Seven Part Test of Significance for Square-stemmed spike-rush (*Eleocharis tetraquetra*)

Background Information

The Scientific Committee, established by the *Threatened Species Conservation Act 1995 (TSC Act),* has made a Final Determination to list Square-stemmed spike-rush (*Eleocharis tetraquetra*) as Endangered in Part 1 of Schedule 1 of the Act.

Square-stemmed spike-rush is a tufted herbaceous perennial that is distinguished by its slender, four-angled stem and broad spikelet on top of the stem. The stems, which arise from a short rhizome, grow 30 – 100 cm tall and are approximately 1 – 1.5 mm in diameter. The leaves are at the base of the stem and are not very conspicuous, being reduced to tubular sheaths. The spikelet is ellipsoid to ovoid, 10 – 20mm long and 3.5 – 5mm in diameter. The seeds are contained within the spikelet and are a shining yellowish or brown nut, approximately 1.5 mm long and 1 mm wide and are crowned by the persistent style base.

Square-stemmed spike-rush is found in damp locations at the edges of streams and in and on the margins of freshwater swamps, at about the level of the wet season water table. The NSW Threatened Species website indicates that in the Northern Rivers Region essential habitat for the species is identified as wet sclerophyll forests, dry sclerophyll forests, grassy woodlands and forested wetlands.

Square-stemmed spike-rush is currently at threat from:

- clearing of habitat for development and agriculture;
- invasion of habitat by weeds and pasture grasses;
- changes to the natural disturbance patterns such as grazing, fire and flooding; and
- degradation of habitat through intensive grazing by stock.

Square-stemmed spike-rush was recorded in relatively low densities (<5% cover) within a small area of the highly degraded wetland located in the central portion of the project site. The area of potential habitat for Square-stemmed spike-rush on the site is estimated to be approximately 8.5ha. The proposal will necessitate the removal of approximately 6.7ha (or 78%) of this habitat, with the remaining 1.8ha (or 22%) being retained within the Conservation Zone/Green Space network.

In order to compensate for the displacement of Square-stemmed spike-rush within site, a detailed Management Strategy will be prepared that specifically addresses the management and enhancement of populations of Square-stemmed spike-rush that will be retained within the development layout. This Management Strategy will be of a similar form and nature to the existing Hairy Joint Grass Management Strategy (HJG MS) prepared by Cardno (QLD) Pty Ltd and will provide measures that contribute to a number of Priority Actions for the recovery of Square-stemmed spike-rush as identified by DECC. The preparation of this Management Strategy similar to the existing HJG MS is considered to be an appropriate mitigation measure given that:

- Hairy joint grass (*Arthraxon hispidus*) and Square-stemmed spike-rush have similar life-cycles where the vegetative part of the plants (i.e. stems or culms) emerge, flower and fruit within one year and then die-off;
- Square-stemmed spike-rush was found growing sympatrically with Hairy joint grass and both species are reported to occur in damp situations; and
- Hairy joint grass and Square-stemmed spike-rush share a number of Priority Actions identified by DECC as being essential to their recovery.

In addition to on-site retention of wetland habitat, two adjoining off-site reserves currently owned by Council have, in consultation with Council, also been included within the Conservation Zone network. These reserves have a dual function in increasing the linkage value of the entire Conservation Zone network, as well as providing offsets for the loss of habitat within the site. These reserves will provide opportunities to reinstate a range of Endangered Ecological Communities in the locality as well as providing habitat for a number of threatened flora species, including Square-stemmed spike-rush known to occur within the site.

Seven Part Test of Significance

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The proposal will necessitate the permanent displacement of approximately 6.7ha of degraded wetland within which low abundances of Square-stemmed spike-rush have been recorded. The current management regime (i.e. livestock grazing) does not offer any assurance that the viability of Square-stemmed spike-rush populations within the project site will be sustained in the long-term.

While it is recognised that the *in situ* extent of Square-stemmed spike-rush habitat will be considerably reduced by the proposed development of the site, a main focus of the Management Strategy will be the translocation of individuals from the disturbance footprint into similar habitat that will be retained within the Conservation Zone and within the proposed off-site reserves. Translocation of Square-stemmed spike-rush will coincide with the dormant phase of the life-cycle when disturbance to the root system will have the least impact on the growth and survival of individuals. The expected success of this translocation program is bolstered by experimental work conducted on the species by Bell *et al* (2000), which indicates that plants are relatively resilient to disturbance events and can be translocated and grown in pots with a high survival rate.

