

The road through the 7(a) zone is permissible by virtue of the provisions of Tweed Local Environmental Plan 2000.

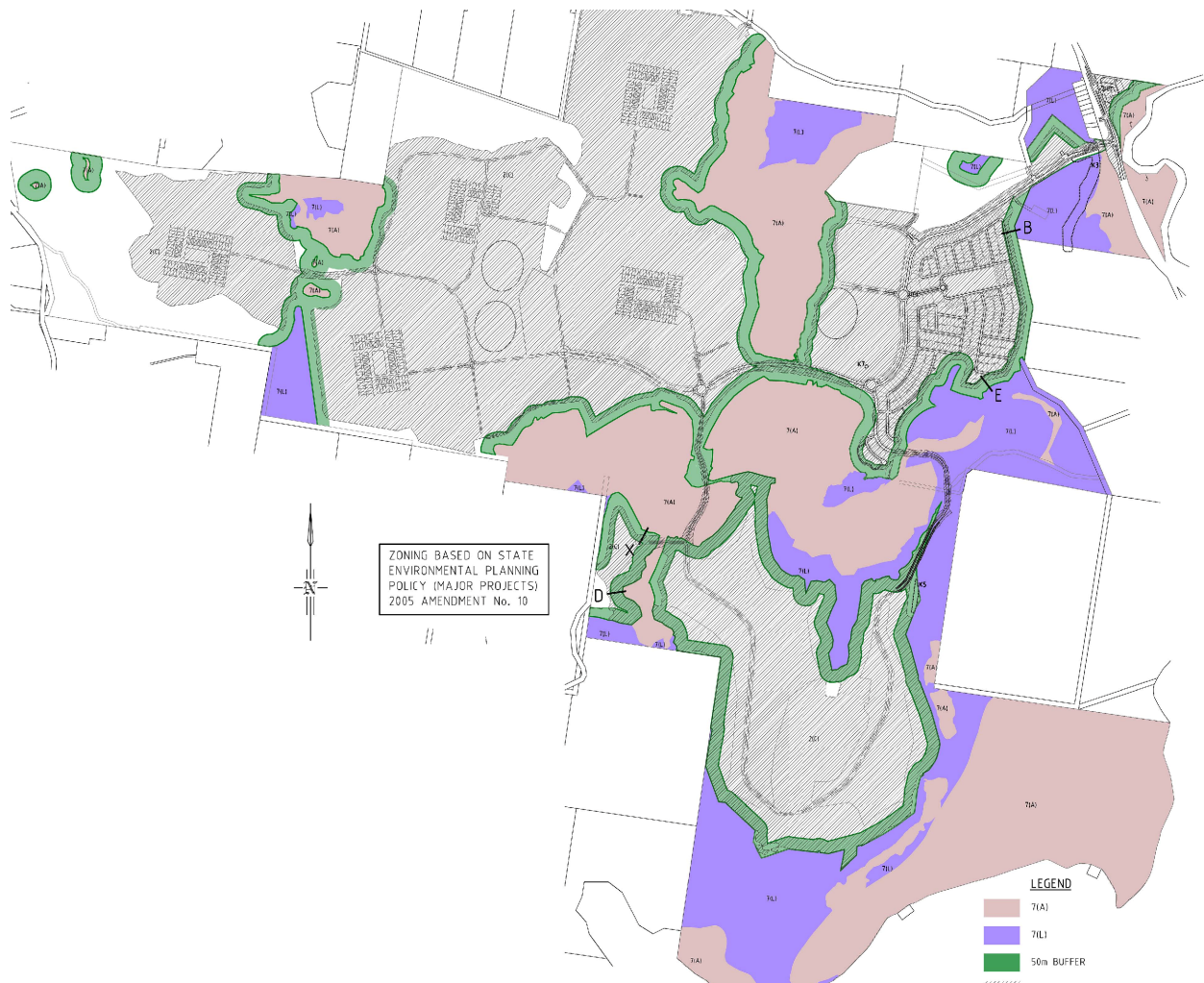


Figure 5 – Proposed works in buffers and 7(a) and 7(l) zones (Source: Mortons Urban Solutions)

