



Byron Shire Council

Technical review of West Byron development control plan and reports

June 2017

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1. Introduction

1.1 Purpose of this report

GHD Pty Ltd (GHD) was engaged by Byron Shire Council (Council) to undertake a review of Chapter E8 – West Byron Urban Release Area of the draft Byron Shire Development Control Plan 2014 (draft DCP) and supporting specialist reports in accordance with Council Resolution 16-583.

Council Resolution 16-583 resolved:

1. That subject to peer reviews of frog, koala, traffic, and water and flood management reports, Council approve the Byron Shire Development Control Plan 2014 - Chapter E8 West Byron Urban Release Area and associated amendments to Part A and Part D of the Byron Shire Development Control Plan 2014 in Attachments 1 and 2 at the first Ordinary Meeting after Council's summer recess, and that notice of the decision be published in a local newspaper within 28 days of this decision being made.

This report presents the findings of the review and identifies recommendations for Chapter E8 of the draft Byron Shire DCP 2014.

1.2 Methodology and personnel

A number of background reports and documents were provided to GHD by Council. These were reviewed by GHD technical specialists in each speciality area. The documents reviewed are listed in the following chapters. Document content was reviewed for technical adequacy and alignment with current best practice. Recommendations for amendment of the draft DCP are also provided where relevant.

The personnel involved in the peer review include:

Dr Kirsten Crosby

Kirsten is a Senior Ecologist with over 13 years' ecological survey experience including nine years as a consultant. Kirsten has a strong background in animal ecology and identification, and has field experience throughout NSW, ACT, and parts of QLD and VIC using a wide range of survey techniques. Kirsten has experience with infrastructure projects (electricity, rail, roads, water), urban development (including subdivisions and land release masterplans), and mining and energy (coal mines, sand quarries and wind farms). She has managed ecology teams to prepare comprehensive and detailed reports, including ecological impact assessments and approval documentation. Kirsten also has experience in preparing policy documents for government departments, and fauna management plans and offset strategies for approved projects. She has undertaken pre-clearance surveys and clearing supervision for a range of projects.

Kirsten reviewed the documents relating to koala and frog management.

Dr Rainer Berg

Rainer is a Principal Engineer and has extensive experience in hydrology / hydraulics, stormwater / floodplain management, water resources planning, water sensitive urban design, and catchment management. His strengths are in simulation and modelling. He has also provided advice to government regarding strategic planning for growth centres on flooding and water sensitive urban design. Rainer has managed multidiscipline teams on significant road and rail drainage, master planning, flood mitigation, water resource and catchment management studies. He has experience throughout Southern Africa, United Kingdom and Australia.

Rainer reviewed the documents relating to water and flood management.

Tim Bickerstaff

Tim is a Senior Traffic and Transport Planner with over fifteen years of post-graduate experience across Australia. He has a Master's Degree in traffic planning from Monash University. His background in geography and post-graduate qualifications in traffic planning and engineering provide a well-rounded approach to developing solutions and providing insightful analysis. Tim has provided leadership and technical input on a wide range of traffic and transport projects, including traffic management planning, traffic impact assessment, planning for pedestrians and cyclists, parking strategy, public transport planning, road safety auditing, strategic transport directions, and traffic modelling.

Tim reviewed the documents relating to traffic management.

1.3 Project background

The key background of the West Byron site is as follows:

- 1988 - A 108 hectare site was zoned 1(d) investigation under the *Byron Local Environmental Plan (LEP) 1988*.
- 2002 - The *Byron Bay and Suffolk Park Settlement Strategy 2002* identified about 40 hectares of unconstrained land that was suitable for residential development, but deferred the matter for a number of reasons including it was unlikely to yield affordable housing in terms of low density development and traffic and parking infrastructure concerns.
- September 2009 - The former Minister for Planning declared the site to be a potential State Significant Site under the *State Environmental Planning Policy (Major Development) 2005*.
- October 2011 – Exhibition of draft rezoning proposal for West Byron.
- November 2013 to January 2014 – A second public exhibition was held for the rezoning, voluntary planning agreement and the draft development control plan (DCP).
- November 2014 - The State Significant Site was approved and gazetted by NSW Planning and Environment. The West Byron Urban Release Area included land zoned for a mix of residential, industrial, business, recreational and environmental protection purposes.
- March 2015 - Council was advised by NSW Planning and Environment that it had delegated authority to prepare a DCP for the West Byron Urban Release Area.
- 22 October to 4 December 2015 - The draft DCP was placed on public exhibition for six weeks. Over 750 submissions were received.
- 17 November 2016 – Council resolved to seek peer reviews of frog, koala, traffic, and water and flood management reports.

1.4 Scope and limitations

This report: has been prepared by GHD for Byron Shire Council and may only be used and relied on by Byron Shire Council for the purpose agreed between GHD and the Byron Shire Council as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Byron Shire Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Byron Shire Council and others who provided information to GHD, which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

2. Koala management

2.1 Documents reviewed

The following documents were reviewed:

- Biolink Ecological Consultants (2010). SEPP 44 Koala Habitat Assessment, Ewingsdale Rd, West Byron (including Belongil Fields). Report to Byron Bay West Landowners Association.
- LandPartners (2010). Preliminary ecological assessment; proposed rezoning of land at West Byron. Report to Byron Bay West Landowners Association.
- Australian Wetland Partners (2010). Ecological Assessment. West Byron Project.
- Office of Environment and Heritage (OEH) (2012). Response to proposal to list West Byron Bay Urban Release Area as a State Significant Site. Letter to Department of Planning and Infrastructure.
- Austeco Ecological Consultants (2012). West Byron Urban Land Release Area: Response to submissions by Byron Shire Council and Office of Environment and Heritage - Koala Management. Report to Byron Bay West Landowners Association 06/11/2012.
- Austeco Ecological Consultants (2012). Response to Koala Management in the West Byron Urban Release Area. Report to Byron Bay West Landowners Association 16/11/2012.
- Australian Wetlands Consulting Pty Ltd (2012). West Byron Urban Land Release Area: Response to submissions received during public exhibition- ecological matters. Report to Byron Bay West Landowners Association.
- Byron Shire Council (2016). Byron Coast Comprehensive Koala Plan of Management. Report to Byron Shire Council.
- Department of Environment and Climate Change (DECC) (2008). Recovery plan for the Koala (*Phascolarctos cinereus*).
- Byron Shire Council, June 2016, Draft Byron Shire Development Control Plan 2014: Chapter E8 West Byron Urban Release Area.

2.2 Review findings

2.2.1 Recovery plan for the Koala (DECC 2008)

The Koala inhabits a range of eucalypt forest and woodland communities, and is also known to utilise isolated paddock trees. Throughout NSW, Koalas have been observed to use 66 eucalypt and seven non-eucalypt species. However, in any one area, Koalas feed almost exclusively on a small number of preferred species which vary widely on a regional, local and possibly seasonal basis.

Small, fragmented or highly disturbed habitats are less likely to be able to support Koalas in the long term due to edge effects, limited resource availability and increased predation. Although Koalas do utilise scattered trees in largely cleared environments, travelling across open ground leaves them more vulnerable to threats such as predation. Vegetated links are important to support continued Koala movement; where dispersal and recruitment are impeded by barriers such as large areas of open ground and roads, populations would be expected to decline.

Areas without primary feed trees may not provide important foraging resources and therefore may not necessarily support resident Koala populations, but may still provide resources important to the survival of Koala populations, such as providing links between areas of primary and secondary habitat.