The survival of Square-stemmed spike-rush populations within the on-site Conservation Zone network and off-site reserves will also be enhanced through:

- the removal of cattle from the site, which are currently a source of degradation and disturbance within areas of Square-stemmed spike-rush habitat;
- the removal and control of weed populations;
- extensive rehabilitation and revegetation works; and
- implementation of management regimes that are aimed at threatened species survival and biodiversity enhancement.

In conclusion, while the proposal will result in the displacement of Square-stemmed spike-rush, appropriate mitigation measures will be implemented to ensure that individuals are retained within suitable habitat and are able to complete their life-cycle such that populations become self-sustaining. Implementation of an active management regime aimed at retaining and enhancing populations within suitable habitat within and adjacent to the site offers more security to the long-term survival of populations in the Lennox Head locality than the existing land use and management regime (i.e. livestock grazing).

The proposal will not result in a viable local population of Square-stemmed spike-rush becoming extinct.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

No consideration under this part of the assessment is required.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No consideration under this part of the assessment is required.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

As previously established the proposal will necessitate the permanent displacement of approximately 6.7ha or 78% of Square-stemmed spike-rush habitat within the project site. When assessing the magnitude of the impact the removal of 6.7ha of habitat will have, the following must be taken into consideration.

1. Wetland vegetation within the site is currently in a highly degraded state owing to livestock grazing and weed invasion.
2. Square-stemmed spike-rush was recorded in very low densities (<5% cover) within areas of degraded wetland.
3. The current land use does not provide any certainty for the long-term survival of Square-stemmed spike-rush within the site.
4. Compensation for the displacement of degraded wetland habitat will be provided through:
    i) the implementation of a detailed Management Strategy that is focussed on the enhancement and management of retained Square-stemmed spike-rush populations; and
    ii) extensive revegetation and rehabilitation works within on-site and off-site reserves that will reinstate degraded elements of Square-stemmed spike-rush habitat.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Square-stemmed spike-rush was found in low abundances within the highly degraded wetland vegetation in the central portion of the site. At present this wetland vegetation links to surrounding native vegetation (i.e. SEPP 14 wetland to the west of the site) via the maintained grassland associated with the water quality control pond on only one compass quarter. As such, this community currently has low connectivity values.

It is also relevant to note the site's Square-stemmed spike-rush populations do not contribute or adjoin any of the currently known populations of this species (i.e. Boambee, Fortis Creek, Copmanhurst and Murwillumbah populations).

Areas designated as Conservation Zone/Green Space included within the proposed development have been specifically designed to enhance connectivity between wetland habitats within the site to the Ballina Nature Reserve and the proposed off-site reserve areas which will also function as offsets for the displacement of habitat within the site. The combined effect of these measures will be to promote the:

- long-term viability of threatened species populations that occur within the site locality; and
- the conservation value of the degraded freshwater wetlands within which the Square-stemmed spike-rush has been recorded.

With consideration to the above, the proposed will not result in the further fragmentation or isolation of Square-stemmed spike-rush within the Lennox Head locality.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

As previously discussed in (i) and (ii) above, the wetland habitat within the site that supports low abundances of Square-stemmed spike-rush is currently in a highly degraded state and has relatively low connectivity values. The proposal will not have a significant impact on the long-term survival of Square-stemmed spike-rush in locality given:

- similar representations of this community are relatively widespread throughout the locality and are not exclusive to the site alone;
- the proposal provides the retention of approximately 1.8ha (or 22%) of wetland within the Conservation Zone/Green Space network; and

- extensive revegetation and rehabilitation works will be undertaken within the on-site Conservation Zones and areas identified as suitable off-site reserves to re-instate the floristic and structural elements of freshwater wetlands with particular emphasis on the provision of habitat for Square-stemmed spike-rush.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly of indirectly),

No areas of critical habitat are listed pursuant to the *TSC Act* as occurring within the site.

Furthermore, the site does not encompass any areas that could, by any objective measure, be considered critical habitat for Square-stemmed spike-rush.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

The overall objective of the Recovery Plan prepared for Square-stemmed spike-rush by the New South Wales National Parks and Wildlife Service (NPWS) is to maintain viable populations of Square-stemmed spike-rush in the long term.