Clause 7 - Ecological Buffers

Under Clause 7(1) of the Schedule to the SEPP, consent must not be granted to development on land within an ecological buffer unless the consent authority is satisfied, after considering a detailed environmental assessment, that:

- the development complies with the objectives for ecological buffers and other provisions of the clause; and
- there is no practicable alternative to siting the development within the buffer.

The Buffer Management Plan approved under the Concept Plan (James Warren & Associates, 2009), established the principles for the use of the ecological buffers on the site (with the exception of the Golf Course area) as follows:

- a minimum 30m vegetated inner zone; and
- a maximum 20m outer zone within which roads, footpaths and cycle ways, APZs, stormwater management and passive recreation areas could be located subject to approval in each case.

The Concept Plan foreshadowed that compatible works would be undertaken in the 20m outer buffer. This Project Application proposes the following development within the ecological buffers:

- **Precinct 1:**
 - Bulk earthworks within, and use (including maintenance) of, the outer 20 metres of the buffer as an APZ in accordance with the Bushfire Risk Assessment;
 - a koala proof fence between the inner and outer buffers (there will be no works or impact from the development within the 30 metre inner buffer).
- **Precinct 5:**
 - Bulk earthworks within, and use for roads, APZ and bio-retention swales in the outer 20 metres; the road reserves in the buffer form part of the requisite 20 metre APZ.
 - Use for a koala proof fence and whole or part of a bio retention swale within the 30 metre inner buffer.
 - Removal of all vegetation within the outer 20 metres and in some portions of the inner 30 metres.
- **Precincts 2, 3, 4, 6, 7, 8, 9, 10 and 11:**
 - Bulk earthworks within the outer 20 metres of the buffer only.
- **Precincts 12, 13 and 14:**
 - Bulk earthworks generally within the outer 20 metres and inner 30 metres of the buffer to form the proposed golf course in accordance with the Golf Course Management Plan approved under the Concept Plan.
- **Roads:**
 - Construction of, and use for, the Kings Forest Parkway (Precinct 2) within the inner and outer buffers as approved under the Concept Plan.
 - Part construction of the two roads to Precincts 12, 13 and 14 through the inner 30 metre and outer 20 metre buffers as approved under the Concept Plan.

In addressing the provisions of clause 7 the proponent needs to demonstrate that:

- The development complies with the objectives for ecological buffers - these being to:
 - protect wetlands or areas of particular habitat significance, and
 - restrict development so that, as far as practicable, it does not occur within ecological buffers, and
 - 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
 - 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; and
- The development complies with the other provisions of clause 7, being that development on land within an ecological buffer is to:
 - incorporate effective measures to manage wetlands or areas of particular habitat significance, and
 - be designed and sited to maintain connectivity of vegetation and minimise vegetation clearing, soil disturbance and alterations to the rate, volume or quality of surface and ground-water flows, and
 - retain and maintain all existing native vegetation outside the area immediately required for the development, and
 - incorporate measures to regenerate native vegetation for all disturbed areas within the buffer, and
 - incorporate appropriate stormwater and erosion control measures to protect the buffer from surface water run-off or other disturbance; and

- Whether or not there is a practicable alternative to siting the development within the buffer. In this regard, the consent authority must consider [in accordance with clause 7(4)] the:
 - design, type and site cover of the proposed development, and
 - physical characteristics of the land on which the development is proposed to be carried out, and
 - suitability of the land for the proposed development.