Table 2-1 Threats to the Koala and their relevance to the proposal

Threat	Relevance to proposal
Habitat loss and fragmentation	Highly relevant
Habitat degradation	Highly relevant
Road kills	Highly relevant
Dog attacks	Highly relevant
Fire	Low relevance
Logging	Not relevant
Disease	Highly relevant
Severe weather conditions	Not relevant
Swimming pools	Highly relevant
Over-browsing	Not relevant

Recovery objectives of relevance to the project include the following (DECC 2008):

- Identify and conserve habitat important for Koala conservation.
- Assess the impact of habitat loss and fragmentation on Koala populations.
- Integrate Koala habitat conservation into local and state government planning processes.
- Develop appropriate road risk management in Koala habitat.
- Implement strategies which minimise the impacts of dogs on Koala populations.
- Rehabilitate and restore Koala habitat and populations.

2.2.2 SEPP 44 Koala Habitat Assessment, Ewingsdale Rd, West Byron (including Belongil Fields). (Biolink Ecological Consultants 2010).

Biolink conducted targeted surveys for Koalas in the West Byron Urban Release Area. The main survey results are noted as:

- Swamp Mahogany is the tree species most preferred by Koalas in the site, with faecal pellets recorded beneath 44 percent of the sampled trees of this species.
- The Urban Release Area contains potential Koala habitat as defined under *State Environmental Planning Policy No. 44 – Koala Habitat Protection* (SEPP 44), primarily within Coastal Swamp Forest (containing Swamp Mahogany) but also within largely cleared areas containing scattered trees.
- Core Koala habitat is present in the Urban Release Area given observations of long-term residents and visitors to the adjacent camping area, even though the habitat present is an area too small to contain a self-sustaining population.

Planning recommendations included the following:

- Any development in the Urban Release Area should ideally be based on a principle of no net loss of potential Koala habitat (defined as vegetation communities containing the preferred food tree Swamp Mahogany, or individuals of this species where they occur on otherwise cleared lands).

- The maintenance and enhancement of connectivity between the two cells identified as core Koala habitat in the Urban Release Area should be a primary consideration when planning for development in the eastern portions of the Urban Release Area.
- Enhancement and maintenance of connectivity (vegetation cover) across the Urban Release Area, with particular emphasis on linkages from areas of core Koala habitat to adjoining forest to the southeast, should also be a key aim of Koala management on the Urban Release Area.
- Development design should maximise the retention of native vegetation within areas identified as core Koala habitat.
- All preferred Koala food trees within areas of core Koala habitat are to be retained, and habitat augmentation with the aim of increasing connectivity and provision of linkages should be focused in these areas.
- There should be no net loss of potential Koala habitat.
- Revegetation works for offsetting any removal of potential Koala habitat should be directed with the aim of consolidating and increasing connectivity between areas of potential Koala habitat.
- Excluded development options i.e. excluding development in areas mapped as core Koala habitat but instead developing in areas of potential Koala habitat with replanting as a compensatory initiative.
- Integrated development options i.e. integrating Koala habitat into developed landscapes through larger lot sizes (with retention of food trees), tree plantings and prohibition of domestic dogs.

2.2.3 Preliminary ecological assessment (LandPartners 2010)

Land Partners prepared a preliminary ecological assessment of the West Byron Urban Release Area. They differed in opinion compared to Biolink on the following points relating to Koala habitat:

- While Biolink speculate that Koalas at the site may be part of a population in adjacent land, vegetation mapping indicates this vegetation as being swamp sclerophyll (Paperbark) forest which is unsuitable for the Koala in uniform stands. Based on observations of this forest type in the locality, it would be expected that the occurrence of Swamp Mahogany (a primary feed tree) within these communities would be relatively low.
- Biolink considers that core koala habitat occurs at the site where scat frequencies exceed threshold values which are indicative of core koala habitat. This differs from the definition of 'core koala habitat' under SEPP 44 which is defined as: *"...an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population"*. Given that the sex of the observed animals is not known, preferred habitat (Swamp Mahogany) is relatively small in area and would be unlikely to support many animals, and that historical records in the locality appear scant, it cannot be said conclusively that core Koala habitat occurs.

The recommendations of Biolink with regard to minimising habitat loss (and hence maximising retention of habitat areas), replacing habitat where removed and creating linkages between habitat areas were broadly supported by LandPartners.

2.2.4 Ecological Assessment: West Byron Project (Australian Wetland Partners 2010).

Australian Wetland Partners (2010) prepared the ecological assessment for the structure plan for the project. This report drew on various field surveys conducted in the Urban Release Area over a number of years. The following key points from the assessment relate to Koala habitat:

- The majority of existing Koala habitat (approximately two hectares) will be retained and zoned for Environmental Protection.
- Assisted regeneration of Swamp Mahogany in previously cleared parts of the Urban Release Area will result in the expansion of Koala habitat in the long term.
- In combination, there would be a net gain in Koala habitat at the Urban Release Area over time to offset the small area of habitat removed.
- Other potential impacts to the Koala in addition to habitat clearing may include:
 - Injury/mortality from vehicle strike
 - Injury/mortality from domestic dogs
 - Barriers to movement
 - Drowning in swimming pools

2.2.5 Response to submissions by Byron Shire Council and Office of Environment and Heritage - Koala Management. (Austeco 2012)

Austeco Ecological Consultants (2012) raised various concerns regarding the West Byron Urban Release Area, with respect to Koalas and Koala habitat:

- Koala habitat in the Urban Release Area is small and highly fragmented with a large edge to area ratio.
- This habitat is likely to be isolated from Koala habitat to the south by Belongil Creek and an associated drainage canal.
- Existing Koala habitat in this area has a low to negative conservation value due to its location in a 'cul de sac' adjoining a busy road where the risk of collision with motor vehicles is high.
- This area may currently act as a sink habitat where mortality exceeds reproduction.

Recommendations included:

- Vary the preliminary DCP to require the construction of at least one Koala bridge across Belongil Creek to the east of the Urban Release Area.
- Retain the current boundaries of the E2 and E3 zones in the short term (until completion of vegetation restoration and stormwater infrastructure works) but consider rezoning primary and secondary Koala habitat restoration areas to E2 after restoration works have been completed and vegetation community boundaries have been confirmed and mapped on the ground.
- Investigate the use of community title on the residential areas east of the road reserve as a mechanism for funding and management of E2 and E3 zones in the long term (after vegetation restoration and capital infrastructure works are complete).
- Amend the draft DCP to provide further certainty that standard Koala friendly urban design principles and management measures will be implemented in residential zones and lots adjoining Koala habitat.

- Amend the draft DCP to include the construction of Koala proof fencing between the Koala habitat restoration areas and any adjoining residential development (except where existing retained Koala habitats extend to the west).
- Exclude residential perimeter roads from any E2 and E3 zones.

2.2.6 Additional response to submissions by Byron Shire Council Koala Management (Australian Wetlands Consulting 2012)

Australian Wetlands Consulting (AEC, 2012) disagreed with Council's mapping of Koala habitat and corridors in and around the Urban Release Area. AEC (2012) noted that:

- Council's mapping of Koala habitat included large areas of cleared and non-forested land.
- Based on surveys, there is no certainty that a viable Koala population exists in the West Byron Urban Release Area.

2.2.7 Response to proposal to list West Byron Bay Urban Release Area as a State Significant Site. Letter to Department of Planning and Infrastructure (OEH 2012)

Issues and recommendations raised by OEH (2012) included:

- The proposed E3 zone is not adequate for protecting areas of high conservation value as the uses in this zone have the potential to adversely impact such values. It is recommended that E2 zones and offset areas are set aside as high conservation value. The proponent should rationalise the areas proposed for E3 zoning and exclude future infrastructure (roads/stormwater) from E2, E3 and offset areas.
- There are no adequate measures to address future impacts on the Koala. Recommend a legal binding agreement to offset impacts or apply E2 zoning to offset areas and a revised zoning plan addressing impact on the Koala population.
- The land proposed for environmental conservation is not suitable for transfer into the National Parks estate. Land should be subject to legally binding agreements with appropriate funds for future maintenance.
- Some detailed controls are to be incorporated into the DCP, including management of adverse land use within the E2 or E3 zones, and Koala-friendly designed fencing of the E2 and E3 zones.

