approval decision

Controlling Provision	Decision
Listed threatened species and communities (ss 18, 18A)	Approve

conditions of approval

This approval is subject to the conditions specified below.

expiry date of approval

This approval has effect until 31 December 2023

Decision-maker

name and position

Mahani Taylor
Acting Assistant Secretary
South-Eastern Australia Environment Assessments

Signature

date of decision

22 November 2013

Conditions of Approval:

1. The person taking the action must not remove more than 37 koala habitat trees as part of taking this action.
2. To assist in mitigating the impacts of the proposal on the koala and koala habitat, the person taking the action must prepare and submit a Vegetation Management Plan (VMP) for the Minister's written approval prior to commencement of the action. The VMP must include:
 - a. Management actions designed to rehabilitate lands disturbed by the action and improve its habitat value to koalas. This must include all lands identified in the map at Schedule 1 of this notice as "Vegetated Riparian Zone".
 - b. Management actions designed to improve the koala habitat value, including area and quality, of offset areas identified in the map at Schedule 1 of this notice as "7.29ha Offset in Unvegetated portion of Wandobah Reserve". Including:
 - i. Planting of indigenous koala feed trees using locally sourced seed.
 - ii. Evidence that the proposed management actions to improve koala habitat are effective at improving koala habitat quality and area.
 - iii. A schedule of koala habitat restoration that compensates for the lag time between planting of trees and those trees having value as koala habitat.
 - c. An ecological monitoring program to monitor the success of the management actions in the VMP and define measurable targets of management actions, performance indicators, and an adaptive management framework for the duration of the action's impact on koala habitat.

The action must not commence until the VMP is approved by the Minister. The approved VMP must be implemented.

3. To ensure the long term viability of the offset and mitigation measures the person proposing the action must prepare and submit a Management Plan for the whole of Wandobah Reserve for the Minister's written approval prior to commencement of the action. The Wandobah Reserve Management Plan must include:
 - a. Management actions designed to improve the value of the reserve for koala habitat, including:
 - i. Management of unauthorised access to and use of the reserve
 - ii. Management of koala predators that may access the reserve
 - b. An ongoing ecological monitoring program to monitor the success of the management actions in the Wandobah Reserve Management Plan and define measurable targets of management actions, performance indicators, and an adaptive management framework for the duration of the action's impact on koala habitat.

The action must not commence until the Wandobah Reserve Management Plan is approved by the Minister. The approved Wandobah Reserve Management Plan must be implemented, reviewed annually and made available on the website of the person proposing the action for the duration of the impact on koala habitat.

4. Prior to the commencement of the action the person taking the action must provide evidence to the Department of:
 - a. The land tenure of Wandobah Reserve including the legal mechanisms that ensure council are able to manage the site as an offset area for in perpetuity of the proposal on koala habitat.
 - b. Offset attributes, shapefiles and textual descriptions and maps to clearly define the location and boundaries of Wandobah Reserve.
5. Within 30 days after the commencement of the action, the person taking the action must advise the Department in writing of the actual date of commencement.
6. The person taking the action must maintain accurate records substantiating all activities associated with or relevant to these conditions of approval, including measures taken to implement the management plans described in conditions 2 and 3, and make them available upon request to the Department. Such records may be subject to audit by the Department or an independent auditor in accordance with section 458 of the EPBC Act, or used to verify compliance with the conditions of approval. Summaries of audits will be posted on the Department's website. The results of audits may also be publicised through the general media.
7. Within three months of every 12 month anniversary of the commencement of the action, the person taking the action must publish a report on their website addressing compliance with each of the conditions of this approval, including implementation of the management plans described in conditions 2 and 3. Documentary evidence providing proof of the date of publication must be provided to the Department at the same time as the compliance report is published. Non-compliance with any of the conditions of this approval must be reported to the Department within 2 business days of becoming aware of the non-compliance.
8. Upon the direction of the Minister, the person taking the action must ensure that an independent audit of compliance with the conditions of approval is conducted and a report submitted to the Minister. The independent auditor must be approved by the Minister prior to the commencement of the audit. Audit criteria must be agreed to by the Minister and the audit report must address the criteria to the satisfaction of the Minister.
9. If the person taking the action wishes to carry out any activity otherwise than in accordance with the management plans described in conditions 2 and 3, the person taking the action must submit to the Department for the Minister's written approval revised versions of those plans. The varied activity shall not commence until the Minister has approved the varied management plans in writing. The Minister will not approve a varied management plan unless the revised plan would result in an equivalent or improved environmental outcome over time. If the Minister approves the revised management plan, that management plan must be implemented in place of the management plan originally approved.
10. If the Minister believes that it is necessary or convenient for the better protection of listed threatened species and ecological communities to do so, the Minister may request that the person taking the action make specified revisions to management plans described in conditions 2 and 3 and submit the revised plans for the Minister's written approval. The person taking the action must comply with any such request. The revised approved plans must be implemented. Unless the Minister has approved the revised plans then the person taking the action must continue to implement the plans originally approved.