The following discussion addresses the above requirements for each of the above five groups of buffers and demonstrates that the proposed development in the ecological buffer will comply with the provisions of the SEPP. Section 7.23 of this EAR provides a detailed assessment of the impacts of works in the buffers, and further supporting information and illustrative plans are provided in the following reports prepared by James Warren and Associates: the Precincts 1 and 5 Buffer Management Plan appended at **Appendix MM**, and the Precincts 2 - 4 & 6 - 14 Buffer Management Plan appended at **Appendix NN**.

Precinct 1

The development complies with the objectives for ecological buffers in that:

- There are no wetlands or areas of particular ecological significance within the outer 20 metres of the buffer, with most of the 20 metre outer buffer highly modified and cleared of native vegetation.
- Restricting any development within the 20 metre buffer is not practicable as it would constrain economic development of the site by limiting necessary parking and potential floor area for a viable rural retail development. The use of the buffer is for an APZ only. Its preparation and maintenance will be in accordance with the Bushfire Risk Assessment report appended to this EAR.
- The Buffer Management Plan and the other supporting management plans will ensure that the design, construction and management of Precinct 1 will minimise impacts on the ecological and hydrological functions of the buffer. Specifically, the inner 30m of the buffer will be fully restored with weeding, natural regeneration and enhancement plantings. The restoration measures will include Koala habitat enhancement and fencing measures in accordance with the Stage 1 KPOM and creation of core Acid frog habitat in accordance with the Precinct 1 & 5 Threatened Species Management Plan. It is intended that the 30m wide inner buffer will be dedicated to Council, in conjunction with the adjacent Environmental Protection-zoned land, with the outer 20m (APZ) remaining part of the developed site and the responsibility of its proprietor.
- The above regeneration and restoration measures will encourage native vegetation as will dedication and amalgamation with the adjacent sensitive bushland.
- The use of the buffer for a koala proof fence aids their long term viability, as discussed in Section 7.21.2.

The development complies with the other provisions of the clause, in that:

- Specific and generic management strategies for areas of particular habitat significance are detailed in the Buffer Management Plan covering vegetation protection; protection of threatened flora; protection of EECs; stormwater management; weed control; native vegetation regeneration and restoration, and pest management.
- The APZ has been designed and sited to maintain connectivity of vegetation (see above dedication) and minimise vegetation clearing, soil disturbance and alterations to surface and ground-water flows.
- All existing native vegetation outside the area immediately required for the APZ will be retained and maintained.
- Surface water run-off or other disturbance during construction and operations will be managed and mitigated in accordance with the erosion and sediment control measures detailed in the Erosion and Sediment Control Plan (see **Appendix GG**).

There is no practicable alternative to siting the APZ within the outer 20 metres of the buffer as the development of the Precinct 1 site would be significantly constrained due to its shape and size - and thus its economic viability. However, it is suitable for the proposed development given its access from the Tweed Coast Road and proximity to Precinct 5 - particularly in the early years prior to the development of the proposed Town Centre. The land is relatively level and devoid of significant native vegetation. Accordingly, the use of the buffer as proposed is considered suitable and practicable in the circumstances.

Precinct 5

The development complies with the objectives for ecological buffers in that:

- The bulk of vegetation to be removed is highly modified. The vegetated areas of the inner 30 metres closest to the Cudgen Nature Reserve are largely retained.
- Restricting development to the 20 metre buffer is not practicable as it would compromise the development potential of Precinct 5 site and thus economic use of land zoned for urban purposes. The use of the buffer is restricted to use for APZs, parts of roads and access ways (as described above), a koala proof fence and bio-retention swales.
- The Precinct 1 and 5 Buffer Management Plan and the other supporting management plans will ensure that the design, siting and management of the development within the buffer will minimise impacts on the ecological and hydrological functions of the buffer.