2.2.8 West Byron Urban Land Release Area: Response to submissions received during public exhibition- ecological matters (Australian Wetlands Consulting Pty Ltd 2012)

Australian Wetlands Consulting (2012) made a number of responses to submissions received on their ecological assessment report (AWC, 2010). Those of relevance to the Koala included:

- Master planning of urban development and preparation of the detailed DCP should consider the principles of a Koala Plan of Management (KPoM) and provide clear guidance for future development applications and Koala management.
- Retention of habitat within E2/E3 zones provides for habitat protection for the Koala.
- Nearly all Koala habitat in the Urban Release Area is within environmental protection zones (E2 or E3).
- The substantial areas of revegetation proposed at the east of the Urban Release Area will include preferred Koala feed tree species and will be designed to encourage Koala movement outside urban areas.

- Dog exclusion measures are recognised as being desirable within the eastern part of the Urban Release Area to protect fauna habitat and can also be included within the DCP.
- Other mitigation measures (fencing, road speeds, signage etc) can also be included within the DCP and/or prescribed within a dedicated KPOM.
- The majority of vegetation to be cleared is not of high conservation value (HCV). HCV mapping by Council (2004) is incorrect in many places.

2.2.9 Office of Environment and Heritage comments (February 2014)

OEH (2014) commented on the draft DCP that was released in 2013 for review. No specific comments relating to Koala management were provided, however the following comments are of relevance to the protection of Koala habitat:

- OEH supported the revised zoning of the majority of conservation zones as the more conservation focused E2 zones. OEH also suggested that an area of land in the southwest of the Urban Release Area changed to E3 in the 2013 version, should be reconsidered for E2 zoning as originally proposed.
- The DCP should adopt the avoid - mitigate - offset approach. If impacts on areas in E3 conservation zones which contain biodiversity values and are also earmarked for infrastructure cannot be avoided, then they should be mitigated as far as is practicable and any residual impacts compensated by the provision of suitable offsets by the proponent.
- Consideration should be given to the voluntary planning agreement (VPA) applying to both the E2 and E3 zones with respect to the rehabilitation of conservation areas.

2.2.10 Byron Coast Comprehensive Koala Plan of Management. Report to Byron Shire Council (Byron Shire Council 2016).

The Comprehensive Koala Plan of Management (CKPoM) for the Byron Shire includes the West Byron Urban Release Area within the West Byron Key Management Precinct (KMP). The management objectives for this KMP are to consolidate the existing sub-populations of the Koala and improve the exchange of genetic material with other KMPs to the north and south (Council 2016). Areas within the West Byron Urban Release Area are mapped as potential Koala habitat.

Habitat buffers adjoin areas of core and potential Koala habitat and can provide for the likely extension of Koala activity and help protect areas from external impacts. Habitat buffer areas may include vegetated areas, semi-vegetated areas or cleared land. Habitat buffer management principles include:

- Due to their role in protecting and allowing expansion of existing habitat, buffers should be considered a priority for habitat restoration work.
- Where buffers are not fully vegetated the establishment of scattered preferred koala habitat trees that provide a discontinuous canopy (at a minimum) is encouraged.

Management of road strike is identified as a key management action in the CKPoM. Council will prepare a koala road-kill mitigation strategy for those roads within the Koala planning area (other than the Pacific Highway) identified by the Habitat Study as Koala black spots, notably Ewingsdale Road adjacent to the West Byron Urban Release Area. Management measures to be considered include:

- Traffic calming devices.
- Koala warning signs.
- Lighting.

- Road verge management, including vegetation management.
- Fauna exclusion fencing and underpasses.
- Driver education.

Council will amend the Companion Animals Management Plan to include specific measures to reduce the impact of domestic dogs on koalas.

The CKPoM identifies the requirements for various levels of Koala assessment reports that would be required to accompany development applications. These reports are required for sites that contain core Koala habitat (as defined in SEPP 44). No core Koala habitat is mapped in the West Byron Urban Release Area.

2.3 Recommendations for the draft DCP

2.3.1 Management measures outlined in the DCP

Biodiversity and vegetation management measures are outlined in section E8.10.5 of the draft DCP. The measures have taken into account many of the issues raised in the documents reviewed above. In particular:

- A VPA has been signed between the Minister for Planning and the landowners requiring a vegetation management plan to be prepared addressing matters such as a program and implementation strategy of environmental management works for the land zoned E2 Environmental Conservation.
- Vegetation management however will need to apply to the entire Urban Release Area, and any native vegetation that is proposed to be removed from within the urban footprint will need to be appropriately compensated.

The DCP will protect biodiversity values of the Urban Release Area within E2 and E3 zoned land and prescribes the preparation of a comprehensive Biodiversity Conservation Management Plan for the Urban Release Area. This plan will cover:

- Vegetation to be retained.
- Vegetation management works, including in the E2 and E3 zoned land.
- Management of exotic pests.
- Ongoing monitoring.
- Vegetation Management Plan for the E2 zone, including:
 - Management actions for threatened species, including the Koala.
 - Belongil Creek Plan of Management.
 - SEPP 44 Koala habitat protection, including preparation of a KPoM, including:
 - Identification of Core Koala habitat.
 - Rehabilitation of Koala habitat, with a focus on providing habitat links.
 - Measures to protect existing Koala habitat.
 - Details of a Koala crossing over/under Ewingsdale Road.
 - Other measures to protect Koalas, including fencing, dog prohibition, pool safety and so on.
- Offsetting of impacts that cannot be avoided.

Any future development applications for land within the Urban Release Area must be prepared in accordance with the *Environmental Planning and Assessment Act 1979* (EP&A Act), and must consider potential impacts on:

- Threatened biota listed under the *Threatened Species Conservation Act 1995* (TSC Act) and matters of national environmental significance (MNES) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- Areas mapped under *State Environmental Planning Policy No. 14 – Coastal Wetlands* (SEPP 14) and SEPP 44 Koala habitat.

2.3.2 Specific comments on the DCP and recommendations for revisions

As detailed in Section 2.3.1, a range of measures are included in the DCP to protect and enhance Koala habitat. In particular, these include protection of large areas of potential or Core Koala habitat in E2 conservation areas, and rehabilitation of habitat areas to improve Koala habitat and connectivity. Fencing and prohibition of dogs will further protect the Koala population that occurs in the area. It is considered that the DCP adequately addressed Koala habitat protection. It is recommended that the Byron Bay West Landowners Association consult with Roads and Maritime regarding the location and type of Koala crossing proposed for Ewingsdale Road. A number of dedicated culverts for Koala connectivity have been included in the upgrade of the Pacific Highway on the North Coast, and include a range of features to encourage use by Koalas.

Comments and suggested revisions of the DCP relating to the Koala are detailed in Table 2-2.

Table 2-2 Comments and suggested revision of the DCP in relation to the Koala

Heading	Section number	Current DCP wording	Comment and suggested revision
E8.10.5.1 Biodiversity and Vegetation Management	Performance Criteria 3.	Protect core koala habitat areas from development that would compromise habitat quality and integrity and enhance koala habitat to provide connectivity links to facilitate the natural movement of koalas.	Many of the reports reviewed note that Core Koala Habitat is not present, as the site does not support breeding individuals. Rather the site contains potential Koala habitat and links. Revise this point to include potential and core Koala habitat.
	Prescriptive Measures 1 (h) (iii)	Core Koala Habitat on and surrounding the site. Rehabilitation of habitat in the E Zones to focus on Koala Habitat restoration to address any compensation requirement and to provide or embellish linkages between Core Koala habitat areas.	Revise this point to include potential and core Koala habitat.

