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Mr Stuart Withington
NSW Department of Planning and Infrastructure
GPO Box 39
SYDNEY NSW 2001

File Ref: DPI-11/17689 ELA-11SYDPLA24

28 February 2012

Dear Stuart,

Review of Koala and Threatened Species Management Measures for Stage 1 of the Kings Forest Residential Development

Please find attached a concise review by Eco Logical Australia of relevant documents relating to the management of Koala and other Threatened Species as part of Stage 1 of the Kings Forest Residential Development. Documents that have been reviewed are:

- Project Application Environmental Assessment Report, Kings Forest, Stage 1 and Bulk Earthworks (MP 08_0194) (JBA 2011)
- Stage 1 Project Application Koala Plan of Management (James Warren & Associates, June 2011)
- Threatened Species Management Plan – 3 separate plans covering all precincts (James Warren & Associates, June 2011)
- Feral Animal Management Plan (James Warren & Associates, April 2011)
- Site Based Management Plan (Gilbert & Sutherland, June 2011)
- Other management plans to the extent of their interaction with the above plans including:
    - Groundwater Management Plan (Gilbert & Sutherland, February 2011)
    - Stormwater Management Plan (Gilbert & Sutherland, June 2011)
    - Erosion and Sediment Control Plan (Gilbert & Sutherland, April 2011)
    - Drainage Maintenance Management Plan (Gilbert & Sutherland, June 2011)
    - Buffer Management Plan (James Warren & Associates, June 2011) – 2 separate plans covering all precincts, except precincts 12, 13 & 14 for which no plan was provided
    - Vegetation Management Plan – 3 separate plans covering all precincts (James Warren & Associates, June 2011)
    - Weed Management Plan – 3 separate plans covering all precincts (James Warren & Associates, June 2011)

These documents have been reviewed in consideration of the following Director Generals Requirements:

- Traffic and Access (5.5 and 5.6);
- Flora and Fauna (9.1 - 9.12); and
- Water Cycle Management (7.1, 7.2 and 7.6)

The aim of this review is to outline the potential deficiencies in the project application documentation regarding the proponent's proposed methods to manage impacts of the proposal on threatened species (in particular koalas and wallum frogs) and ensuring the safe passage of wildlife between habitat areas on the site.

In addition, agency/council comments received following the exhibition period of the Environmental Assessment Report (JBA 2011) have been reviewed as they relate to threatened species management of Stage 1, including:

- EPA letter to DoP (6/2/12)
- DPI Fisheries letter to DoP (25/1/12)
- Tweed Shire Council Meeting Agenda (24/1/12) - Kings Forest Stage 1 Project Application and Amendment 2 to the Concept Plan - Council's Submission to the NSW Department of Planning and Infrastructure
- NSW Office of Water letter to DoP (13/2/12)

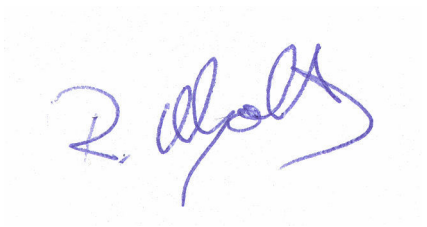
ELA have liaised with Dr Stephen Phillips regarding the consistency between the Kings Forest Koala Plan of Management and the Tweed Shire Comprehensive Koala Plan of Management (currently being drafted by Dr Phillips). Any inconsistencies have been noted in the section of the attachment that addresses the KPoM.

Overall, the threatened species management proposed for Stage 1 of Kings Forest has numerous information gaps and inconsistencies between management plans. The numerous plans (Weeds, Buffers, Threatened Species and Vegetation) contained an excessive amount of repetition of information and maps with minor differences in some of the Management Actions and Monitoring and Reporting sections. It would be more practical to have each management plan presented as one document with separate sections for the different areas (groups of precincts) where appropriate.

While a large amount of information is provided in the management plans, the relationship between the various documents and plans is quite complex and sometimes unclear. There is often a lack of detail within the plans that has left a number of issues unresolved, leaving open the potential for inadequate management over the site.

The Site Based Management Plan (SBMP) (Gilbert & Sutherland, June 2011) is the main document that brings all the management plans together and provides a working document for undertaking the actions proposed for ecological management of the site. Any updates to the plans or associated documents should be clearly cross referenced into the SBMP.

Yours Faithfully,



Robert Mezzatesta
Manager, Sydney

Review of Koala and Threatened Species Management Measures for Stage 1 of the Kings Forest Residential Development

This review has been structured as a collated review of the various management plans for Stage 1 of Kings Forest as they relate to koala and threatened species management. Comments by Eco Logical Australia (ELA) are supplemented with agency/council comments where relevant. This review is divided into relevant headings/issues and structured as follows:

Wildlife Corridors and the Safe Passage of Wildlife

B4 of the Concept Plan Approval (CPA) states: *As identified in Koala Plan of Management, an east west wildlife corridor of up to 100 metres wide (with a minimum of 50 metres at any one point) must be established.* However, this corridor has not been identified and as stated in the Tweed Shire Council (TSC) submission, the proponent rejects the need for this corridor and will delay the resolution of this issue.

However, the proposal for bulk earthworks means that the soil profile in the western part of the development will be disrupted, which would make delivery of an the east – west corridor consisting of fully structured vegetation communities approximating what would have been present prior to development extremely difficult. It is thus recommended that the provision of an east – west ecological corridor should be resolved prior to any bulk earthworks in the western portion of the site.

Wildlife corridors are essential for maintaining populations of threatened species at the site. The Koala is seen as a keystone species in this respect, with the lack of a need for the east-west corridor justified in the Environmental Assessment Report (JBA 2011) (EAR) by the lack of koala habitat at the western end of the site. However, other threatened species will benefit from the provision of an east-west wildlife corridor, particularly less mobile species.

The presence of environmental protection zones (EPZs) across the centre of the site provides good connectivity with Cudgen Nature Reserve to the east, which connects with EPZ's to the north and south. This southern connection is particularly important for maintaining connectivity with Cudgen Nature Reserve to the south at Bogangar and Hastings Point and further south along the Tweed Coast via vegetated lands currently zoned for Environmental Protection. Such connectivity is of vital importance in the conservation of the Tweed Coast Koala Population.

To the west of the central EPZ at the Kings Forest site, the corridor ends near the southwest corner of Precinct 6. Maintenance of a 100m corridor along the southern boundary of Kings Forest to connect an isolated EPZ and continue further west to Duranbah Road is the obvious solution to providing an east-west corridor. However, current layout features a lake and development zones along most of this boundary.

If the east-west corridor is not provided, there are potential impacts on fauna movements and habitat connectivity at a regional scale, with reduced connectivity to the north west and south west of the Kings Forest site. To the north-west, connectivity will be reduced to Duranbah and along Cudgen Road (via the Cudgen Road fauna overpass over the Pacific Highway) to Stotts Island. To the south west of Kings Forest, patchy vegetation cover provides for fauna movements towards the Pacific Highway underpass in the vicinity of Eviron Road, which provides connectivity to the west of the Pacific Highway around Eviron, Farrants Hill and Clothiers Creek. TSC note that a small outlier koala population exists at Eviron. Such habitat connectivity would be reduced by the loss of habitat at the western edge of the development without the provision of a wildlife corridor.

The EPA note that this east-west wildlife corridor was not only concerned with providing better movement opportunities for koala and recommend that this issue (Condition B4 of the CPA) be fully satisfied in the broader context before determination of Stage 1.

Director General Requirements (DGR) 5.5 requires that a safe passage of wildlife be maintained between habitat areas and DGR 5.6 requires that creek crossing or waterways maintain fish passage.