The Management Strategy that will be prepared for Square-stemmed spike-rush will be consistent with the overall objective of the recovery plan prepared for Square-stemmed spike-rush as:

- a representative and sustainable proportion of the site's degraded Square-stemmed spike-rush habitat will be preserved and enhanced within the Conservation Zone/Green Space network;
- connectivity between retained wetland within the development layout and surrounding areas will be provided through the Conservation Zone/Green Space network;
- where environmentally sensitive areas are not included within the Conservation Zone/Green Space network, appropriate offsets shall be provided in the form of on-site compensatory habitat and off-site reserves;
- areas included within the Conservation Zone/Green Space network and off-site reserves will be rehabilitated and managed in a manner that re-instates the ecological values and functions of the degraded habitat and ensures the long-term viability of Square-stemmed spike-rush in the locality; and
- human induced threats (i.e. stock, weed incursion, inappropriate mowing regimes and etc) will be removed or suitably managed.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A threatening process is identified under the *TSC Act* as a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or communities. The current list of key threatening processes under the *TSC Act*, and whether the proposed development is recognised as a threatening process is shown below.

Listed Key Threatening Process (as described in the final determination of the Scientific Committee to list the threatening process)	Is the development or activity proposed of a class of development or activity that is recognised as a threatening process?		
	Likely	Possible	Unlikely
Invasion and establishment of exotic vines and scramblers			√
Invasion of native plant communities by bitou bush & boneseed			√
Invasion of native plant communities by exotic perennial grasses			√
Invasion, establishment and spread of Lantana camara			√
Competition and grazing by the feral European rabbit			√
Competition and habitat degradation by feral goats			√
Competition from feral honeybees			√
Herbivory and environmental degradation caused by feral deer			√
Importation of red imported fire ants into NSW			√
Introduction of the large earth bumblebee (*Bombus terrestris*)			√
Invasion and establishment of the Cane Toad			√
Invasion of the yellow crazy ant (*Anoplolepis gracilipes*)			√
Predation by feral cats			√
Predation by the European Red Fox			√
Predation by the Plague Minnow (*Gambusia holbrooki*)			√
Predation by the ship rat (*Rattus rattus*) on Lord Howe Island			√
Predation, habitat degradation, competition and disease transmission by Feral Pigs (*Sus scrofa*)			√
Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands.		√	
Bushrock Removal			√
Clearing of native vegetation	√		
Alteration of habitat following subsidence due to longwall mining			√
Ecological consequences of high frequency fires			√
Human-caused Climate Change			√
Loss and/or degradation of sites used for hill-topping by butterflies			√
Loss of Hollow-bearing Trees - key threatening process			√
Removal of dead wood and dead trees			√
Infection by Psittacine circoviral (beak & feather) disease affecting endangered psittacine species			√
Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis			√
Infection of native plants by *Phytophthora cinnamomi*			√
Death or injury to marine species following capture in shark control programs on ocean beaches			√
Entanglement in, or ingestion of anthropogenic debris in marine and estuarine environments			√

With regard to the above, 'clearing of native vegetation' is a threatening process listed under the *TSC Act*. Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss, or long term modification of the structure, composition and ecological function of a stand or stands. The proposal will necessitate the clearance of

approximately 6.7ha (78%) of degraded wetland vegetation, which currently supports patches of Square-stemmed spike-rush at very low densities (i.e. less than 5% cover). The clearance of this vegetation will be compensated for by:

- on-site retention and enhancement of 1.8ha (or 22%) of retained wetland vegetation within the Conservation Zone network; and
- the establishment of off-site reserves that have a dual function in increasing the connectivity values of the entire Conservation Zone/Green Space network, as well as providing offsets for the displacement of Square-stemmed spike-rush habitat within the site.

'Alteration to natural flow regimes' can occur through reducing or increasing flows, altering seasonality of flows, changing the frequency, duration, magnitude, timing, predictability and variability of flow events, altering surface and subsurface water levels and changing the rate of rise or fall of water levels (DEC 2004).