3. Frog management

3.1 Documents reviewed

The following documents were reviewed:

- Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2011). *Environment Protection and Biodiversity Conservation Act 1999* draft referral guidelines for the vulnerable wallum sedge frog, *Litoria longburensis*.
- Landmark Ecological Services (2017). Comments on the management of Wallum frog habitat at West Byron as proposed in the West Byron DCP. Letter to Byron Shire Council.
- Fitzgerald, M. (2017). West Byron acid frogs - Wallum Sedge Frog *Litoria longburensis*. Letter to Byron Shire Council.
- Meyer, E., Hero, J-M., Shoo, L. and Lewis, B. (2006). National recovery plan for the wallum sedgefrog and other wallum-dependent frog species. Report to Department of the Environment and Water Resources, Canberra. Queensland Parks and Wildlife Service, Brisbane.
- NSW Office of Water (NOW) (2011). Exhibition of West Byron Bay State Significant Site Study.
- Office of Environment and Heritage (OEH) (2012). Comment on the proposed rezoning of the West Byron State Significant Site.
- Byron Shire Council, June 2016, Draft Byron Shire Development Control Plan 2014: Chapter E8 West Byron Urban Release Area.

3.2 Review findings

3.2.1 National recovery plan for the wallum sedgefrog and other wallum-dependent frog species (Meyer et al 2006)

According to the recovery plan, essential habitat for these species may be defined as freshwater wetlands and associated vegetation communities occurring on low nutrient sandy soils along the east coast of Australia. While nutrient poor, these soils support a range of vegetation types, including melaleuca (paperbark) woodland, sedgeland, rainforest, eucalypt forest and heath.

For breeding habitat, the Wallum Sedgefrog shows a clear preference for ephemeral (seasonally inundated) perched swamps with emergent sedges. The more widely distributed Wallum Froglet is more commonly associated with ephemeral swamps and soaks than lakes and will also breed in disturbed habitat more readily than the Wallum Sedgefrog.

The Wallum Froglet may disperse into eucalypt forest and woodland and/or rainforest after breeding. The Wallum Sedgefrog, by contrast, appears more sedentary, sheltering amongst sedges, reeds and ferns during dry periods, however during wet periods it too may move away from breeding areas.

Populations under greatest threat, in the short term, are those, which occur on freehold land in mainland coastal areas. In these areas, habitat has become highly fragmented leaving many small isolated populations. These populations may be at greater risk of extinction because of limited gene flow, reduced likelihood of immigration, and greater vulnerability to stochastic demographic and genetic processes.

Known and potential threats are listed in Table 3-1 in order of importance based on current knowledge. The relevance of these threats to the proposal is also identified.

Table 3-1 Threats to wallum-dependent frogs and their relevance to the proposal

Threat	Relevance to proposal
Habitat loss	Highly relevant
Habitat degradation, including trampling of reed beds, change in hydrology, habitat eutrophication and pollution	Highly relevant
Habitat fragmentation from land clearing	Highly relevant
Inappropriate fire regimes	Not relevant
Predation by the introduced mosquitofish	Highly relevant
Use of biocides in weed and mosquito control	Highly relevant
Pig damage	Not relevant
Exotic disease	Highly relevant
Vehicular traffic	Highly relevant

The protection of wallum frog habitat from human impacts is essential for the recovery of species listed in the recovery plan, as is management of habitat/populations in parks, reserves and state forest. Rehabilitation of disturbed wallum frog habitat in protected areas can help offset habitat loss. Revegetation of corridors linking protected areas can also help, facilitating movement of wallum frogs between wetlands.

3.2.2 Draft referral guidelines for the vulnerable wallum sedge frog, *Litoria olongburensis* (DSEWPaC 2011)

An important population of a species listed as vulnerable under the EPBC Act, such as the Wallum Sedge Frog, is one that is necessary for the species' long-term survival and recovery (DSEWPaC 2011). The Wallum Sedge Frog is highly restricted in terms of its habitat requirements: populations and suitable habitats are extensively isolated across the species' distribution. Therefore, the department considers that a large majority of Wallum Sedge Frog populations may meet the important population criteria. For example, small, isolated populations occurring along the mainland coast, and populations occurring in protected areas may be essential for maintaining the dispersal, breeding and genetic diversity of the species over the long term (DSEWPaC 2011).

The draft referral guidelines (DSEWPaC 2011) identifies the following actions that have a high risk of significantly impacting populations of this species:

- A change in the ecological character or function of the natural environment within 100 metres of habitat for an important population of Wallum Sedge Frogs (e.g. through actions such as the clearing or burning of vegetation, or the drainage, flooding, or infilling of wetlands).
- Actions resulting in the alteration of the existing natural hydrological regime and/or surface water or groundwater quality within 100 metres of habitat for an important population.
- The fragmentation of connective habitat corridors between breeding habitats, or within 500 m of breeding habitats, resulting in the isolation or fragmentation of one or more important populations.
- Actions resulting in the spread of amphibian chytrid fungus to a population of Wallum Sedge Frogs.
- The deliberate or accidental introduction of animal or plant pests, predators, or competitor species to the habitat of an important population.

3.2.3 Ecological Assessment: West Byron Project (Australian Wetland Partners 2010)

Australian Wetland Partners (2010) prepared the ecological assessment for the structure plan for the project. This report drew on various field surveys conducted at the Urban Release Area over a number of years. The following are their main points relating to habitat for the threatened Wallum Froglet and Wallum Sedge Frog:

- No habitat for the Wallum Sedge Frog would be removed and all known habitat retained. The Structure Plan has not made any specific allowance for the retention of Wallum Sedge Frog (and Wallum Froglet) habitat in the west of the Urban Release Area, west of Melaleuca Drive. This area would be too small to merit specific zoning, but core habitat (as identified in the habitat mapping) will be identified within the DCP for the Urban Release Area to ensure that this area is retained.
- Potential impacts on Wallum Sedge Frog habitat in the east of the Urban Release Area (eastern watercourse) are likely to be relatively low due to the retention of habitat, the provision of vegetated buffers and the presence of an established watercourse with several pools for the free movement of individuals. While some potential for roadkill of individuals traversing habitat areas exists, this could be largely ameliorated by appropriate design of culverts and road structures.
- Extensive areas of both primary (breeding) and secondary (foraging) Wallum Froglet habitat would be retained while up to 4.66 hectares of habitat may be removed (much of which includes areas of low-lying grassland prone to periodic inundation). Potential impacts on the species could include changes in water quality, human visitation (trampling) and mortality from vehicles. However, nearly all habitat to be retained has good connectivity with protected SEPP 14 wetlands to the south and east and so isolation or restriction of movement is not likely to be significant.
- A specific habitat management plan will be prepared for the Wallum Froglet and Wallum Sedge Frog species to oversee the retention, protection, and restoration of habitat. Habitat will be retained within designated habitat areas with opportunities for habitat creation within constructed wetlands for stormwater detention, or in constructed wetlands for frog habitat. Procedures to provide appropriate hydrological regimes in artificial wetlands (stormwater retention areas) will be included in the plan. Habitat areas should be designed to be consistent with the species' habitat requirements and monitor outcomes.

3.2.4 Exhibition of West Byron Bay State Significant Site Study (NOW 2011)

NOW (2011) notes that the southern and eastern boundary of the property is adjacent to a SEPP 14 wetland. The majority of the Urban Release Area is also subject to *State Environmental Planning Policy No 71—Coastal Protection* (SEPP 71) with the exception of a portion of land to the west. The wetlands surrounding the Urban Release Area are zoned 7(a) (Environment Protection Wetlands) under the Byron LEP 1988. The north-eastern boundary of the Urban Release Area is adjacent to Cumbebin Swamp Nature Reserve (Reserve No.0781). The soils are generally poorly drained podzols which are of low fertility and water-holding capacity, strongly acid, permeable, and often waterlogged with permanent high water tables (NOW 2011).

NOW (2011) makes the following comments that are of relevance to habitat for frog species:

- The proposal must not contaminate groundwater quality (NSW Groundwater Quality Protection Policy 1998) or impact on groundwater dependent ecosystems (GDEs) (NSW Groundwater Dependent Ecosystem Policy 2002).