The EAR states that this DGR has been addressed in Appendix E. These engineering plans were viewed from the DoP website and there was no obvious plan/s that referred to fauna underpasses and traffic control methods to provide a safe passage for fauna. The only other documentation in the EAR that discusses fauna movements was as follows:

> Section 7.21.4:
> In order to mitigate and manage exposure of koalas to these identified threats, the KPoM recommends the following:
> - Fencing (in accordance with Figures 17 and 18 of the KPoM) to exclude koalas from the development areas in Precincts 1 and 5 in conjunction with the required road underpasses/bridging and grids. Fencing to the northern boundary of Precinct 2 is also be provided. All fencing is to be in place prior to the occupation of any buildings constructed within these precincts.
> - Measures on roads intersecting fauna linkages, involving:

- construction of grids (in accordance with Figures 17 and 18 of the KPoM) in roadways at both ends of the koala habitat, and the installation of appropriate lighting (capped) and signage at each grid location;
- construction of a temporary grid to the Kings Forest Parkway, where it extends from Precinct 5 through to the western precincts;
- construction of an underpass beneath the Kings Forest Parkway at the entrance of the estate to facilitate the movement of koalas (and other fauna); and connection of underpasses, bridging and grids to exclusion fencing and the connection of new fencing to the existing fencing along Tweed Coast Road, to effectively complete the enclosure of the defined Koala habitat area.

Section 3.3.3

- states that the 2 access road to Precincts 12, 13 and 14 have been designed to allow fish passage and minimize disturbance to SEPP14 wetlands by use of a bridge or bebo arch on the eastern road and a series of box culverts on the western road.

The safe passage of wildlife across the site has not been addressed for individual threatened species, but has focused on the movement of koala throughout the site. The TSMP, does not appear to contain any discussion of fauna movements for other threatened fauna species. Therefore, it appears that provision of fencing and the measures outlined above and in the KPoM assumes to benefit all fauna species, but without any assessment to demonstrate this. A discussion of the adequacy of these measures for koala is discussed below under the heading Koala Plan of Management.

In summary, ELA recommend that:

- exclusion fencing and the use of cattle grids needs discussion as to how and why these measure will provide safe movement of all threatened fauna, not just koala;
- the exclusion fencing should be provided along all the boundaries of the EPZ's to benefit all threatened species, not just around koala habitat areas;
- details of fencing and fauna movements haven't been provided for the entire site in the KPoM or TSMP;
- Other than Figure 18 of the KPoM which shows the fence and grid design, there is no detailed design plan within Appendix E that shows the proposed traffic calming devices, fauna underpass design, furniture, lighting and signage proposed, despite being directed to Appendix E in the EAR.

TSC note that *this issue does not appear to be specifically addressed within the Environmental Assessment except as it relates to koalas.* TSC had a number of issues in relation to this including:

- koala fencing not "sealing off" *precinct* 5, allowing koalas to enter the residential area from the north.

- installation of gates to prevent public access to undeveloped parts of the site;

- fencing should be completed as soon as possible (ie. earlier than prior to occupation of buildings, as proposed)

- It is not clear what is proposed in relation to fencing along Tweed Coast Road from the bridge over Cudgen Creek to beyond the northern boundary of the Precinct 1

- TSC support the use of "traffic calming devices" along roads that traverse EPZ's provided that:

- the design is such that motor vehicles are physically prevented from travelling more than 40kph (e.g. full width speed humps at a maximum of 200m intervals);
- adequate lighting to road verges is provided *in any areas where koalas and other wildlife are able to cross roads;*
- dogs are banned from the development; and
- signage alerting drivers that wildlife could be crossing

The EPA note that the KPoM effectively aims to separate koalas from the proposed development and therefore from vehicle strike. However, they are concerned that the number of underpasses between core vegetated areas is very limited, and that it is unclear what effort has been made to assess whether the proposed koala fencing will provide significant barriers to movement of other ground dwelling native fauna such as reptiles, small ground dwelling mammals and possibly amphibians.

Endangered Ecological Communities (EECs)

The Threatened Species Management Plan (TSMP) states that the following EECs were recorded on the site:

- Swamp sclerophyll forest on coastal floodplain;
- Freshwater wetlands; and
- Subtropical coastal floodplain forest.

While the EECs are mentioned in the TSMP, there is no reference made to the fact that the management of EECs is covered by the Vegetation Management Plan. The TSMP should include a discussion of the condition and distribution of EEC's across the site and describe the actions proposed in the VMP for their protection and enhancement. The information needs to again be relayed into the Site Based Management Plan to ensure that all management actions are tabulated into one document.

Within the Kings Forest development, the central EPZ will be intercepted by two roads providing access to Precincts 12, 13 & 14. These roads will intercept three EEC's including Swamp Sclerophyll Forest on Coastal Floodplain, Freshwater Wetlands and Subtropical Floodplain Forest. It appears the proposed route of the eastern-most road has been positioned to minimise vegetation clearing. However, re-routing the western-most road further to the east to within already cleared areas will remove the need to clear and fragment a patch of Swamp Sclerophyll Forest EEC, which is also mapped under SEPP 14. Reducing the interface of the road with vegetation will also reduce the potential for vehicle strike with fauna.

The current plan positions an electricity substation with an Environmental Protection Zone (EPZ) to the east of Precinct 5. However, ELA support the suggestions by the EPA and TSC to position the proposed electricity substation outside of the EPZ and re-align the proposed and existing transmission lines to avoid areas containing EEC's, threatened species habitat and SEPP14 areas.

The EPA are concerned about the loss of Littoral Rainforest EEC from within precinct 1. However, the Environmental Assessment Report (EAR), TSMP and Vegetation Management Plan (VMP) do not mention the presence of this EEC within the Kings Forest. The EPA notes that 0.42 ha of native

vegetation including 0.11 ha of littoral rainforest EEC and 0.06 ha of Swamp Sclerophyll Forest EEC will be removed from the outer ecological buffer area at Precinct 1. Littoral Rainforest is listed as an Endangered Ecological community under the *NSW Threatened Species Conservation Ac*t (TSC Act) and as a Critically Endangered Threatened Ecological Community under the *Commonwealth Environment Protection and Biodiversity Conservation Act 5* (EPBC Act). There must be an adequate assessment of the impacts to this EEC within the project application, including the EPBC referral document.

Tweed Shire Council (TSC) also considers the clearing of littoral rainforest inappropriate for a number of reasons including:

- Littoral Rainforest is Federally listed as Critically Endangered and Endangered in NSW;
- no statutory assessment is presented to indicate its removal would not be significant;
- its retention in the Ecological Buffer is consistent with the Clause 7 of Part 6 of SEPP (Major Projects) which regulates the use of Ecological Buffers; and
- the proposed use of the Ecological Buffer for development infrastructure in this location is not considered consistent with the Clause 7 of Part 6 of SEPP (Major Projects).

Threatened Flora

A search of the current NSW Wildlife Atlas data base has records of the following species within about 2.5 km of the Kings Forest site:

- *Acronychia littoralis* (Scented Acronychia)
- *Archidendron hendersonii* (White Lace Flower)
- *Cryptocarya foetida* (Stinking Cryptocarya)
- *Dendrocnide moroides* (Gympie Stinger)
- *Desmodium acanthocladum* (Thorny Pea)
- *Geodorum densiflorum* (Pink Nodding Orchid)
- *Oldenlandia galioides*
- *Syzygium moorei* (Durobby)

The last 5 of these species are not mentioned in any of the management plans, however, they may have been considered in earlier assessments. Suitable habitat could occur for these species and other listed species on the Kings Forest site.

Each Threatened Species Management Plan states it was prepared in accordance with requirements of 9.4 of these DGR's. However there is no clear indication of the timing of the management actions in these plans.