11. If, at any time after 5 years from the date of this approval, the person taking the action has not substantially commenced the action, then the person taking the action must not substantially commence the action without the written agreement of the Minister.
12. Unless otherwise agreed to in writing by the Minister, the person taking the action must publish the management plans described in conditions 2 and 3 on their website. The plans must be published on the website within 1 month of being approved.

Definitions

- a) Department, the Australian Government Department administering the *Environment Protection and Biodiversity Conservation Act 1999*.
- b) Commencement, the earthworks, vegetation removal or construction of any infrastructure, associated with the proposed action.
- c) Koala habitat tree/s, are tree species that are used by koalas for food or shelter. Tree species used by koalas vary spatially and temporally and trees that can be considered koala habitat trees are often highly specific to the local area.
- d) Minister, the Minister administering the *Environment Protection and Biodiversity Conservation Act 1999* and includes a delegate of the Minister.
- e) Offset attributes, mean an '.xls' file capturing relevant attributes of the Offset Area, including the EPBC reference ID number, the physical address of the offset site, coordinates of the boundary points in decimal degrees, the EPBC protected matters that the offset compensates for, any additional EPBC protected matters that are benefiting from the offset, and the size of the offset in hectares.
- f) Shapefiles, means an ESRI Shapefile containing '.shp', '.shx' and '.dbf' files and other files capturing attributes of the Offset Area, including the shape, EPBC reference ID number and EPBC protected matters present at the relevant site. Attributes should also be captured in '.xls' format.

Appendix 3: Site Photographs

Blackjack Creek Riparian Corridor/Channel Reconstruction – Photos and Coordinates