- The applicant should address the likelihood for groundwater contamination and outline any protective measures to minimise the threat.
- The proposal must be consistent with and consider the NSW State Rivers and Estuaries Policy 1993, to sustainably manage rivers, estuaries and wetlands and where possible slow, halt or reverse geomorphic, biologic and chemical degradation.
- The applicant must specifically address the potential impacts of surface water runoff and infiltration on the nearby groundwater sources and SEPP 14 wetlands.

3.2.5 Comment on the proposed rezoning of the West Byron State Significant Site (OEH 2017)

The OEH (2017) noted that the two species of threatened frog, the Wallum Sedge Frog and the Wallum Froglet, were recorded in the area proposed for zoning as urban and business purposes. The following comments were made:

- Both of these frog species are considered to be able to withstand moderate impacts.
- Firm agreements should be required to offset any impacts through appropriate management and rehabilitation of areas of habitat proposed for E2 and E3 zoning elsewhere on the State Significant Site.
- The commitments provided in the reports are insufficiently firm or detailed to demonstrate that an 'improve or maintain' outcome would be achieved for these species.

The OEH can support the proposal subject to the potential adverse impacts on threatened species being addressed through:

- Appropriate zoning and associated restrictions on land uses.
- Appropriate management and rehabilitation of proposed compensatory habitat being implemented through legally binding agreements.

3.2.6 Comments on the management of Wallum frog habitat at West Byron as proposed in the West Byron DCP (Landmark Ecological Services 2017)

Landmark Ecological Services (2017) considers that the proposed management of the Wallum Sedge Frog and Wallum Froglet habitat detailed in the West Byron DCP has no prospect of achieving the maintenance of viable populations or suitable habitat for these species in the Urban Release Area. In particular, the high density of development would lead to detrimental impacts on ground and surface water levels and quality, as well as a range of other threats.

The following recommendations were made:

- Buffering the entire western wetland and the adjoining section of the western drain along its full extent, to the north and east, with a minimum 50 metre wide stand of planted Broad-leaved Paperbark, itself surrounded on its outer edge with a dense 20 metre wide buffer of sedges.
- The western wetland should be connected via a minimum 100 metre wide corridor of planted Broad-leaved Paperbark to habitat adjoining the development footprint to the south and/or south-west.
- Acquisition of a suitable portion of Wallum Frog habitat on the adjoining property to the southwest as compensatory habitat to offset Wallum habitats destroyed by the development.

- All surface water from the Urban Release Area and the industrial sites across Ewingsdale Road (which currently enters the drain on the site) should be prevented from entering this enhanced wetland system.

This letter also noted that these measures may assist with the maintenance of a viable population of Wallum Froglets, but probably not the Wallum Sedge Frog, due to the density of residential development and the associated changes to ground and surface water levels and quality in particular.

3.2.7 Letter to Byron Shire Council regarding West Byron acid frogs (Fitzgerald, 2017)

A letter to Council from Mark Fitzgerald, an ecological consultant (dated 30 January 2017), outlined the following issues for the Wallum Sedge Frog with respect to the draft DCP:

- Measures to conserve the frog are likely to be inadequate, and the local population is likely to become extinct.
- Provision of pools will not benefit the Wallum Sedge Frog, but rather increase a known and listed threat, predation by the Plague Minnow *Gambusia holbrooki*.
- The species is unlikely to use drains to disperse.
- The likely practical inability to maintain groundwater levels or groundwater quality within the development would threaten the viability of the local population of the frog.

Fitzgerald (2017) made the following recommendation:

- Extensive buffering of the known western Wallum Sedge Frog population location with native wallum vegetation, essentially paperbarks and sedges, to the greatest extent practically possible.

3.3 Recommendations for the draft DCP

3.3.1 Management measures outlined in the DCP

Biodiversity and vegetation management measures are outlined in section E8.10.5 of the draft DCP. The DCP will protect biodiversity values of the Urban Release Area within E2 and E3 zoned land and prescribes the preparation of a comprehensive Biodiversity Conservation Management Plan. This plan will cover:

- Management actions for threatened species, including the Wallum Sedge Frog and Wallum Froglet.
- Belongil Creek Plan of Management.
- Offsetting of impacts that cannot be avoided.

Any future development applications for land within the Urban Release Area must be prepared in accordance with the EP&A Act, and must consider potential impacts on:

- Threatened biota listed under the TSC Act and MNES listed under the EPBC Act.
- SEPP 14 wetlands and SEPP 44 Koala habitat.

Further information relating to wallum habitat is covered in the Section E8.10.8.3 (Groundwater) and Section E8.10.4 (Stormwater management). Objectives of the groundwater section include maintaining groundwater quality and levels in the vicinity of wallum frog habitats and wetlands. Stormwater is also to be managed to maintain appropriate water quality and levels and provide habitat for wallum frogs.

3.3.2 Specific comments on the DCP and recommendations for revisions

As discussed in Section 3.3.1 above, the DCP has been revised in regards to concerns relating to habitat for the two wallum sedge frog species. This includes protection of much of the habitat in E2 conservation areas, rehabilitation works, management of habitat areas, maintenance of appropriate groundwater quality and levels, and appropriate stormwater management. The OEH (2017) noted that management and rehabilitation of proposed compensatory habitat must be implemented through legally binding agreements. A vegetation management plan for the E2 conservation zone is required under the VPA and will be incorporated into the Biodiversity Conservation Management Plan, which also includes offsetting of impacts of development of the site that cannot be mitigated. It is assumed that offsetting would be undertaken according to an approved scheme (i.e. Biobanking).

Comments relating to the wallum-dependent frogs are detailed in Table 3-2. In particular, mention of these frogs should be clarified so that it includes both species, and cannot be taken to only refer to the Wallum Froglet.

Table 3-2 Comments and suggested revision of the DCP in relation to wallum-dependent frogs

Heading	Section number	Current DCP wording	Comment and suggested revision
E8.10.5	Introductory paragraph	The subject site provides important habitat for a range of species and ecological communities including koalas, Wallum Froglet, blossom bat and remnant coastal cypress pine communities.	Only the Wallum Froglet is mentioned in the introductory paragraph. Include mention of the Wallum Sedge Frog as this species is also known to occur at the site.
	Performance criteria 7.	To identify, protect and maintain wallum frog habitat areas where appropriate and to provide additional wallum frog habitat areas within the West Byron Site, so that there is no net loss in habitat.	There is no mention in this section of the Wallum Sedge Frog. This performance criteria should also include the protection and enhancement of Wallum Sedge Frog habitat.
E8.10.8.3 Groundwater	Objectives 2	To maintain existing groundwater level in the vicinity of wallum frog habitats and wetlands.	Amend to say Wallum Froglet and Wallum Sedge Frog habitats to avoid confusion over which species the DCP is referring to.
	Performance Criteria 2	Groundwater quality is to be maintained and levels are not lowered in the vicinity of wallum frog habitats or wetlands.	As above.
	Prescriptive Measure 3	The pH and water levels of groundwater near and or adjacent to wallum frog habitat and wetlands not to be altered such that it impacts on the health of that habit for the frogs.	As above. Change 'habit' to 'habitat'.

Heading	Section number	Current DCP wording	Comment and suggested revision
E8.10.4 Stormwater Water Management	Performance Criteria 7.	Stormwater is managed to maintain appropriate water quality and levels for wallum frog habitat	Change to Wallum Froglet and Wallum Sedge Frog
	Prescriptive measure 1 (o)	Identification of all areas proposed for fill or other major earth works and an assessment of impacts on stormwater runoff, ground water levels, acid sulphate soils and wallum frog habitat and identification of effective mitigation measures where impacts can't be avoided.	As above

4. Traffic management

4.1 Documents reviewed

The following documents were reviewed:

- Veitch Lister Consulting (VLC) (2011). West Byron Development Transport Study.
- Veitch Lister Consulting (2011). West Byron Development Transport Study – supplementary Report on changes in level of service.
- Veitch Lister Consulting (2012). Byron Bay Traffic Microsimulation Study – model development and calibration.
- Byron Shire Council, June 2016, Draft Byron Shire Development Control Plan 2014: Chapter E8 West Byron Urban Release Area.