Specifically:

- Proposed regeneration and revegetation measures will result in a long-term net gain of 7.03 hectares of heathland within the Precinct 5 ecological buffers.
- With respect to the buffer adjacent to the Cudgen Nature Reserve, the approximately 20 metre wide inner area abutting the reserve is heavily vegetated and includes substantial native trees. This vegetation will be retained. The approximately 10 metre wide balance of the inner 30m buffer zone comprises predominantly exotic pasture grass which will be removed. Buffer enhancement measures (as described in Section 3.4 of **Appendix MM**) and specific management strategies (as described in Section 4 of **Appendix MM**) will include koala habitat enhancement and fencing in accordance with the Stage 1 KPoM and the creation of core Acid frog habitat in accordance with the Precinct 1 & 5 Threatened Species Management Plan, as well as appropriate stormwater and erosion control measures.
- Along the southern parts of Precinct 5 the ecological buffer predominantly consists of exotic pasture grass, with some native vegetation regrowth occurring between periodic slashing and slash pine wildings. This will be removed and buffer enhancement measures to the inner 30m will include stormwater and erosion control measures, koala habitat enhancement and fencing measures in accordance with the Stage 1 KPoM, and the creation of core Acid frog habitat in accordance with the Precinct 1 & 5 Threatened Species Management Plan.
- It is intended that the buffer, from and including the koala fence, will be dedicated to NPWS in conjunction with other Environmental Protection zoned land as additions to the Cudgen Nature Reserve..
- The above regeneration and restoration measures will encourage native vegetation as will dedication and amalgamation with the adjacent sensitive bushland.
- As detailed in Section 7.23.2 of this EAR and detailed in the Groundwater Assessment at **Appendix AA**, the proposed swale enhances the hydrological function of the ecological buffer, and thus the protection of wetlands and areas of habitat significance, by virtue of its role in:
 - maintaining the existing hydrological regime in the neighbouring nature reserve, where recharge is necessary to maintain the existing groundwater hydrological regime along the eastern boundary; and
 - providing stormwater and erosion control measures to protect the buffer from surface water run-off and other disturbances in the urban areas to the west (see discussion in Section 4.4 of the Groundwater Assessment at **Appendix AA**).

The development complies with the other provisions of the clause, in that:

- Specific and generic management strategies for areas of particular habitat significance will be implemented (detailed in the Buffer Management Plan for Precincts 1 and 5) covering vegetation protection; protection of threatened flora; protection of EECs; stormwater management; weed control; native vegetation regeneration and restoration, and pest management.
- The layout of the buffer has been designed to maintain connectivity of vegetation (see above dedication) and minimise vegetation clearing, soil disturbance and alterations to surface and ground-water flows.
- All existing native vegetation outside the area immediately required for the APZ will be retained and maintained.
- The proposed koala fence serves an added function by preventing human and domestic animal access beyond the revegetated swale.
- Surface water run-off or other disturbance during construction and operations will be managed and mitigated in accordance with the erosion and sediment control measures detailed in the Erosion and Sediment Control Plan (see **Appendix GG**).

There is no practicable alternative to siting the APZ, roads and parts of the bio-retention swales within the outer 20 metres of the buffer as the proposal makes the most productive use of the land zoned for urban development. The achievement of the dwelling yield and the urban design principles for Kings Forest could be compromised if the outer buffer was not used as proposed. The proposed location of the bio-retention swale, in particular, is crucial for mitigation of potential groundwater drawdown impacts on wetland vegetation in the adjacent Cudgen Nature Reserve.

Precincts 2, 3, 4, 6, 7, 8, 9, 10 and 11 and Precincts 12, 13 and 14

The development complies with the objectives for ecological buffers in that:

- The existing vegetation to be removed from the outer 20 metres of the buffer is predominantly disturbed and highly modified. Proposed revegetation and regeneration measures will cover 44.15 hectares and result in a long-term net gain of 18.99 hectares of intact heathland communities.
- Preventing any development within the outer 20 metre buffer is not practicable as the bulk earthworks are required to provide flood immunity for the site. Not proceeding would compromise the future development of the site and thus economic use of land zoned for urban purposes. The 20 metre outer buffer is to be used for bulk earthworks only and is an interim measure. Future applications will seek approval to use the buffers for other purposes if, and as, required.
- The Buffer Management Plan (**Appendix NN**) and the other supporting management plans will ensure that the earthworks will be undertaken in a manner to minimise impacts on the ecological and hydrological functions of the buffer. On completion of the works within the 20 metre outer zone the disturbed areas will be revegetated to stabilise the works and control erosion and sedimentation.