The hydrology of wetland habitat retained within the development layout area will not be significantly altered from the existing situation. Any changes will involve increased short term flood depths upstream of the two proposed constructed weirs and slightly increased flood flow velocities over these weirs in some storm events. These weirs will only function during storm events, causing water to be stored at a greater depth than is currently the case. Water flow velocities remain largely unchanged because weirs have low flow bypasses to mimic existing stream flow outside of storm events. During flood events, the detention effects provide the same peak flow discharges as the existing situation at slightly increased velocities. Therefore, the impact on retained wetland is that there will be a greater depth of water in the area during a storm event. It is not envisaged that an increase in the depth of water during a storm event will have an adverse impact on retained populations of Square-stemmed spike-rush

Conclusion

Given the above facts and circumstances, the proposed development will not have a significant impact on the ongoing viability of Square-stemmed spike-rush in the locality as:

- 22% of the potential Square-stemmed spike-rush habitat located on the site will be retained and rehabilitated with the Conservation Zone/Green Space network;
- appropriate off-site reserves have been identified and negotiations are in place to secure this land biodiversity conservation purposes;
- proposed on-site mitigation measures will enhance retained populations within the development layout;
- the proposed Conservation Zone/Green Space network will provide connectivity between the known Square-stemmed spike-rush population within the site and areas of suitable habitat within and adjacent to the site; and
- contributions will be made through the implementation of a Square-stemmed spike-rush Management Strategy, to a number of the Priority Actions identified by DECC for the recovery of Square-stemmed spike-rush.

References

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New South Wales National Parks and Wildlife Service (2004). *Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands - key threatening process listing*
http://www.environment.nsw.gov.au/threatenedspecies/AlterationNaturalFlowKTPListing.htm

New South Wales National Parks and Wildlife Service (1999). *Square-stemmed spike-rush Eleocharis tetraquetra Nees – Approved Recovery Plan.*
http://www2.nationalparks.nsw.gov.au/PDFs/Eleoch.pdf

Seven Part Test of Significance for *Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*

Background Information

The Scientific Committee, established by the *Threatened Species Conservation Act 1995* (*TSC Act*), has made a Final Determination to list *Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions* as an Endangered Ecological Community in Part 3 of Schedule 1 of the Act.

Freshwater Wetlands on Coastal Floodplains Endangered Ecological Community (FWCF EEC) are associated with coastal areas subject to periodic flooding and in which standing fresh water persists for at least part of the year in most years. FWCF EEC typically occurs on silts, muds or humic loams in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes but may also occur in backbarrier landforms where floodplains adjoin coastal sandplains. Representations of FWCF EEC generally occur below 20 m elevation on level areas and are dominated by herbaceous plants and have very few woody species. The structure and composition of the community varies both spatially and temporally depending on the water regime. Structure and species can also be altered by grazing history, changes to drainage regime, soil salinity and catchment run off, and often disturbed areas of FWCF EECs support a substantial proportion of exotic flora species.

FWCF EEC is identified as being at threat from:

- Land clearing
- Continuing fragmentation and degradation
- Flood mitigation and drainage works
- Filling associated with urban and industrial development
- Pollution and eutrophication from urban and agricultural runoff
- Weed invasion
- Overgrazing, trampling by livestock
- Soil disturbance by pigs
- Activation of acid sulfate soils
- Dumping of landfill, rubbish and garden refuse
- Native fauna is threatened by predation, particularly by mosquito fish and cane toads
- Anthropogenic climate change

The project site supports approximately 4.2ha of vegetation that is considered to support elements of FWCF EEC. At present, areas of FWCF EEC within the site are in a highly degraded state owing to a history of livestock grazing and on-going weed invasion. Nonetheless, two threatened flora species were recorded within areas identified as supporting FWCF EEC, namely Hairy Joint Grass (*Arthraxon hispidus*) and Square-stemmed spike rush (*Eleocharis tetraquetra*)[1]. The current management regime for the site (i.e. livestock production) does not afford any protection for areas of FWCF EEC identified within the site and has substantially contributed to the degraded nature of the site's vegetation. While it is recognised that the proposal will necessitate the removal of approximately 2.6ha of FWCF EEC within the site, the remaining 1.4ha (or 33%) will be retained and protected within the Conservation Zone/Green Space network. Additional offsets for the displacement of the site's degraded FWCF EEC are provided through the establishment of two off-site reserve systems, which have also been included within the Conservation Zone network. These reserves have a dual function in increasing the linkage value of the entire Conservation Zone network, as well as providing offsets for the loss of habitat within the site. These reserves will provide opportunities to reinstate a range of Endangered Ecological Communities in the locality as well as providing habitat for a number of threatened flora species known to occur within the site.

[1] Separate Seven Part Tests have been completed for each of these flora species.