Below are comments in relation to specific actions for threatened flora species as detailed within the TSMP:

- Green-leaved Rose Walnut (*Endiandra muelleri* subsp. *bracteata*) - The Recovery Plan referred to is not referenced and it is not mentioned that it is a Recovery Plan for Green-leaved Rose Walnut and Rusty Rose Walnut.

- Southern Swamp Orchid (*Phaius australis*) - If populations/individuals of Phaius orchids are located on the Kings Forest site they need to be identified by a recognised orchid authority. Some cultivated plants (which may have become naturalised if vegetative material has been dumped in native vegetation) may be *Phaius tankervilliae* (a native of China) or *Phaius wallichii* (a native of Malaysia) (Jones 2006).

- Stinking Laurel (*Cryptocarya foetida*) - As there is only one individual known from the vicinity of Precinct 5, propagation and establishment of further individuals in suitable habitat would be desirable.

- White Yiel Yiel (*Grevillea hilliana*) – a 10m buffer seems inadequate.

- There is some inconsistency in the management actions between the different species. Propagation of all species from local material should be a priority where possible. All personnel involved in any works within areas where threatened species might occur should be familiar with all threatened species that are likely or possible on the site.

A suitably qualified flora ecologist should carefully assess all areas of vegetation to be impacted by any of the proposed operations shortly before such works are carried out. This includes areas of degraded vegetation as these could still support Threatened species such as *Eleocharis tetraquetra* and *Arthraxon hispidus*, and isolated trees could be individuals of a Threatened species. Without access to the original survey reports it is not possible for ELA to comment on the adequacy of these surveys. Even if they were considered adequate it is still possible that unrecorded Threatened species occur on the site.

The DGRs 9.13 states "Survey for the Square Stemmed Spike Rush in those areas of the site corresponding to future precincts 13, 14 and 16. Provide, within an update to the Vegetation Management Plan, procedures for the protection and management of any newly identified occurrences of this species that are in accordance with the Approved Recovery Plan for this species".

Square-stemmed Spike Rush was recorded in Precinct 11 not 13, 14, or 16 (also Precinct 16 does not appear to be present). This appears to be a problem with the DGRs.

Threatened Fauna

The EAR states that twenty (20) fauna species listed under the TSC Act and/or in the EPBC Act were recorded on the site and that a further seven (7) threatened fauna species are considered to possibly occur on the site over times as indicated on the NPWS and EPBC wildlife databases. However, when reviewing the TSMP, the total list of threatened fauna species discussed in these plans totals 15 threatened fauna. Therefore, a further 12 species are not mentioned within the any documentation.

The Threatened Species Management Plans (TSMP) were prepared by James Warrens & Associates (2011). There is a lack of identification of potential habitat areas for most species, so that determining areas of habitat to be removed and conserved/rehabilitated is not clear. Mapping these areas for each threatened species would resolve this issue.

The plans do not contain a detailed vegetation map of the entire Kings Forest site. Such a map would assist with identification of habitat areas, as discussed in the point above.

Potential threats to Black Bittern include the clearing of riparian vegetation, however, this issue is not addressed in the Drainage Maintenance Impact Assessment or Drainage Maintenance Management Plan. The EPA notes that the Black Bittern has been previously recorded at Blacks Creek (NSW Wildlife Atlas); that the species is largely dependent on riparian vegetation and that potential impacts resulting from maintenance of Blacks Creek on this species have not been addressed.

The TSMP states that cats will be prohibited from Kings Forest as a management action for the Common Planigale. The TSMP does not state how this will be achieved. However, Section 7.21.5 of the EAR states that cats will be prohibited from the site and a section 88B or section 88E Instrument under the *NSW Conveyancing Act 1919* will be attached to the land title of each residential allotment within Precinct 5 prohibiting the keeping of cats.

ELA support this action and the prohibition of domestic cats from Kings Forest, and note that for the Koala Beach development to the south of Hastings Point, the prohibition of cats and dogs was written into the KPoM, which then translated into a restriction on each title under Section 88B of the Conveyancing Act 1919. ELA recommend that prohibiting the keeping of cats be written into both the TSMP and KPoM to be most effective.

The TSMP states that it was prepared in accordance with requirements of 9.4 of these DGR's. However there is no clear indication of the timing of the management actions in these plans. The flora and fauna monitoring, performance criteria and reporting detailed in the TSMP must be consistent with those proposed in the SBMP.

Under the Monitoring and Reporting section of the TSMP, it states that *a well-designed monitoring program will allow project managers to detect results months, years, or decades following implementation of a plan*. This suggests that this monitoring plan will apply for decades when in fact it is only to be in place for 5 years and it is unclear of what will happen after this time. The SBMP states that the proponent will maintain the site, including all the proposed monitoring and reporting for 6 months following the civil construction period, at which time it will be handed onto TSC. However, the level of flora and fauna monitoring required by TSC (if any) is not described.

Ecological Buffer Zones

Condition C20 'Development within Ecological and Agricultural buffers' of the Concept Plan Approval is relevant and states:

All future development applications proposing development within either the ecological or the agricultural buffer must demonstrate that, as relevant, clauses 7 or 8 of Schedule 3 of the State Environmental Planning Policy (Major Development) 2005 have been adequately addressed.

Schedule 3, Part 6, Clause 7(2) of SEPP (Major Development) states that the objectives for ecological buffers are:

1. to protect wetlands or areas of particular habitat significance, and

2. to restrict development so that, as far as practicable, it does not occur within ecological buffers, and

3. to help ensure that development is designed, sited and managed so as to minimise its impact on the ecological and hydrological functions of ecological buffers, and

4. to encourage the restoration and maintenance of native vegetation and the ecological processes of land within and adjacent to wetlands or areas of particular habitat significance.

Given the proposed development of residential areas within Kings Forest is adjacent to land of high conservation value and environmental sensitivity including EEC's, SEPP14 wetlands, Cudgen Nature Reserve and threatened species habitat, ELA believe that the buffer areas should remain vegetated and not include infrastructure as proposed in Precincts 1 and 5. It is noted that clause 7 of the Major Projects SEPP does not prohibit development in the ecological buffers, but does identify that there should be *'no practicable alternative to siting the development within the buffer'* and *'incorporate measures to regenerate native vegetation for all disturbed areas within the buffer'*, as well as measures to protect the buffer from stormwater. It is noted that the proposal to locate portions of the development, asset protection zones and a swale for stormwater treatment within the ecological buffer does not appear to be consistent with these Major Projects SEPP controls.

It is noted that the EAR seeks approval for bulk earthworks across the site. There are a number of concerns with the information currently supplied. It is extremely difficult to determine what bulk earthworks will be performed across the site and where these will be located. An indicative plan of cut and fill volumes is provided, but includes no details. Of particular concern is that the cut and fill plan shows bulk earthworks being performed across environmental buffers. EPA has recommended that a program of assisted natural rehabilitation be utilised as much as practicable. ELA concurs that an approach of assisted natural rehabilitation gives much better ecological outcomes compared to revegetation (ie. planting). Significant disturbance of the natural soil profile (such as through bulk earthworks) is likely to prohibit the approach of assisted natural rehabilitation, as bulk earthworks will likely lead to the loss of the soil seed bank and disrupt the soil profile (in particular the loss or disruption of the topsoil).

Therefore, ELA recommend that earthworks within the buffers be restricted, particularly in consideration of:

a) the environmental sensitivity of the site,
b) the agency comments which are not supporting the current level of use of the buffers, including the level of earthworks proposed (see below);
c) the objectives of the ecological buffers, which are stated above; and
d) the difficulty recreating natural landscapes following disturbance to the soil profile and soil seed bank

There was no Buffer Management Plan provided for Precincts 12, 13 and 14.