Figure 1 – 'Balmoral' looking north. Coordinates -30.991591 150.230782



Figure 2 – 'Balmoral' looking south. Coordinates -30.990991 150.230179



Figure 3 – Wandobah Reserve looking north. Coordinates -30.979584 150.241286

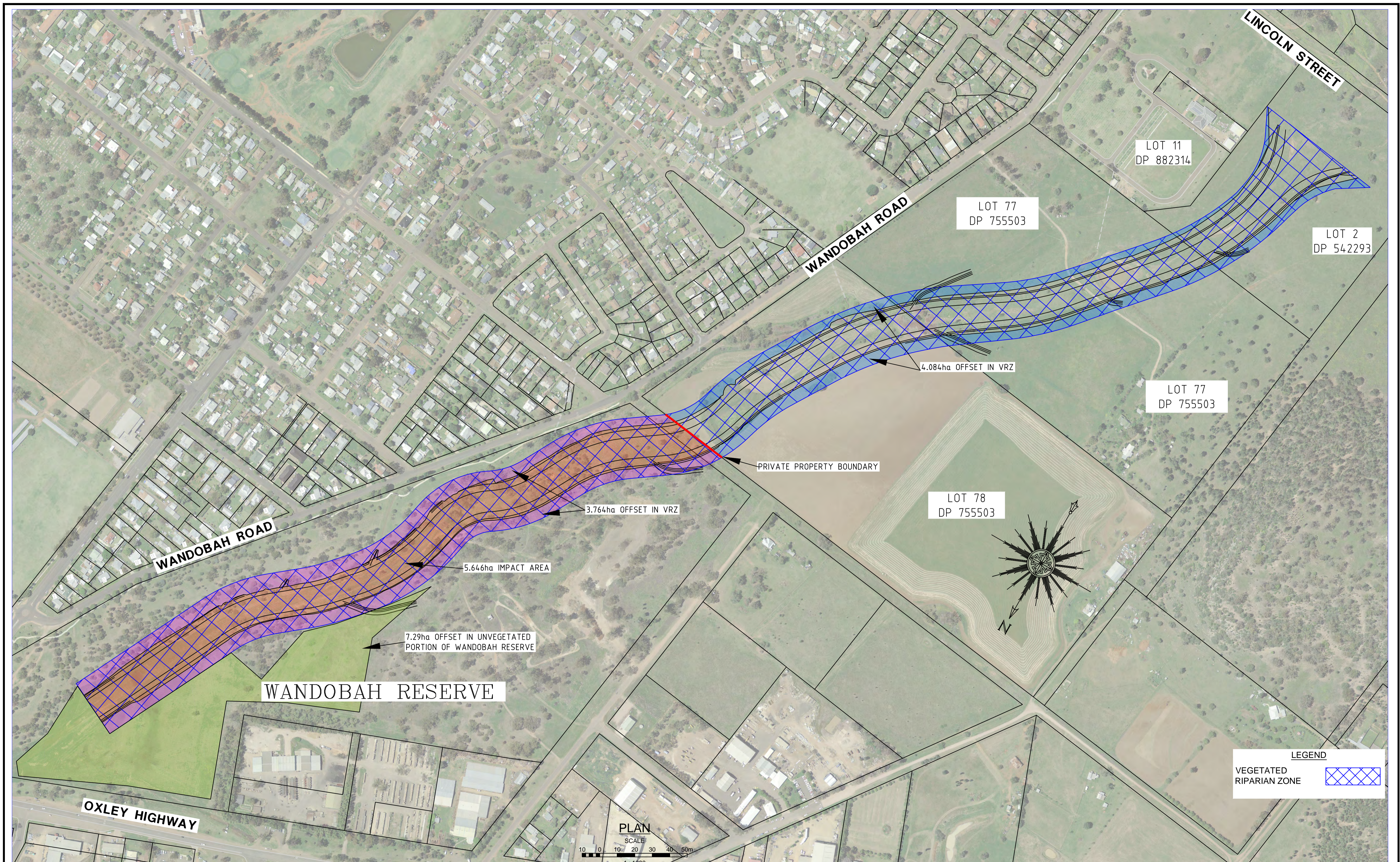


Figure 4 – Wandobah Reserve looking south. Coordinates -30.980736 150.240330



Figure 5 – Wandobah Reserve looking south. Coordinates -30.983114 150.238288

Appendix 4: Offset Areas Map



REV.	DATE	BY	DESCRIPTION	CHK.
A	03.12.2012	DB	ISSUED FOR REVIEW	--

**VEGETATED RIPARIAN ZONE EXTENTS PLAN
- BLACKJACK CREEK**

Client: **GUNNEDAH SHIRE COUNCIL**

**BLACKJACK CREEK RIPARIAN CORRIDOR &
CHANNEL RECONSTRUCTION**

Design Completed: 03.12.2012 Designed: DB Status: **PRELIMINARY**

CONSTRUCTIVE SOLUTIONS PTY. LTD.
 PO Box 1498 Tamworth NSW 2340 Australia
 Tel: (02) 6762 1969 Fax: (02) 6762 1969
 Email: admin@constructivesolutions.com.au
 www.constructivesolutions.com.au