4.2 Review findings

4.2.1 West Byron Development Transport Study (VLC 2011)

The West Byron Development Transport Study was produced by Veitch Lister Consulting (VLC), who were commissioned by the Byron Bay West Landowners Association to undertake a transport study for the 108 hectare greenfield urban development at West Byron.

The basis of the study was VLC's proprietary travel forecasting model of south-east Queensland and northern NSW (Zenith), with forecasts produced for a 2008 base year, and future scenarios for 2018 and 2028. This report documents details of the model calibration and validation, and the various parameters used by the model. The model is reported as having a very good level of calibration across the wider model area, and within the Byron Shire in particular. The model coverage was refined in the vicinity of the study area, for the purposes of this study. The model is calibrated to traffic counts from the tourist low season, during school term.

For the West Byron study area, the forecast development is for a population of some 2,180 people in 856 separate households, with 380 jobs. This development would generate 6,000 traffic movements per day.

Several scenarios were run for the 'base case' (no West Byron development). Similar results were observed for both 2018 and 2028 as follows:

- Base case (no development, no network changes):
 - 24 percent increase in traffic volumes on Ewingsdale Road over 10 years to 2018, with 34 percent over 20 years to 2028.
 - Lawson Street/ Jonson Street roundabout near capacity in 2018, and well over capacity by 2028.
- Four-lane Ewingsdale Road:
 - Improves safety for pedestrians and vehicles, but no major improvement in traffic performance.
 - Future provision for this widening should be made.
- Mini bypass (connecting Jonson Street to Butler Street in the vicinity of Marvell Street):
 - Over 30 percent reduction in traffic on Lawson Street at the level crossing, and 48 percent reduction on the northern end of Jonson Street.
 - Significant traffic reductions in the high pedestrian areas of northern part of the town centre, but little impact on the southern part of the town centre.

- Long bypass, with a connection across the railway at Browning Street:
 - Over 22 percent reduction in traffic at Lawson Street level crossing, and 36 percent on the northern end of Jonson Street.
 - Adding the Marvel Street connection over the rail line (as per the mini bypass) increases the traffic reduction to 35 percent in Lawson Street and 53 percent in Jonson Street.

The Transport Study recommends that the West Byron development be serviced by two separate accesses onto Ewingsdale Road. The development does not have a significant impact on the Base Case results when considering the mini bypass and the long bypass.

Recommended road infrastructure improvements to 2018 include:

- Mini bypass with connection across the railway line at Marvell Street:
 - Single lane roundabouts at Jonson Street/ Marvell Street (with dedicated left turn lanes) and Butler Street/ Bypass intersection.
 - Two-lane roundabout at Butler Street/ Shirley Street/ Lawson Street intersection.
- Dual lane roundabouts on Ewingsdale Road at McGettigans Lane, Bayshore Drive and at the SAE Institute on Ewingsdale Road.
- Pedestrian/ cycleway along the southern side of Ewingsdale Road.
- Two accesses to the West Byron development, at Bayshore Drive and the SAE Institute.

These recommendations would be sufficient to accommodate the full West Byron Bay development with 2018 traffic volumes. Additional requirements to 2028 would include:

- Maintain the corridor to widen Ewingsdale Road to four lanes.
- Parking restrictions in Shirley Street near Butler Street to provide four moving lanes.
- Maintain the option of construction the long bypass, maintaining the Marvell Street connection.

Commentary

The use of the Zenith strategic model for this purpose is considered appropriate, as it provides a high level indication of traffic impacts of the proposed development and other changes to the road network. Limited detail is provided in the report, with the main conclusions appearing to be drawn based on changes in traffic volumes at key locations, rather than on a specific assessment of need (although this is addressed in the Supplementary Report, discussed in Section 4.2.2).

The construction of either bypass option will have a positive impact on traffic conditions and amenity in the town centre, but will have minimal effect on Ewingsdale Road and access to and from the West Byron Urban Release Area.

4.2.2 West Byron Development Transport Study Supplementary Report on Changes in Level of Service (VLC 2011)

The supplementary report provides more detailed information on the existing performance of key intersections on Ewingsdale Road and within the Byron Bay town centre.

Existing operation of Ewingsdale Road is level of service (LOS) D in the weekday peaks, reducing to LOS E in high tourism periods. With future traffic growth, a reduced LOS is predicted in the future, even without the West Byron Urban Release Area. The recommendation is that Ewingsdale Road needs to transition from a rural road to an urban road, with safer, higher capacity intersections and lower speed limits.

Commentary

Existing and forecast LOS within the study area were determined with reference to Austroads criteria for two-way rural roadways (for Ewingsdale Road) and SIDRA intersection modelling for key intersections. The assessment acknowledges the limitations of the Austroads LOS methodology for Ewingsdale Road, particularly as the role of this corridor becomes increasingly focussed on providing access to and from adjacent development areas.

SIDRA intersection modelling used volumes extracted from the strategic model in the Transport Study. Whilst this level of analysis may be appropriate for a strategic assessment of traffic impacts, there are limitations on the applicability of specific turn movement volumes to future year forecasts. The model calibration has been based on mid-block traffic volumes, on major roads only. The level of calibration for individual turn movements has not been reported, and so the robustness of the SIDRA modelling cannot be verified.

The West Byron Development Transport Study and the Supplementary Report do not contain many of the elements that would typically be provided in a traffic impact assessment for a proposed development, or rezoning. It is therefore possible that there are other potential impacts that have not been identified. These may relate to such issues as road safety, pedestrian and cyclist access, or integration with the broader Byron Bay area.

Nonetheless, the general findings of the study, regarding upgrades to Ewingsdale Road, and changes to intersection control in and around the town centre, are likely to be reasonable, but should be subject to further detailed investigation before these works are committed to.

4.2.3 Byron Bay Traffic Microsimulation Study – model development and calibration (VLC 2012)

This report details the development and calibration of a microsimulation traffic model for Byron Bay town centre and the West Byron Urban Release Area. Data was collected in late December 2011 (pre-Christmas) and the model represents a seasonal peak. The time of day modelled also reflects the seasonal tourist activity, with 9am to 11am modelled.

The model calibration and validation was considered acceptable for informing future model development.

Commentary

The calibration of the microsimulation model was against quite a small data set, being turn movement counts at the intersection of Lawson Street and Jonson Street. This limits the appropriateness of the model being used outside of the immediate vicinity of this intersection. The model calibration outside this core area, particularly along Ewingsdale Road and in other parts of the Town Centre, is not reported. The modelling of the high tourist season also limits the applicability of the model to broader usage, although the importance of the tourist high season is acknowledged.

It is understood that the microsimulation model has been used to assess the Town Centre bypass options, but its usage beyond this scope is not known.

4.2.4 Draft Byron Shire Development Control Plan 2014 Chapter E8 West Byron Urban Release Area (Council 2016)

The DCP chapter provides a framework to guide the future development of West Byron. The document specifies subdivision, built form, environmental protection and other controls to achieve the vision for West Byron.

Relevant to traffic management are the following sections:

- E8.10.3 (Transport Movement and Street Hierarchy):
 - Dictates the general road layout as per the concept plan (Appendix B of the draft DCP), including limiting the number of accesses off Ewingsdale Road (two, as per the West Byron Transport Study recommendations).
 - An allowance for widening Ewingsdale Road is included in the site boundary (refer Appendix G of the draft DCP).
- E8.10.6 (Public Facilities, Services and Infrastructure):
 - Nominates requirements for car parking, cycleways and footpaths, and bus stops.
- Table E8.3 (Key Controls for Dwelling Houses etc.)
 - Performance Criteria 11 relates to car parking and vehicle access, with minimum parking requirements nominated, along with design stipulations for car parking areas.
- E8.10.10.4 (Industrial Area)
 - Establishes requirements for the industrial area within the West Byron Urban Release Area.