The development complies with the other provisions of the clause, in that:

- Specific and generic management strategies for areas of particular habitat significance are detailed in the Precincts 2-4 and 6-14 Buffer Management Plan (**Appendix NN**) covering vegetation protection; protection of threatened flora; protection of EECs; stormwater management; weed control; native vegetation regeneration and restoration, and pest management. In addition, the Buffer Management Plan proposes a monitoring and reporting regime for the rehabilitation works.

- The planting of koala food and shelter trees undertaken generally in combination with heath regeneration/revegetation activities will contribute significantly as mitigation for the loss of any vegetation within the buffer zones (see Figure 15 at **Appendix NN**) . Compensatory habitat areas for Acid frogs will also be created within the ecological buffers and include core breeding habitat and forage habitat areas (see the Threatened Species Management Plans at **Appendices TT**).
- Surface water run-off or other disturbance during the bulk earthworks will be managed and mitigated in accordance with the erosion and sediment control measures detailed in the Erosion and Sediment Control Plan (see **Appendix GG**).
- The outcome for the proposed golf course buffer will be an actively managed biological screen between the urban land uses and the adjacent sensitive ecological areas. Proposed regeneration and vegetation works will contribute to the buffer capacity of the golf course and provide the following benefits:
 - the land will be actively managed to maintain its ecological integrity including regeneration;
 - the costs of management will be paid for by the users of the golf course;
 - the stormwater treatment measures will actively control the flow of water and contaminants to the SEPP 14 wetlands;
 - the ecological zone will be protected through active management of access and security;
 - the monitoring of the golf course and ecological zones will be on-going and for an indefinite period.

There is no practicable alternative to undertaking the earthworks within the outer 20 metres of the buffer as the proposal enables the future flood free development and use of land zoned for urban development.

Kings Forest Parkway

A very small area of the inner and outer buffer area is impacted by the proposed alignment of the Kings Forest Parkway - the main (and only) access point to the site from Tweed Coast Road (see Bulk Earthworks and Engineering Plans at **Appendix E**).

The development complies with the objectives for ecological buffers in that:

- The land within the affected buffer area is substantially cleared of native vegetation and there are no wetlands or areas of particular ecological significance.
- Restricting the construction of the road to outside the buffer is not practicable as the proposed alignment is the only feasible option given the location of the access point to the site from Tweed Coast Road. The alignment of the road also serves as a buffer to land zoned 7(a) and 7(l) to the south, and as an APZ.
- The Precincts 1 and 5 Buffer Management Plan and the other supporting management plans will ensure that the design and construction of the road will minimise impacts on the ecological and hydrological functions of the buffer. Specifically, any impacts as a result of construction in both the inner 30 metres and outer 20 metres of the buffer will be fully restored with weeding, natural regeneration and enhancement plantings.
- The above regeneration and restoration measures will encourage native vegetation and amalgamation with the adjacent sensitive bushland.

The development complies with the other provisions of the clause, in that:

- Specific and generic management strategies for areas of particular habitat significance are detailed in the Precinct 1 and 5 Buffer Management Plan covering vegetation protection; protection of threatened flora; protection of EECs; stormwater management; weed control; native vegetation regeneration and restoration, and pest management.

- The road will be constructed to minimise vegetation clearing, soil disturbance and alterations to surface and ground-water flows.
- All existing native vegetation outside the area immediately required for the road will be retained and maintained.
- Surface water run-off or other disturbance during construction and operations will be managed and mitigated in accordance with the erosion and sediment control measures detailed in the Erosion and Sediment Control Plan (see **Appendix GG**).