Seven Part Test for Significance

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

No consideration under this part of the assessment is required.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

No consideration under this part of the assessment is required.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

The removal of 2.6ha of wetland vegetation within the site identified as supporting elements of FWCF EEC will not place the occurrence of FWCF EEC in the Lennox Head locality at risk of extinction given the following.

1. Areas identified as supporting FWCF EEC within the site are in a highly degraded state and exotic species were found to constitute 46% of the species composition.
2. The site's degraded wetland communities have low connectivity values and only link to surrounding native vegetation (i.e. SEPP 14 wetland to the west) via the maintained grassland associated with the water quality control pond on one compass quarter (refer connectivity estimation methodology provided in Gibbons *et al.* 2005).
3. Visual inspection of aerial photography indicates that similar communities, namely degraded drainage lines and damp depressions in grazed paddocks are widespread throughout the Lennox Head locality.
4. The site's degraded wetlands were not recommended to be zoned for Environmental Protection during a review conducted in 2000 into the adequacy and suitability of the zoning provided in the BLEP (refer Lennox Head Structure Plan 2004).
5. The Environmental Protection Zone review also states that sedgelands and rushland habitats are typically well represented in the existing Environmental Protection Zones (refer Lennox Head Structure Plan 2004).

Given the above facts it is determined that the proposed development will not have an adverse affect on the extent of the ecological community nor adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposal will necessitate the removal of approximately 2.6ha (or 67%) of highly degraded FWCF EEC within the site. Compensation for the loss of this habitat will be provided through:

- the removal of livestock, which are currently a major source of degradation and disturbance within the site's wetland areas
- extensive revegetation and rehabilitation works to be undertaken within on-site Conservation Zones;
- extensive revegetation and rehabilitation works within suitable areas of off-site reserves (refer Conceptual Rehabilitation Plan prepared by Cardno and dated 29th May 2008) to re-instate the floristic and structural elements of freshwater wetlands; and
- implementation of management regimes that are focussed on biodiversity conservation, including the conservation of threatened flora species recorded within the site's wetland vegetation (i.e. Hairy joint grass and Square-stemmed spike rush).

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The FWCF EEC located on the site is highly degraded and currently surrounded by expanses of cleared grassland and existing urban development.

Using the criteria set out by Gibbons et al (2005), the freshwater wetlands within the site are considered to have nil – low connectivity value given:

- the vegetation is in a reasonably low condition (Gibbons et al [2005] consider grasslands where <50% of the vegetation is native to be in low condition); and
- the wetland vegetation links to surrounding native vegetation (i.e. SEPP 14 wetland to the west of the site) via the maintained grassland associated with the water quality control pond on only one compass quarter.

With regard to the above, areas designated as Conservation Zone/Green Space included within the proposed development have been specifically designed to enhance connectivity to the Ballina Nature Reserve and proposed off-site reserve areas that will function as offsets for the removal of FWCF EEC within the site. As such, the proposal will improve the connectivity of wetland vegetation within and adjacent to the site, which is essential to the long-term sustainability of these systems and the threatened flora species that have been recorded within them (i.e. Hairy joint grass and Square-stemmed spike rush).

(ii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

As described in points (i) and (ii) above, areas within the site identified as supporting FWCF EEC are currently in a highly degraded state and have relatively low connectivity value. The proposed plan of development will result in the removal of 2.6ha of this degraded wetland community, but a number of measures and off-sets have been proposed in order to mitigate against this loss of habitat. Of key importance is the:

- rehabilitation and revegetation of this currently degraded vegetation community;
- rehabilitation and revegetation of similar degraded habitat within the off-site reserve; and
- increased connectivity between wetland habitat to be retained within the development layout to the SEPP 14 wetland contained within Ballina Nature Reserve to the west.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly of indirectly),

No areas of critical habitat are listed pursuant to the *TSC Act* as occurring within the site.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

No recovery plan or threat abatement plans are prepared for the FWCF pursuant to the *TSC Act*.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A threatening process is identified under the *TSC Act* as a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or communities. The current list of key threatening processes under the *TSC Act*, and whether the proposed development is recognised as a threatening process is shown below.