Commentary

The transport provisions of the draft DCP are consistent with the recommendations of the West Byron Transport Study (relating to the external road network), and are reasonable in comparison with similar subdivisions in NSW.

The maximum number of dwellings allowed in the Urban Release Area is not specified in the DCP, and there is therefore the possibility that the actual development will exceed the 856 households assumed by the West Byron Transport Study. Development above this threshold may result in additional impacts on the road network, which have not been taken into account in the transport assessments to date.

4.3 Recommendations for the draft DCP

The draft DCP does not specify the detailed configuration of the two access intersections on to Ewingsdale Road, other than these being nominated as dual lane roundabouts. Due to the limitations of the strategic transport model used in the West Byron Transport Study (VLC 2011), and as background traffic grows on Ewingsdale Road and the Urban Release Area is developed, it is recommended that a more detailed traffic study be undertaken to confirm the appropriate configuration of these intersections and their ongoing future suitability. Such a study should address the requirements of Guide to Traffic Generating Developments (RTA 2002), and consider any additional traffic studies and design plans prepared by Council and submitted with the initial development applications that trigger the roundabout construction to inform the final design. The study should preferably be done to address the requirements of the whole site.

Design investigations should include the two proposed roundabouts, but also pedestrian and cyclist access along and across Ewingsdale Road. If Ewingsdale Road will not be widened prior to the other works, then a staging plan for future widening is required.

If a more detailed traffic study is undertaken to investigate access from the Urban Release Area on to Ewingsdale Road with the initial development applications, individual traffic impact assessments for future development may not be required.

Development of the Urban Release Area should be limited to a maximum of 856 dwellings in total, unless an increased yield is supported by further detailed assessment of the impacts on Ewingsdale Road and the wider road network. The following amendments to the DCP are recommended:

Prescriptive measure 2 under Chapter E8.10.1 Staging Plan to be amended to include the following:

- A detailed traffic study be undertaken to confirm the appropriate configuration of the two roundabout intersections with Ewingsdale Road. The study is to address the requirements of Guide to Traffic Generating Developments (RTA 2002), and consider any additional traffic studies and design plans prepared by Council to inform the final design of the roundabouts. The study should be completed to address the requirements of the whole site based on a maximum yield of 856 dwellings.

The prescriptive measures under Chapter E8.10.3 be amended to include the following additional measure:

- Should the development exceed 856 dwellings, a further traffic impact assessment is required to address impacts on Ewingsdale Road and the wider road network from the increased traffic numbers. The study is to be prepared in accordance with Guide to Traffic Generating Developments (RTA 2002).

5. Water and flood management

5.1 Documents reviewed

The following documents were reviewed:

- BMT WBM (2010) – West Byron Flood Impact Assessment Final Report, R.B17404.001.03, December 2010.
- NSW(2011) - NSW Office of Water, Exhibition of West Byron Bay State Significant Site Study, ER21643, 16 December 2011.
- BMT WBM (2012) - RE: WEST BYRON EXTERNAL SUBMISSIONS, CC: L.B17404.006.WB_Submissions.doc, 22 March 2012.
- WMA Water(2012) - WEST BYRON BAY DEVELOPMENT PROPOSAL REVIEW, FINAL – REVISION 1, June 2012.
- NSW(2012a) – NSW Office of Environment and Heritage, West Byron Bay Urban Release Area, 20 April 2012.
- NSW(2012b) – NSW Office of Environment and Heritage, Re: Proposal to list the West Byron Bay Urban Release Area as a State Significant Site, 16 October 2012.
- NSW(2014) – NSW Planning & Environment, West Byron Release Area Assessment Report, 27 May 2014.
- Byron Shire Council, June 2016, Draft Byron Shire Development Control Plan 2014: Chapter E8 West Byron Urban Release Area.

5.2 Review findings

5.2.1 West Byron Flood Impact Assessment Final Report, R.B17404.001.03 (BMT WBM, December 2010)

This report prepared for the Byron Bay West Landholders Association noted the following key matters:

- In terms of planning considerations:
 - The Climate Change Strategic Planning Policy (Council, 2009, now superseded) adopted the NSW Sea Level Rise Policy Statement (DECC, 2009), sea level rise values of 0.4 and 0.9 metres, which were in turn adopted by the assessment.
 - The assessment notes an increase in rainfall intensity of 10% consistent with the upper range of the Practical Considerations of Climate Change (DECC, 2007) guideline value for the 2070 timeframe. However, this is not considered consistent with the guideline as these increases are for extreme 1-day total rainfall. The guideline recommends sensitivity analysis considering 10%, 20% and 30% increases in rainfall intensity.
 - That the 'Belongil Large Development Flood Planning Level' should be used to define floor levels in the West Byron development. This requires the flood planning level to be the 100 year annual recurrence interval (ARI) design peak flood level, including 30% increase in rainfall intensity, 0.91 metre sea level rise and 0.5 metre freeboard. The assessment however deviates from this and adopted a 100 year ARI design peak flood level including a 10% increase in rainfall intensity, 0.90 metre sea level rise and a 0.5 metre freeboard allowance, arguing inconsistency with the NSW Guideline values.

- In terms of modelling:
 - The Belongil Creek Flood Study (SMEC, 2009) 1D/2D TUFLOW model of the Belongil Creek catchment, at a 10 metre grid resolution and calibrated to the 1974 and 1984 flood events and further validated using the 2003 flood event used as the base model, was used for the assessment. The model was reviewed and updated, correcting some 1D modelling, bathymetry and other issues.
 - The developed case flood modelling assumed filling of areas classified as low/medium flood hazard to minimise the potential for offsite flood impacts. Proposed fill levels include a 0.5 metre freeboard above the 100 year ARI event peak flood level. The drainage channel traversing the site has been allocated a width of 30 metres (current width ≈10 metres).
- The findings were:
 - Assessment of the developed case scenario for the full range of flood events highlights that the proposed site filling resulted in all proposed developable areas being flood free for all flood events, including the probable maximum flood (PMF) event.
 - The flood impact assessment indicated that the developed case flood levels within the main Belongil Creek floodplain were within ±0.01m of the base case peak flood levels, which is the limit of accuracy of the flood model. The proposed development of the West Byron site was found to have a negligible impact on offsite peak flood levels

5.2.2 Exhibition of West Byron Bay State Significant Site Study, ER21643 (NOW 16 December 2011)

Key comments with regards to water cycle, acid sulfate soils (ASS) management and erosion/sediment control by NSW Office of Water included:

- The potential to contaminate groundwater through the direct infiltration of stormwater runoff or the construction of stormwater ponds/lagoons/wetlands that intercept the water table, which may provide further movement of pollutants down gradient that, could discharge to surface waters.
- Ponds/lagoons/wetlands that are constructed below the water table should be lined (clay or geo-fabric) to minimise the hydraulic connection with the surrounding groundwater system or if unlined constructed so that the base of the excavation is one metre above the water table for most of the time.
- The potential of ASS to be exposed when constructing ponds/lagoons/wetlands and drains creating acid leachate.
- Potential of eutrophication and algal blooms in constructed ponds/lagoons/wetlands and the possibility of toxic algae being flushed to surface waters and/or natural wetlands.
- On coastal land of very low relief, flooding is an issue especially considering the longer term possibility of sea level rise and increases in the range of inundation depths.
- All works that intercept groundwater including constructed ponds/lagoons/wetlands must be licensed under Part 5 of the *Water Act 1912*.