There is no feasible alternative to siting this small area of the Kings Forest Parkway within the ecological buffer as the alignment of the junction with the Tweed Coast Road cannot be adjusted. The land is relatively level and devoid of significant native vegetation. Accordingly, the use of the buffer as proposed is considered suitable and practicable in the circumstances.

Two roads to the southern precincts

Perforce, areas of the inner and outer ecological buffers (to Precincts 5, 7 and 14) are impacted by the proposed alignments of the two roads to the southern precincts of the site (see **Figure 5** above and the Bulk Earthworks and Engineering Plans at **Appendix D**). These are the only means of access to these precincts, they provide evacuation routes in the event of flooding, and were approved as part of the Concept Plan for the site.

The development complies with the objectives for ecological buffers in that:

- The small portion of the ecological buffer traversed by the eastern road is substantially cleared of native vegetation and there are no wetlands or areas of particular ecological significance within the affected area.
- In the case of the western road, most of the affected area is highly modified - cleared of native vegetation and dominated by exotic grassland. There is a small portion of Freshwater Wetland at the southern end of the affected buffer area.
- Restricting the construction of the two road to outside the buffers is not practicable as the proposed alignments are the only feasible option given other surrounding sensitive vegetation and the requirement to provide flood free access to the southern urban areas of the site.
- The Buffer Management Plans and the other supporting management plans will ensure that the design and construction of the roads will minimise impacts on the ecological and hydrological functions of the buffer. Specifically, any impacts as a result of construction on the buffer will be fully restored with weeding, natural regeneration and enhancement plantings.
- The above regeneration and restoration measures will encourage native vegetation and amalgamation with the adjacent sensitive bushland.

The development complies with the other provisions of the clause, in that:

- Specific and generic management strategies for areas of particular habitat significance are detailed in the Precincts 2-4 & 6-14 Buffer Management Plan covering vegetation protection; protection of threatened flora; protection of EECs; stormwater management; weed control; native vegetation regeneration and restoration; and pest management.
- The roads will be constructed to minimise vegetation clearing, soil disturbance and alterations to surface and ground-water flows.
- All existing native vegetation outside the area immediately required for the roads will be retained and maintained.
- Surface water run-off or other disturbance during construction and operations will be managed and mitigated in accordance with the erosion and sediment control measures detailed in the Erosion and Sediment Control Plan (see **Appendix GG**).

There are no feasible alternatives to siting these small sections of the two roads to the southern precincts within the ecological buffers as their alignments are based on avoiding sensitive vegetation and to provide for flood evacuation. Accordingly, the use of the buffers as proposed is considered suitable and practicable in the circumstances.

In summary, given the merits of the proposed uses for the ecological buffers, the provisions of clause 7 have been satisfied.

Clause 8 - Agricultural Buffers

Under Clause 8 development consent cannot be granted on land within an agricultural buffer without consideration of the potential impacts of the proposed development on agricultural activities on land adjoining the buffer, as well the potential impact of agricultural activities on future occupiers of the buffer. The SEPP also requires that the (then) Department of Primary Industries (DPI) be consulted. The zoning plan for the Kings Forest site indicates the land affected by agricultural buffers.

The rural retail development within Precinct 1 will occur entirely on land within an agricultural buffer. Bulk earthworks will also occur within the buffers.

The impacts on adjacent agricultural zoned land as a result of the proposed development within the buffer in Precinct 1 and as result of bulk earthworks have been assessed and reported by Gilbert + Sutherland (see Section 7.22 of this report and **Appendix LL**). The DPI has been briefed and provided with a copy of the relevant information, plans and the Agricultural Buffer Assessment report, and the proponent is providing further information requested by DPI.