It appears that the locations of the koala proof fence will mean that a maximum of 20m of the ecological buffer would be available to koalas. The Buffer Management Plan states that "The inner 30m of the buffer will be fully restored...". As the swale and koala proof fence are located within this 30m portion of the buffer this is considered to be impractical. It is not clear how the swale will be constructed and what vegetation will be present. Furthermore, it appears that the koala proof fence will be located approximately 10m within the 'inner' portion of the buffer. The koala proof fence will require ongoing maintenance and thus access to this infrastructure will be required.

EPA has raised concerns that the ecological buffers contain: (a) development including roads and/or paths, (b) fauna exclusion fencing, (c) stormwater swale, (d) asset protection zones (APZ's), in some places (ie. the eastern edge of Precinct 5 adjacent to Cudgen Nature Reserve) reducing the effective vegetative buffer to 15m. They have stated that these elements will significantly reduce the effective width of the buffer zone. They have also offered to receive the buffer lands via dedication, but that

they are not willing to take on management and maintenance of any infrastructure including fencing, stormwater controls and APZ's.

TSC note that the proponent seeks to use the outer 20 m of the Ecological Buffers for purposes such as roads, footpaths, cycleways, bushfire Asset Protection Zones, stormwater management, passive recreation and similar "compatible" purposes. It is also proposed to clear some 30ha of existing native vegetation in the Ecological Buffers to assist with the provision of fill for the developable portion of the site.

TSC consider that small-scale incursions into the outer 20m of ecological buffer from roads and cycle ways and the like may be acceptable in some circumstances but the extensive use of the outer 20 m and in some cases the inner 30m of the ecological buffer, as proposed, is not consistent with Clause 7 of Part 6 of SEPP (Major Projects) 2005 which explicitly seeks to restrict development and retain native vegetation in these areas.

Vegetation Management Plan

Harvesting of Slash Pine plantations should be done as soon as possible to remove the continuing input of wilding propagates.

The list of species for additional plantings for either native vegetation regeneration and amenity planting other than dry and wet heath and koala food trees is rather limited. This also implies that natural regeneration will be relied on for other species; this may or may not occur.

There are some errors in the lists of species recommended for revegetation. *Hakea dactyloides, Persoonia cornifolia* and *Petrophile pulchella* (probably) do not occur on the NSW North Coast. *Restio pallens* is now known as *Baloskion pallens* and spelling correction - *Velleia* not *Valleia.*

Any bush regeneration company employed on the site should be suitably qualified and experienced in the local area.

The plan needs to specify why works in wetland areas should be carried out during drier months. There could be times when winter and spring are not dry so this needs to be more specific.

When planting out seedlings, a slow release fertilizer and water crystals should be used (to manufacturers recommendations) to maximise survival rates. Other forms of mulch could be used. Plantings should occur during the wetter months (late summer/autumn).

It is recommended that all retained vegetation be fenced in accordance with Australian Standard 4970 - 2009 Protection of Trees. It is also recommended that a condition of consent be that no machinery, spoil or rubbish is stored within retained vegetation, and similarly no vehicle washdown areas or access tracks are to be located in retained vegetation.

Figure 9 of the VMP appears to identify that only boundaries of the precinct will be managed, rehabilitated, or revegetated. This is a weakness. It is noted that the EAR states that 178 ha will be dedicated to NPWS, and 154 ha of Environmental Protection Zone will be dedicated to Council. However, areas to be dedicated, details and timing of rehabilitation and revegetation, fencing and like works, and maintenance responsibilities are yet to be agreed (amongst other matters). Given the uncertainty associated with this outcome, it is recommended that the VMP should at least (a) identify these lands within the precincts, (b) identify the works to be performed to (at a minimum) maintain the environmental condition of these lands until lands can be dedicated (or until agreed works to be performed supersede such maintenance works).

Figure 10 in the VMP for precincts 1 & 5 appears to show "Heathland to be revegetated" within some of the buffer zones, which are within the red line for the development (ie. 20 – 30m within the buffer zone). There appears to be an inherent conflict in the proposed heathland revegetation areas when roads, swales, APZ's, and koala proof fences are proposed with some of these buffer lands. However, due to the broad scale of the map, and because development is not shown, it is not possible to confirm this.

Further, the management zones 1 – 16 identified (Figure 11 of VMP) do not appear to follow the boundaries of the retained vegetation. Some retained vegetation does not have management zones identified.

With regards to SEPP14 wetlands the VMP states (p9) *"Erosion and sediment control devices shall be installed prior to commencement of earth works within Precincts 1 & 5 in accordance with the Erosion & Sediment Control Plan (Gilbert & Sutherland 2011a). This will prevent the movement of sediment into ecologically sensitive areas as well prevent the dispersal of weed seeds and vegetative material"*

The EAR identifies that substantial amounts of cut and fill are proposed. The Stormwater / Sediment Control Plan identifies as a control that there should be minimal areas of disturbed soil at any time. It appears questionable whether this assumption will be possible given the large amounts of earthworks proposed. It is recommended that confirmation is sought from the proponent that either (a) there will be minimal exposed soils (the area should be specified), or (b) the proposed controls are adequate to deal with substantial areas of exposed soil.

The EPA believe that the VMP lacks detail and suggests that detailed plans for each work area need to be developed. Detailed plans for each specific work area should be provided and include mapping of existing remnant vegetation and identifying specific areas where protection, assisted natural regeneration or revegetation is proposed.

The EPA suggests that the VMP should also consider changes to nutrient loading; changes to hydrology; urban weed escapes and dumping and an assessment of the possible threats to ecologically significant values of the EPZ's. For example, the proposed fencing between precinct 5 and the EPZs will only be 1.2m in height and will not prevent pedestrian access to threatened species habitat, EECs and SEPP14 areas.

Weed Management Plan

There is no mention of avoiding the use of weed species for planting in private gardens once the site is occupied. A list of noxious and environmental weeds should be provided to residents and written into a DCP or other development design requirements for the site.

Weed hygiene should apply to all machinery entering the site as well as movement within the site to minimise the risk of introducing new weeds to the site.

Koala Plan of Management (KPoM)

It is not clear what lands the KPoM applies to, and how this relates to the development which is the subject of the current project application. This makes determining whether the current KPoM is adequate extremely difficult. It is presumed that the KPoM is only meant to apply to a portion of the Kings Forest Estate, as it clearly does not specify a management regime across the entire site.

The KPoM needs to clearly identify how future plans (for other development precincts) or updates will relate to the current KPoM, and how any lessons learnt from the various development stages (or from monitoring and reporting) will be integrated back into the plan. A process should be identified to allow for changes to be discussed with an appropriate authority (likely Council).

Because of the potential impact of Myrtle rust on species in the family Myrtaceae it may be better to avoid any species in this family for amenity plantings and not rely solely on Myrtaceae for the Koala plantings. Some plantings of Forest Red Gum *Eucalyptus tereticornis* in the Lismore area have been affected by Myrtle rust (Rick Stewart pers. comm. 2012). Also planting of native species that are just outside their natural distribution (eg Smooth-barked Apple *Angophora costata)* should be avoided to reduce the risk of these becoming weeds by the establishment of wild populations in the local area.