Listed Key Threatening Process (as described in the final determination of the Scientific Committee to list the threatening process)	**Is the development or activity proposed of a class of development or activity that is recognised as a threatening process?**		
	Likely	**Possible**	**Unlikely**
Invasion and establishment of exotic vines and scramblers			√
Invasion of native plant communities by bitou bush & boneseed			√
Invasion of native plant communities by exotic perennial grasses			√
Invasion, establishment and spread of Lantana camara			√
Competition and grazing by the feral European rabbit			√
Competition and habitat degradation by feral goats			√
Competition from feral honeybees			√
Herbivory and environmental degradation caused by feral deer			√
Importation of red imported fire ants into NSW			√
Introduction of the large earth bumblebee (*Bombus terrestris*)			√
Invasion and establishment of the Cane Toad			√
Invasion of the yellow crazy ant (*Anoplolepis gracilipes*)			√
Predation by feral cats			√
Predation by the European Red Fox			√
Predation by the Plague Minnow (*Gambusia holbrooki*)			√
Predation by the ship rat (*Rattus rattus*) on Lord Howe Island			√
Predation, habitat degradation, competition and disease transmission by Feral Pigs (*Sus scrofa*)			√
Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands.		√	
Bushrock Removal			√
Clearing of native vegetation	√		
Alteration of habitat following subsidence due to longwall mining			√
Ecological consequences of high frequency fires			√
Human-caused Climate Change			√
Loss and/or degradation of sites used for hill-topping by butterflies			√
Loss of Hollow-bearing Trees - key threatening process			√
Removal of dead wood and dead trees			√
Infection by Psittacine circoviral (beak & feather) disease affecting endangered psittacine species			√
Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis			√
Infection of native plants by *Phytophthora cinnamomi*			√
Death or injury to marine species following capture in shark control programs on ocean beaches			√

Entanglement in, or ingestion of anthropogenic debris in marine and estuarine environments			√

With regard to the above, 'clearing of native vegetation' is a threatening process listed under the *TSC Act*. Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss, or long term modification of the structure, composition and ecological function of a stand or stands. The proposal will necessitate the clearance of approximately 2.6ha (67%) of degraded wetland vegetation, which is only marginally dominated by native plants species (i.e. 46% of species were found to be exotic or introduced). The clearance of this vegetation will be compensated for by:

- on-site retention and enhancement of 1.4 ha (or 33%) of retained wetland vegetation within the Conservation Zone network; and
- the establishment of off-site reserves that have a dual function in increasing the connectivity values of the entire Conservation Zone/Green Space network, as well as providing offsets for the loss of FWCF EEC and other habitat within the site.

'Alteration to natural flow regimes' can occur through reducing or increasing flows, altering seasonality of flows, changing the frequency, duration, magnitude, timing, predictability and variability of flow events, altering surface and subsurface water levels and changing the rate of rise or fall of water levels (DECC 2004).

The hydrology of wetland habitat retained within the development layout area will not be significantly altered from the existing situation. Any changes will involve increased short term flood depths upstream of the two proposed constructed weirs and slightly increased flood flow velocities over these weirs in some storm events. These weirs will only function during storm events, causing water to be stored at a greater depth than is currently the case. Water flow velocities remain largely unchanged because weirs have low flow bypasses to mimic existing stream flow outside of storm events. During flood events, the detention effects provide the same peak flow discharges as the existing situation at slightly increased velocities. Overall, the impact on retained wetland is that there will be a greater depth of water in the area during a storm event. It is not envisaged that an increase in the depth of water during a storm event will have an adverse impact on the retained wetland community.

Conclusion

With regard to the above facts and circumstances, the proposal will result in the clearance of approximately 2.6ha of degraded wetland vegetation considered to support elements of the FWCF EEC. However, the proposal will not have a significant impact on the long-term viability of this EEC in the Lennox Head region given that:

- the FWCF on the site is in a highly degraded state and has low connectivity value;
- similar representations of this community are relatively widespread throughout the locality and are not exclusive to the site alone;
- the proposal provides the retention of approximately 1.4ha (or 33%) of this community within the Conservation Zone/Green Space network;
- extensive revegetation and rehabilitation works will be undertaken within the on-site Conservation Zones and areas identified as suitable off-site reserves to re-instate the floristic and structural elements of freshwater wetlands with particular emphasis on the provision of habitat for Hairy joint grass and Square-stemmed spike rush; and
- active management of FWCF EEC retained within the Conservation Zone network and off-site reserves will provide for the long-term survival of FWCF EEC within and adjacent to the site more so than existing scenario (i.e. exposure to livestock grazing and weed invasion).

References

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