The NOW endorsed the recommendation made that both an ASS management plan (ASSMP) and earthworks management plan (EWMP) will be required for future development applications, which must cover construction techniques and materials to be used on the site, and the methods adopted to safeguard the surrounding environment from possible contamination from acidic leachate. In addition, the applicant should ensure proposed earthworks on site provide erosion and sediment control consistent with the Blue Book – Managing Urban Stormwater: Soils and Construction, Volume 1, 4th Edition, 2004 (Landcom) ('blue book').

**5.2.3 Re: West Byron external submissions, cc:
L.B17404.006.WB_Submissions.doc (BMT WBM 22 March 2012)**

In this response, the following key matters are noted:

- Makes reference to a later version of the BMT WBM (2010) report numbered R.B17404.001.04.FIA_Revision.doc (which was not sighted as part of this assessment).
- Notes that in the revised assessment referred to above, the 2100 planning horizon 100 year ARI flood levels within the West Byron site have been revised from 2.6 metres Australian height datum (mAHD) to 3.1mAHD. Including a 0.5 metre freeboard, the 2100 flood planning level is therefore nominated as 3.6mAHD. This aligned with the then Council Policy No 09/10, Climate Change Strategic Planning Policy, which recommended tail water levels as 2.29mAHD (current conditions), 2.89mAHD (2050 climate conditions) and 3.49mAHD (2100 climate conditions).
- In response to a question by NSW Department of Planning, regarding simulated site flood levels of 3.1mAHD when using ocean boundary levels of 3.49mAHD, the response explains that the disused railway line regulates the volume of flow backing up into the Belongil Creek floodplain, where the West Byron site is located.
- Noting that the actual extent and level of fill has not yet been finalised, and will be determined as part of the development planning based on the proposed nature and layout of the development, and taking into account Council planning policy:
 - Residential and commercial lots - filling of currently flood prone land to a level greater than the current climate 100 year ARI peak flood level (greater than 2.3mAHD).
 - Critical infrastructure lots will require filling above the current climate PMF level, greater than 3.1mAHD (which is equivalent to the 2100 planning horizon 100 year ARI flood level).
 - Emergency response - internal road levels within the site should be designed to the current climate PMF level approximately 3.1mAHD.
 - In all cases, the minimum building floor level of 3.6mAHD applies (2100 planning horizon 100 year ARI flood level plus 0.5 metre freeboard).
- Notes that sensitivity testing has shown, rainfall intensity increases of 30% would result in peak flood levels increasing from the defined 2100 planning horizon 100 year ARI event level by approximately 0.1 metres (3.1mAHD to 3.2mAHD). This is less than the adopted 0.5 metre freeboard amount.

**5.2.4 West Byron Bay Development Proposal Review, Final – Revision 1
(WMA Water - June 2012)**

This review concluded the following key matters:

- Council may consider the reassessment of Policy 09/10 (particularly in light of the ongoing Belongil Creek Floodplain Risk Management Study and Plan) in order to ensure that flood planning levels derived using Attachment 1 (Policy 09/10) do not lead to excessive distortion of event probability and also to ensure better consistency with state guidelines.
- A process should be documented for Belongil Creek which identifies those areas sensitive to climate change predictions for sea level rise and rainfall intensity increase and hence those areas where it would be prudent to incorporate climate change predictions into the determination of flood planning levels.

- At most a 10% climate change rainfall increase should be used to set flood planning levels for greenfield and infill sites alike. This would adhere to NSW (2007) and still takes a relatively conservative approach given uncertainties as to actual rainfall increases to be associated with predicted climate change.
- Current flood planning levels as determined by the proponent are appropriate and should be adopted. As currently proposed, the development has no impact on modelled flood levels. This is because the volume of fill associated with the development (see Table 1 of BMT WBM's letter of 22/3/2012), is relatively small compared to the available storage in the entire Urban Release Area (less than 1%).
- WMA Water was satisfied that impact modelling has been undertaken using an appropriate computer model and appropriate parameter settings. The impact modelling undertaken is best practice and may be relied upon. The overall assessment (from a flooding perspective) is consistent with all relevant government guidelines and can be described as best practice.
- Advised, that the proponent include a focus on emergency egress from the site with a need to consider flooding up to and including the PMF event.

5.2.5 Office of Environment and Heritage Comments, West Byron Bay Urban Release Area (OEH 20 April 2012)

This letter referenced BMT WBM (2012) and found:

- Agreement with the methodology for flood assessment at the site.
- Noted that the flood assessment found that a fill platform at the future (2100) 100 year flood plus 0.5 metre freeboard (i.e. 3.6mAHD) had negligible impact on offsite flood levels.
- Supported the 10% increase in rainfall due to climate change rather than Council's (then policy) of 30% rainfall increase. The reason being that a 30% increase only resulted in 0.1 metre increase in Belongil Creek.

5.2.6 Office of Environment and Heritage Comments, Re: Proposal to list the West Byron Bay Urban Release Area as a State Significant Site (OEH 16 October 2012)

The OEH Urban and Coastal Waters Programs Unit (Alstonville) reviewed the proponent's response to issues raised in previous submissions. It noted that no additional information had been provided in relation to flood hazard, other than the response referred to OEH on 4 April 2012 in relation to the draft West Byron Bay Urban Release Area Flood Review. In this regard, it noted that the advice issued to the Department of Planning and Infrastructure on 20 April 2012 was still of relevance and no additional comment was provided in relation to the matter.

5.2.7 NSW Planning & Environment Comments, West Byron Release Area Assessment Report, 27 May 2014

- The department was satisfied with the overall methodology and assumptions used in the flood impact assessment, and considers that the flood planning levels adopted by the proponent are appropriate for the development.
- The department considered the impacts of climate change on flood behaviour had been adequately considered in assessing the flood impacts on the site, and in determining appropriate flood planning levels.

- The department considered that the recommended stormwater treatment approach outlined in the Water Carbon Group's report was satisfactory subject to detailed analysis at the development application stage. Further, provisions in the draft DCP would ensure an orderly delivery of stormwater infrastructure.
- The department considered that the Preliminary ASS Assessment Report adequately identified and addressed management of actual and potential ASS on the site, and that no further assessment was required at that stage of the process.

5.3 Recommendations for the draft DCP

- Chapter E8 of the draft DCP references Chapter C2 – Areas Affected by Flooding for flood risk management. Chapter C2 applies flood related controls using a flood planning matrix and references Council's Climate Change Strategic Planning Policy. Chapter C2 however precedes the adoption of the Belongil Creek Floodplain Risk Management Study and Plan (adopted 9 April 2015). It is therefore recommended that Chapter E8 refers to both Chapter C2 and the adopted Belongil Creek Floodplain Risk Management Study and Plan, requiring consistency with the both documents as appropriate. In addition, the DCP should require that development to be in accordance with the NSW Flood Plain Development Manual, 2005.
- Chapter E8 of the draft DCP references Chapter D6 - Subdivision and the Northern Rivers Development and Design Manual for stormwater management. The Northern Rivers Development and Design Manual is based on Australian Rainfall and Runoff 1987. However, Australian Rainfall and Runoff 2016 has been released as current best industry practice. Council should consider updating Chapter D6 to be consistent with Australian Rainfall and Runoff 2016.

6. Conclusion

GHD was engaged by Council to undertake a review of the draft DCP – Chapter E8 – West Byron Urban Release Area and supporting specialist reports in accordance with Council Resolution 16-583.

Council Resolution 16-583 resolved:

1. That subject to peer reviews of frog, koala, traffic, and water and flood management reports, Council approve the Byron Shire Development Control Plan 2014 - Chapter E8 West Byron Urban Release Area and associated amendments to Part A and Part D of the Byron Shire Development Control Plan 2014 in Attachments 1 and 2 at the first Ordinary Meeting after Council's summer recess, and that notice of the decision be published in a local newspaper within 28 days of this decision being made.

The recommendations identified in Sections 2.3, 3.3, 4.3 and 5.3 of this report are offered for Council's consideration when revising draft DCP.

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Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	K Crosby R Berg T Bickerstaff L King	S Lawer		S Lawer		06/06/2017

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