A detailed CV as provided in appendix 2 (19 of 88 pages of the document) is not required (or relevant to) a KPoM,

Much of the reference list provided relates to old koala literature. DGR 9.7 requires that the KPoM should take into account contemporary data/literature on koala management. There also does not appear to be a section which summarises key elements from a review of koala literature. For example the KPoM identifies that 4 tree species have been identified by the Tweed Coast koala study (Biolink 2011, referenced as Phillips 2011 in the KPoM) as preferred koala food trees, but does not identify which species are most preferred, or the relationship of tree species preferences to soil landscapes, or how these elements relate to the subject site. Section 5.1 states that "Koalas have been observed to seek out as many as thirty (30) different Eucalypt species...". The approved NSW koala recovery plan (DECC 2008) contains a much longer list (~100 species) of potential koala food trees. Given that koala food tree preferences is an essential component of koala management, this is a very important topic, but there are also others including: dog mortality, car mortality, movement behaviour and home range size. The KPoM also proposes the use of cattle grids, but does not provide a review or synopsis of the literature which supports their contention that cattle grids deter koala movement. Section 5 discusses koala home range behaviour but all studies are from 1985 or earlier. There is much more recent research on koala home range and movement behaviour. For example, dispersing koalas have been recorded as making movements of 19km (or more) (Ward 2002) as well as having been reported to use open habitat and lightly wooded areas (Moon 1990). Similarly section 6.2 relies on old studies of koala ecology (1990 or earlier).

Funding and management - The KPoM does not identify how the actions of the KPoM will be funded, the timeframe for management (eg. whether this is in perpetuity). A criteria for success of the KPoM is that "The designated 178 ha of 'Core Koala Habitat' contiguous with Cudgen nature Reserve is transferred to public ownership'. This should not be a criterion for success, as the performance of the KPoM should not be dependent on public authorities taking on management responsibility for environmental lands. There are a range of mechanisms by which the conservation and management of these lands could be secured under private ownership including as Biobanking Site(s), with in perpetuity funding provided by way of sufficient financial contribution to the trust fund for these sites. Presumably, should the conservation lands be set as Biobanking Site(s), the credits that would have been generated would be considered to be retired. Alternatively, other private ownership conservation mechanisms could be implemented. Responsibility for funding of all management actions should be clearly identified.

Monitoring - It is understood that monitoring is proposed for 5 years from commencement of construction. This time period may not be sufficient to cover all construction works. It is recommended that this should be altered to "Annual monitoring (AKMR) is to continue across the Kings Forest Estate and Cudgen Nature Reserve for 5 years after all construction within Kings Forest Estate is complete". Further detail should be supplied on what monitoring will be undertaken. For example, section 13.4 refers to many factors including home range sizes which would require capture

and radio-tracking, genetic studies which would require analysis of tissue or faecal pellets samples, and various other elements which would likely require capture and ear-tagging of the majority of the koala population. It is unclear exactly what studies and monitoring will be carried out and how this will be implemented. Further, any such studies must meet animal care and ethics requirements to minimise this risk of injury or death to koalas as a result of these studies (koalas may jump or fall to the ground from tree limbs during some attempted captures).

Fencing - The fencing proposed does not appear to be the standard "floppy-top" fencing now used in many locations. It is unclear why the proposed design is being used, and what research supports that it will be effective at creating a barrier to koala movements into development areas. The KPoM merely refers in passing to a Hopkins & Phillips (2009) unpublished study. The KPoM should identify what the study did, how it showed that the fencing (and cattle grids) would function, and other details as necessary to support this contention. The koala exclusion fencing plan in the KPoM (Figure 17) shows a small area between precincts 4 and 7 to be fenced within a much larger environmental protection zone area to be dedicated to Council, which appears to follow the boundary of land mapped as 'core koala habitat'. The fencing should not restrict koala access to other areas of the environmental protection zone area. Koala habitat usage is not restricted solely to 'core koala habitat', other lands will also be used, in particular, young male koalas will often be pushed out into suboptimal habitat by dominant males. Given the approach taken, the fencing should extend around the perimeter of the environmental protection zone.

Relationship of current KPoM to future fencing requirements - It is not clear how the current fencing will relate to fencing for future updates of the KPoM, and the overall movement of koalas across the site.

Underpasses - The use of underpasses to link habitat under road is supported. It is recommended that fauna "furniture" be installed and monitored to evaluate its effectiveness (eg. poles with elevated rails to allow koalas to cross the culvert above ground level.

Maintenance - The maintenance of the koala fencing will be a key element to ensuring their ongoing performance. Such fences can often be affected by vandalism, by residents creating gaps so that they can access bushland, or by falling tree limbs. It is not clear who will be responsible for maintenance of these fences, how often fencing will be checked, the timeframe within which any faults must be rectified, and who will be responsible for costs. The fencing is a critical element in separating koalas from the future urban threats, and any gaps in the fencing will significantly degrade the intended performance. Will gates or other access points be provided for people along the fence?

The EAR states that a "temporary grid" will be constructed on the Kings Forest Parkway through to Western Precincts, but the grid in Figure 17 of the KPoM does not appear to be marked as temporary. It is unclear why this would be a temporary structure.

Koala corridors - The KPoM (and EAR) refers to condition B4 and the requirement for an east-west corridor minimum 50m width. The KPoM states that it is not considered an appropriate allocation of resources. It is noted that much of the vegetation to the west of the site is mapped as exotic pine plantation, which would be poor koala habitat. As discussed under the section above on Wildlife Corridors, facilitating and improving ecological connectivity is a key management issue for koalas, as well as other species.

Fire - It is not clear how bushfire will be managed. Bushfire is recognised as a threat to koala populations, though it is noted that the interaction of bushfire with koalas varies from site to site and that ecological connectivity is a major positive outcome to allow populations of additional animals to be recruited into a population should it be affected by fire (see corridors comments). The KPoM should address bushfire management in more detail. It is noted that management of bushfire for koala populations should be balanced with management of bushfire for other ecological values.

Roads - The KPoM does not identify any measures to avoid koala mortalities where roads pass through koala habitat (or movement) areas. The KPoM should identify relevant measures, such as lowering of the maximum speed, installation of speed humps or other devices to reduce car speed, etc.

Previous studies - The results of previous studies of Koala at the site as outlined Section 4.5 are not clearly presented in the KPoM and the implications for Koala Management are not discussed.

Dogs - The KPoM does not identify how roaming domestic dogs, owners which walk their dog(s) and let them off the leash, and koalas entering properties with dogs are to be addressed. These elements are all known to contribute to koala mortalities. The mechanism to be utilised to prohibit the specific breeds of dog is not specified. Similarly how this measure will be enforced (and who by) is not specified.

Tree planting - The KPoM states that 49ha will be planted with koala food trees (and presumably other tree species to provide an appropriate and diverse mix of local provenance native species). It is noted that the KPoM identifies one tree per 25m^2, for a grand total of approximately 17,000 trees. However, 490,000m^2 at the specified density gives a figure of 19,600 trees. The KPoM gives an "indicative" pattern for koala food tree planting, and does not specify which species will be planted, maintenance of the trees, and many other details. It is recommended that these details be included in the KPoM.

It is not clear how the tree planting areas relate to the development precincts, the position of koala exclusion fencing, and the requirements of APZ's. It is recommended that these elements are clarified. The tree planting areas may possibly be in conflict with (a) areas to be regenerated as heathland, asset protection zone requirements, the location of swales, the location of the koala fence, and possibly other elements of the proposal.

The timing for planting is given as "generally within 180 days of commencement of any works contemplated by this Project Application and, in the golf course area, will commence as soon as the bulk earthworks there are completed". The timing for these works is somewhat vague, and it is recommended that it is more specific.

Provisions for tree deaths (ie. replacement) should also be identified.

Key Discussion Points between Dr Steven Ward (ELA) and Dr Steve Phillips (Biolink)

A submission to the NSW Scientific Committee to list the Tweed Coast & Brunswick Coast koala population as an endangered population under the TSC Act is likely to occur in the future (it is understood that the submission has been drafted). At this stage this listing is not in force and thus does not affect the Kings Forest proposal, however it does indicate that the koala population in this region is considered under pressure.

References in the text below to "CKPoM" refers to DRAFT Tweed Coast Comprehensive Koala Plan of Management that is currently under review by TSC, and "KPoM" refers to draft Kings Forest Koala Plan of Management.