Plan Size: **A1** Drawing No: **201201-035**

Appendix 5: Planting List

**Blackjack Creek Riparian Corridor/Channel Reconstruction
Native Species Recorded in Wandobah Reserve**

Family	Common Name	Scientific Name
Casuarinaceae	River Oak	<i>Casuarina cunninghamiana subsp. cunninghamiana</i>
Cupressaceae	White Cypress Pine	<i>Callitrus glaucophylla</i>
Fabaceae (Mimosoideae)	Green Wattle	<i>Acacia deanei</i>
Fabaceae (Mimosoideae)	Cooba	<i>Acacia salicina</i>
Fabaceae (Mimosoideae)	Golden Wreath Wattle	<i>Acacia saligna</i>
Fabaceae (Mimosoideae)		<i>Acacia sp.</i>
Fabaceae (Mimosoideae)	River Cooba	<i>Acacia stenophylla</i>
Myrtaceae	White Box	<i>Eucalyptus albens</i>
Myrtaceae	Blakely's Red Gum	<i>Eucalyptus blakelyi</i>
Myrtaceae	Yellow Box	<i>Eucalyptus melliodora</i>
Myrtaceae	Bimble Box	<i>Eucalyptus populnea subsp. bimbil</i>
Poaceae	Purple Wiregrass	<i>Aristida personata</i>
Poaceae	Plains Grass	<i>Austrostipa aristiglumis</i>
Poaceae	Speargrass	<i>Austrostipa scabra</i>
Poaceae	Slender Bamboo Grass	<i>Austrostipa verticillata</i>
Poaceae	Red Grass	<i>Bothriochloa macra</i>
Poaceae	Sand Brome	<i>Bromus arenarius</i>
Poaceae	Rhodes Grass	<i>Chloris gayana</i>
Poaceae	Windmill Grass	<i>Chloris truncata</i>
Poaceae	Tall Chloris	<i>Chloris ventricosa</i>
Poaceae	Common Couch	<i>Cynodon dactylon</i>
Poaceae	Queensland Bluegrass	<i>Dichanthium sericeum</i>
Poaceae		<i>Eragrostis sp.</i>
Sapindaceae	Western Rosewood	<i>Alectryon oleifolius</i>

Appendix 6: Monitoring and Maintenance Checklists

**Blackjack Creek Riparian Corridor/Channel Reconstruction
Post-Construction Revegetation Monitoring and Maintenance Checklist**

Issue	Yes	No	Notes/Remedial Action
Soil moisture			
Has watering occurred fortnightly for up to 12 months, or until plants are established? If not, detail why (e.g. heavy rainfall).			
Has regular monitoring of climatic conditions occurred, with watering of revegetation as necessary (e.g. during drought)? Details of watering events (date and volume) must be provided.			
Plants			
Has plant damage occurred as a result of drought, bushfire, severe storm flood, or vandalism? If so, have plants been monitored monthly to ensure recovery or has replacement planting occurred? Details of monthly monitoring (e.g. plant locations and notes on health) and replacement planting must be provided.			
Mowing and Pruning			
Has all mowing been undertaken only for grasses above 10cm and mowing debris prevented from suffocating emerging/establishing plants? If not, detail why (e.g. variable terrain resulting in variable mow heights).			
Has any pruning of vegetation to maintain clearance from infrastructure (e.g. electricity lines)			
been undertaken carefully so as not to damage the functionality of the vegetation? If not, detail why (e.g. Essential Energy undertook pruning without notifying GSC).			
Have all large branches resulting from pruning and any rubbish encountered during mowing been prevented from entering the waterway where possible?			

Name: Position:

Signed: Date:

Blackjack Creek Riparian Corridor/Channel Reconstruction Construction Revegetation Monitoring and Maintenance Checklist

Issue	Yes	No	Notes/Remedial Action
<p>Is the supply of plants for revegetation secured?</p> <p>If not, have additional sources been identified?</p>			
<p>Are all staff and contractors adequately qualified?</p> <p>Copies of staff and contractor qualifications must be held on record at the GSC offices.</p>			
<p>Has the site been prepared for revegetation in accordance with the provisions of the EMP and ESCP (e.g. surface roughness to facilitate vegetation establishment)?</p> <p>If not, detail how remedial actions will be undertaken to ensure compliance with the EMP and ESCP.</p>			
<p>Has revegetation occurred in accordance with the VMP?</p> <p>If not, detail remedial actions will be undertaken to ensure compliance with the VMP (e.g. planting of additional trees of a particular species to replace unavailable species).</p>			
<p>Has watering been undertaken weekly?</p> <p>If not, detail why (e.g. heavy rainfall).</p>			
<p>Have remedial actions from previous inspection been undertaken?</p>			

Name: _____ Position: _____

Signed: _____ Date: _____

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