The CKPoM encourages the all Koala Plans of Management to be adaptive, and to allow the plan to conform over time with the CKPoM (ie. when the plan is reviewed). This is important for a development proposal being carried out over a long time frame like Kings Forest (eg. a large fire event might require a change in management approach).

The CKPoM supports the encapsulation of development areas. However, potential koala habitat should not be enclosed, as the aim of the CKPoM is to lift the current 20% koala occupation of suitable habitat to 40-50% occupation. This is relevant to the northern portion of Kings Forest, where

fencing is proposed around core koala habitat only; and koalas would be excluded from potential koala habitat. This component is inconsistent with the CKPoM

The CKPoM does not specify fence design, but the fence design proposed appears to be consistent with a design effective at koala exclusion purposes. However, a key issue for koala exclusion fences is maintenance. The CKPoM may contain a provision that there be an easement for fence maintenance, that this easement be dedicated to Council, and that there be a developer levy (based on a per kilometre rate) to fund ongoing fence maintenance by Council.

The CKPoM specifies minimum culvert design to allow koala crossing (minimum standard width and height dimensions of approximately 1.2m by 1.2m for a traverse of a distance up to 46m under a road). However, Steve Phillips also commented that culverts will tend to sink over time, and thus permanent water pooling may occur, which can prohibit or discourage koala movements. Thus, the CKPoM recommends that culverts are free draining, and Steve Phillips commented that this can often be delivered by siting culverts 1m above ground level (noting that specific design will be dependent on site conditions, substrates and hydrology).

The CKPoM proposes that Council create a bylaw that areas outside of urban enclave(s) are prohibited to have dogs. The Kings Forest proposal and KPoM should not prevent the application of such a bylaw if/when enacted.

Fire is a major risk to the Tweed Coast koala population. Hazard reduction should be done by mechanical means with no loss of koala food trees.

The CKPoM proposes that habitat restoration (or koala food tree planting) is to be performed by Council, with funding for works provided by developers. The quantum of funding has not yet been approved by Council. Steve Phillips noted that for lands to be dedicated to EPA, Council could do works on behalf of and in consultation with EPA, and that this is occurring successfully at other sites.

Acid Frog Compensatory Habitat Plan

The acid frog compensatory habitat plan (Appendix 1 of the TSMP) tends to focus on the Wallum Froglet in terms of habitat requirements and the provision of compensatory habitat. There is little attention given to the Wallum Sedge Frog, but rather it is assumed to have the same habitat requirements and potential benefits from the Wallum Froglet habitat creation.

Reference is made to compensatory acid frog habitat as part of the Tugun Bypass and cites the work by Ecosense Consulting Pty Ltd, 2005 as containing expert opinion on acid frogs. This document is not in the reference list for the TSMP or the Ecological Assessment Report (EAR). However, from this work, a number of recommendations are provided for compensatory habitat to meet the specific requirements of acid frogs. These include:

- Ponds should be constructed in sandy substrates (which previously contained 'Wallum') with an underlying organic hardpan;
- Ponds should generally be shallow and constructed in areas of high groundwater;
- Water quality should exhibit the following characteristics:
    - pH <5 (as influenced by humic soils);
    - hardness < 100 p.p.m;
    - salinity < 350 uS.cm-1;

- Ponds should be ephemeral to prevent habitation by fish but have a minimum hydro-period of 4-6 weeks for the Wallum froglet; and

- Pond fringes should be densely planted with emergent species to prevent predation by the Cane toad (*Bufo marinus*).

In a paper by Griffith *et al.* 2003, 'wallum' is defined as the vegetation, across the full range of structural formations, occurring on dunefields, beach ridge plains and sandy backbarrier flats in southern Queensland and northern NSW. 'Other definitions include 'coastal vegetation on sandy acidic soils, in south-eastern Queensland' and 'sandy coastal sites with impeded drainage, usually supporting heath, scrubby communities or swamps' (Griffith, *et al.* 2003).

The plan states that *compensatory habitat areas occur on sandy substrate which historically contained 'wallum' vegetation*. However, there is no vegetation map for the entire Kings Forest development to demonstrate vegetation communities (historical and present-day). Therefore, the likely success of the locations for compensatory habitat cannot be accurately determined from the compensation plan.

The plan contains a map showing the location of acid frog compensatory habitat, with 14 separate locations across the site, mostly within environmental buffers and EPZs. The plan also briefly describes the type of works proposed in each of the 14 sites but lacks detail on existing condition. In some cases, works may only require fencing of habitat and ensuring that machinery does not enter the area and therefore, the melon-holes may not add additional habitat value.

From the "Bulk earthworks" plan (Mortons 2010), there appears to be earthworks proposed within some of these compensatory areas, particularly within buffer areas. Page 48 of the plan states *if necessary, topsoil/organic material will be stockpiled during initial earthworks and used to line constructed frog habitat areas.* However, given the complexity of the frogs habitat requirements (*sandy substrates (which previously contained 'Wallum') with an underlying organic hardpan* and water with a *pH <5 (as influenced by humic soils)*), recreating this substrate will be a challenge, is largely experimental and may fail.

Compensation areas 1,3,12 and 14 may not provide the acidic conditions required, as potential acid sulphate soils are not mapped in these locations and there have been no previous records of acid frogs occurring in these locations. Further, when the compensatory habitat map is cross-checked with the acid frog core habitat map contained in the TSMP, compensation areas 1,3,12 and 14 occur outside of the core habitat areas. While the species may occur in such areas during foraging, the habitat elements required for breeding habitat may not occur in these proposed sites.

Given the sensitivity of frogs to pollution, the presence of compensatory habitat within the proposed Golf Course may not be compatible and use of chemicals (herbicides and fertilizer) within the golf course will need to be seriously considered.

It is stated (p. 32) that the *narrow design of the melon holes, coupled with the dense planting of Saw-sedge, will assist in the prevention of mosquito breeding, protect tadpoles from predation and preclude the occurrence of Cane toads.* Cane Toads prefer open habitats, so the plantings will discourage them from breeding in the melon holes; but there is no scientific evidence to support how the thick sedge vegetation will prevent mosquito breeding.

The example of the Tugun Bypass and the presence of wallum frogs within its acid frog compensatory habitat are discussed. However, the compensatory habitat for the Tugun Bypass consisted of 4 larger ponds instead of many scattered melon holes. The melon hole approach was designed at Kings Forest to *reduce the likelihood of mosquito breeding, due to the location of adjacent residential areas*. However, there is no scientific evidence to support this. One benefit, and of potentially more

importance to the success of the compensatory plan, is that many scattered melon holes compared to several large ponds will reduce the chance of *Gambuzia holbrooki* (predatory mosquito fish) occurring. Ensuring the melon holes are designed to be ephemeral (as planned) will also reduce the risk of predation by gambuzia.

Acid frogs are is likely to be particularly susceptible to sediment impacts, changes in hydrology, and potentially changes in pH (associated with acid sulphate soils and/or treatment of these soils with lime). Council has raised concerns about the ability of the stormwater and sediment control measures to adequately control impact during the construction phase.

Removal of soil to create the melon holes (approximately 60cm deep by 180cm long) will lead to oxidation of acid sulphate soils, with a likely spike in pH within the melon hole following its construction. The spoil will also need to be treated offsite with lime.

Section 4.2 of the VMP states "*It should be noted that acidic conditions within revegetation areas need to be maintained in order to provide suitable habitat for acid frogs. Treatment of Acid sulphate soils with lime within and immediately adjacent to the EPZ's and ecological buffers is therefore prohibited".* The distance over which lime treatment is to be prohibited should be specified and integrated into any Acid Sulphate Soil management plan.

The EPA does not support the proposed wallum frog compensatory habitat plan on the following grounds:

- The areas in question are already well known as core breeding habitat and that undertaking earthworks within these areas to enhance habitat values for the targeted benefit of one fauna group, is at odds with the key offsetting principles in NSW

- Regeneration and management regimes already required under the CPA, and the tenure/zoning to be secured for these areas will maintain and improve habitat and breeding opportunities for the Wallum frog species without risking negative impacts associated with widespread earthworks in or near areas of sensitive existing threatened species habitat.

- Key to the wallum frogs survival is the maintenance of suitable hydrology to protect their habitat. As such further information is requested from the EPA regarding the significance of earth works and changed hydrology upon existing and potential habitat values of the environment buffer and EPZs across the site.

TSC are also not supportive of the proposed acid frog compensatory habitat plan as the work proposed is largely experimental and it is not clear if the very specific conditions required by these frogs can be re-created, especially given the major changes to the land surface, drainage and groundwater relations that will occur with the proposed bulk earthworks. TSC recommend that further specialist advice is needed to examine the technical feasibility of the proposal, and that contingency plans be in place in the event that the proposed plans perform poorly.

Feral Animal Management Plan

ELA have reviewed the Feral Animal Management Plan (FAMP) and note that there are many issues as discussed in the report, that inhibit the effective control of feral species, including the need for a coordinated landscape approach to control, the problems associated with baiting including non-target species and proximity to urban areas and the labour intensity and cost associated with trapping.

ELA have the following comments in relation to this plan:

- The government agency that supports and provides information on feral species control is the Rural Lands Protection Board, now know as the North Coast Livestock Health and Pest Authority (LHPA). This agency should be consulted when undertaking any feral pest control to determine the most effective methods within the broader landscape, and to coordinate efforts with adjacent landholders. The FAMP makes no mention of this agency.

- The number of feral species requiring control was narrowed down to Cane Toad, Red Fox and feral cats and dogs. ELA also believe that control of rabbits and the Indian Myna (referred to in the FAMP as Common Myna) should also be included in this list. The TSC undertakes control of rabbit along the coastline and such control should be extended and to the Kings Forest site and control undertaken in coordination with the council. There is a Threat Abatement Plan for rabbit under the EPBC Act. TSC are also actively controlling Indian Myna within the Shire due to the recent arrival of this species on the north coast and the large population growth associated with the arrival of this species.

- The Indian Myna benefits from human habitation and landscape modification. There should be commitment monitoring and trapping of this feral species to reduce the impacts on native species, especially hollow-dependent fauna and native birds that are excluded from habitats by the aggressive nature of the Indian Myna.

- *Gambuzia holbrooki* (Mosquito Fish) is another feral species that threatened the Wallum Froglet and Wallum Sedge Frog at the site. There is no mention of this species or its control within the FAMP. Predation by Gambuzia is listed as a Key Threatening Process under the NSW Threatened Species Conservation Act. A Threat Abatement Plan also been developed for this species.

- There is no discussion of whether native frog species are likely to enter the light traps proposed to trap cane toads and what would be the likely outcome of being trapped with a cane toad given the species is poisonous.

- If the light traps are effective for trapping of cane toads, without attracting or harming native frogs, then they should become part of the regularly maintenance regime for golf course staff.

- Exclusion fencing of ferals is discussed as an option but is not recommended at the site. The proposed koala exclusion fencing and fauna underpasses is mentioned in the FAMP, but there is no discussion of how this with interact with movement of feral animal species. There should be further discussion of this and how feral predation will be managed at fauna underpasses through the provision of escape poles and other furniture.

TSC presented a long list of issues in relation to the inadequacy of the FAMP which included:

1. The inadequate literature review, which should be updated to include more contemporary literature and relevant regulations;

2. Rabbits, Ferrets and Stoats should not be kept on the estate;

3. More detail needs to be provided for each feral species on the objectives, actions for each phase of the development; specific control strategies for any Threatened species and responsibilities for action;

4. The need for a measurable and comprehensive monitoring and evaluation framework; and

5. Partnerships should be developed for feral control between LHPA, NPWS and TSC.

Drainage Maintenance and impacts to threatened species habitat

DGR 7.6 requests that the proponent *assess the necessity of drains currently in operation across the site and for those required into the future, assess the impact of any ongoing maintenance required to ensure their effectiveness*. The only drain across the Kings Forest site identified as necessary for flood mitigation and site drainage is Blacks Creek.

The EAR states that: *"The east-west agricultural drainage channel - also known as Blacks Creek - running through the SEPP 14 wetlands within the central part of the site needs to be retained for flood management purposes and will require periodic maintenance to maintain adequate flows in flood events. This will involve removing excessive vegetation growth, obstructions to water flow (eg snags etc) and deposited sediment. Based on the historical maintenance regime, it is expected that removing vegetation growth by chemical spraying will be required at two-yearly intervals, whilst the removal of deposited sediment will be required approximately once every ten years. The drain has been routinely maintained under Existing Use Rights. The project application is seeking consent for the on-going routine maintenance of the eastwest drain once these rights are relinquished."*

It is not clear why this drain is required for flood management (and would be outside the scope of this review). However, the drain appears to run through SEPP14 wetlands, and thus it recommended that this drainage channel should be rehabilitated rather than maintained. Use of chemical sprays within wetland areas is not recommended due to the potential for spray to migrate into the wetland and cause impacts to flora & fauna.

The Drainage Maintenance Impact Assessment (Gilbert & Sutherland, 2011) suggests that Blacks Creeks be maintained approximately every 10 years to remove the build up of sediment, where the deposition of silt is greater than 20cm deep. In addition, plant growth should be managed to prevent the drainage system from blocking up. While this assessment includes *Section 3.5 Impacts to flora and fauna*, there is really no discussion of "impacts" except that *a visual inspection of flora and fauna should be conducted within 48 hours of herbicide application to ensure no adverse impacts have resulted from the application.*

There is a no assessment of potential impacts to state and federally listed threatened species as result of drain maintenance.

The Drainage Maintenance Management Plan (DMMP) (Gilbert & Sutherland, 2011) aims to *detail strategies to mitigate the potential environmental impacts associated with the ongoing maintenance of the east-west drain at the Kings Forest site* including *impacts to flora and fauna.* However, the only mitigation measures are related to herbicide application as quoted above (a visual inspection within 48 hours of herbicide application). Therefore the proponent has not adequately assessed or mitigated against impacts to threatened species in relation to maintenance of Blacks Drain.

The DMMP notes that approval from DWLC (NSW Office of Water) and DPI (Fisheries) will be required prior to undertaking the proposed maintenance of Blacks Creek. Comments received from these agencies of relevance to threatened species are listed below.

NSW DPI (Fisheries)

- The removal of snags, ongoing dredging and long term removal of marine vegetation, particularly within Cudgen Nature Reserve is inconsistent with the objectives of the Fisheries Management Act 1994 and DPI policy guidelines.

- Blacks Creeks is a natural waterway that has been highly modified, yet is still a tributary of Cudgen Creek estuary and as such contributes to the overall fish habitat values of the estuary.

- The DGR 9.2 – address measures to protect and manage riparian corridors and adjacent aquatic habitats in consideration of the *Tweed Coast Estuary Management Plan* (TCEMP). However, Fisheries (and Council) do not believe the proponent has clearly demonstrated how the proposal meets the objectives and recommendations within the TCEMP.

- The EA fails to adequately assess the presence of aquatic flora and fauna and the likely impacts of the proposal on these aquatic ecosystems. The assessment should also include assessing the quality and quantity of stormwater and flood water discharges into Cudgen Creek Estuary.

NSW Office of Water (NOW)

- There are alternate options to the applicant's proposed methods for on-going routine maintenance of Blacks Creek for flood management purposes. NOW recommend that Blacks Creek be maintained and managed as a functioning stream and the removal of snags is removed from any management strategy.

- The applicant should consider Blacks Creek not simply as a flood channel, but rather as a beneficial ecosystem that will assist in buffering the impacts of urban development and filters pollutants prior to release into receiving SEPP14 Wetlands.

NSW EPA

- The adequacy of Blacks Creek to mitigate flood flows from the subject lands is critical to the project assessment.

- The discharge point from the Kings Forest site is the current Cudgen Nature Reserve boundary at Blacks Creek and the Project Application cannot rely on future downstream flood mitigation within Blacks Creek or Cudgen Nature Reserve (ie. future dredging, clearing, widening, straightening or other works downstream of the Kings Forest site will not be permitted within Cudgen Nature Reserve.

TSC

- The point where Blacks Creek joins Cudgen Creek is approximately 2km downstream from Cudgen Lake. This is a poorly flushed part of the estuary and it is possible that stormwater inputs to this estuary reach could experience extended residence times and increase algae growth potential. It is also possible that stormwater discharged to Blacks Creek and Cudgen Creek could be conveyed into Cudgen Lake on incoming tides, increasing the nutrient input to this system.

- The potential impact of increased nitrogen discharge to Blacks Creek and Cudgen Creek should be discussed, specifically, the potential for increased risk of eutrophication and sags in dissolved oxygen levels in the creek due to increased frequency and duration of algae blooms.

- One remaining concern with the proposed stormwater design is the low flow pipe. Typically it is the low flow "first flush" that is targeted for treatment, as it is likely to contain the most gross pollutants, sediments, hydrocarbons, and other contaminants. Under the proposed stormwater system it appears that this water would, at least in part, be captured by the low

flow system rather than the bio-infiltration treatment areas, and as such, could be discharged directly to Blacks Creek. These same concerns arise should a chemical spill, sewage overflow etc. enter the stormwater system. Council therefore requests the installation of a treatment basin at the outlet of the low flow pipe, for containment of contaminants prior to discharge to Blacks Creek.

Erosion and Sediment Control Plan (Gilbert & Sutherland, 2011):

The plan proposes monitoring of water quality conditions. The report should identify proposed monitoring locations, and should include monitoring sites within the various areas to be retained, in particular for all SEPP14 wetland areas being retained.

The plan identifies locations for sediment basins, often with one sediment basin per catchment. It is noted that locations for sediment fences are not identified. Further, the catchment boundaries mapped do not appear to cover all construction zones, in particular the proposed road crossing through SEPP14 wetland areas. It is recommended that construction boundaries be added (to a separate map if necessary for clarity purposes) to ensure that all construction zones will receive sediment and stormwater controls. Given the close proximity of construction boundaries to SEPP14 wetlands (ie. a low buffer distance to deal with any failures of sediment fencing or stormwater basins) it is essential that sediment and water quality received is of an extremely high standard. It is recommended that the boundary for any areas of vegetation to be retained have sediment fence controls implemented prior to construction works for each precinct.

The direction of all flow from development areas (via perimeter bund) to sediment basins may cause concentration to a few locations of water flows received by SEPP14 wetlands (and possibly other retained vegetation). It is recommended that confirmation be sought from the stormwater consultant that water flows patterns, which are likely currently broad sheet flow, received by native vegetation (in particular for SEPP14 wetlands) will not be altered by the proposed controls. Should water flow patterns be altered then the sediment and stormwater basin design should be altered to result in the minimum change to current water flow patterns.

Section 3.3 identifies that stockpiled soil should be located 2m+ away from hazard areas (presumably also applying to retained vegetation). This is inadequate, particularly given the sensitivity of SEPP14 wetlands. It is recommended that all stockpiles should be at least 60+m away from SEPP14 wetlands, and at least 30+m away from all retained native vegetation (whichever is the greater distance should apply).

The plan states that “All weather access tracks shall be constructed to all internal water bodies...”. It is not clear where these internal water bodies are and where tracks are to be placed. Wherever possible tracks should not be placed within retained vegetation. If this is not possible, tracks should be specifically identified in an approved VMP, and plaved in locations to minimise environmental impact; and constructed so as to minimise erosion. Any such tracks should also be locked with keys available only to approved personnel.

It is also not clear how sediment and stormwater will be managed for any roads that traverse through environmental protection zones. Given that some roads are proposed through SEPP14 wetlands, it is considered that very rigorous controls indeed will be required, particularly if fill will be placed to build up the road base.

Sterile straw bales should be utilised instead of hay bales to avoid the introduction of potential grass seeds (ie. weeds).

Potential enforcement measures which can be applied, and trigger points for these enforcement measures, should the Stormwater / Sediment Control Plan not meet its objectives should be specified. This should include immediate reporting of incidents to the overseeing authority for breaches with potential to cause harm to the environment.

Site Based Management Plan (SBMP)

The SBMP is an important document for collating all the management plans and presenting all the issues, actions, responsibilities, timing and frequency of monitoring, performance criteria, reporting and corrective measures. The various management plans for the site contained an inordinate amount of repetition of information and but often the level of detail of monitoring and reporting is absent from the individual management plans. Therefore, the SBMP is essential in presenting all the mitigation measures and actions that have to take place to protect the environment and threatened species habitat, during the different phases of the development.

However, ELA believe this document requires the following corrections / additions:

- Requires the threatened flora management actions to be entered into the plan for each of the 4 threatened flora species indentified in the TSMP;
- 15 threatened fauna species have been identified within the TSMPs, with management actions detailed in the for each species. However, the SBMP only addresses 5 of these species. All threatened fauna species in the TSMP need to be added to the SBMP to ensure all of the mitigation and restoration actions are undertaken. In addition, there are a further 12 threatened fauna species that have been recorded on the site or have the potential to occur that are not documented anywhere (see page 75 of the EAR).
- The following should be added to the "Identification of incident or failure" section for the Wallum Froglet and Oblongburra Frog
    - Presence of cane toads breeding within the melon holes
    - Presence of *Gambuzia holbrooki* within melon holes
    - Dense plantings around the melon holes not establishing
- Issues identified for Oblongburra Frog include the *protection and restoration of 2 constructed dams which currently occur in precincts 12 and 13, one of which requires repair.* Precincts 12 and 13 correspond to compensatory habitat area 9 in the acid frog compensatory habitat plan, yet there is no mention of this proposed action in the acid frog plan. Both the acid frog compensatory habitat plan and the SBMP actions should be consistent.
- Responsibility for funding of all management actions should be clearly identified. Currently the EAR identifies the intent to dedicate lands to NPWS, Council, or possibly for other ownership and management. The group(s) to be responsible for and to fund works across all environmental lands (and to control any development impacts) must be very clear so that there are clear lines of responsibility. This is particularly the case at ownership boundaries (for example where development lands adjoin lands to be dedicated to NPWS or Council).
- The SBMP needs to resolve the following conflicts between the various management plans, as suggested by the following agency comments:

- TSC note that the proponent presents plans to re-establish heathland, plant koala food trees and create habitat for acid frogs over many of the same areas. As heathland is not regarded as koala habitat and does not contain koala food trees this is considered inappropriate. It is also proposed to plant koala food trees in the area currently mapped as Littoral Rainforest which is also not koala habitat. Similarly, planting of koala food trees in acid frog habitat would only be appropriate around the margins. The proponent also seeks to re-instate heathland (and koala food trees) in bushfire Asset Protection Zones, which is also considered inappropriate.

- The EPA believe that some the works proposed in the various management plans are inconsistent, rather than overlapping and recommend that the vegetation communities proposed should reflect the communities that would naturally occur on each site or designated work area.

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