The impacts of the development both during construction and the operational phase have been assessed, as have any impacts on the future occupiers of Precinct 1. Given the nature of the proposed development and the present and potential future uses on the adjacent agricultural zoned land, Gilbert + Sutherland has concluded that any potential conflict between the rural land and the proposed development in Precinct 1 would be minimal and acceptable (see Section 7.22). In addition, measures to manage potential impacts during construction will be implemented.

The proposed bulk earthworks will also take place on land within agricultural buffers. While the potential impacts are considered to be short-term, measures to minimise the impacts have been recommended and will be implemented.

Based on the above assessment it is considered that the requirements of clause 8(a) of Part 6 have been fulfilled and that consent should be granted, subject to advice from DPI.

7.1.5 State Environmental Planning Policy (Infrastructure) 2007 (ISEPP)

Under clause 104 and Schedule 3 of the ISEPP, development for the following must be referred to the RTA:

- subdivision of land for 200 or more lots where the subdivision includes the opening of a public road; and
- 500m² or more floorspace for shops (with access to a classified road).

Given the proposed development includes the subdivision of Precinct 5 into 410 Torrens title allotments and the rural retail development comprises 2,126m² retail floorspace, this application is required to be referred to the RTA for comment.

7.1.6 State Environmental Planning Policy 14 - Coastal Wetlands (SEPP 14)

SEPP 14 aims to ensure that coastal wetlands are preserved and protected. Under Clause 7(1), land clearing, levee construction, land draining or land fill may only be carried out within the wetlands with development consent and with the concurrence of the Director-General of Planning. However, under Clause 6(2) if the development is a Part 3A development, then concurrence is not required.

An assessment of the proposed roads through the SEPP 14 Wetlands was provided in the Concept Plan. The Department of Planning was satisfied that the proposed roads will not significantly impact upon threatened species, provided that disturbance to the SEPP 14 Wetlands and surrounding EECs is minimised, hydrological processes are not disrupted and adequate connectivity and safe passage is provided to koalas and wildlife.

As discussed in Sections 7.15, 7.17, 7.21 and 7.24, disturbance to the SEPP 14 Wetlands and EECs will be minimised, management strategies will be adopted to ensure adequate connectivity and safe passage is provided to koalas and wildlife and the development will not impact upon the groundwater flow regime and groundwater quality.

7.1.7 State Environmental Planning Policy 44 - Koala Habitat Protection (SEPP 44)

SEPP 44 aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas. Further to SEPP 44, a Koala Plan of Management (KPoM) was approved under the Concept Plan with the conditions of approval requiring that an updated plan be provided with each future Project or Development Application.

The updated Koala Plan of Management submitted with this Project Application (see **Appendix N**) makes recommendations which reflect an alternative approach to koala management to that taken in the Concept Plan KPoM (see Section 4.3). The updated KPoM complies with the requirements of SEPP 44.

7.1.8 State Environmental Planning Policy 55 - Remediation of Land (SEPP 55)

SEPP 55 provides controls and guidelines for the remediation of contaminated land. In particular the policy aims to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment.

A preliminary site assessment undertaken for the Concept Plan identified five potential areas within and adjacent to the Kings Forest site which had potential for contamination. Given the Stage 1 works comprises bulk earthworks across the site, further detailed site investigations of the identified areas of potential contamination have been undertaken and confirm that the site is suitable for the proposed land uses.

In line with SEPP 55, the results of the detailed testing and the management of the identified areas to ensure that the site will be suitable for the future residential uses are summarised in Section 7.10 and **Appendix U**.

7.1.9 State Environmental Planning Policy 71 - Coastal Protection (SEPP 71)

SEPP 71 applies to development within the 'coastal zone' along the eastern seaboard of NSW. As noted in the Concept Plan, part of the Kings Forest site is situated within the Coastal Zone (as defined under *the Coastal Protection Act 1979*).

SEPP 71 seeks to ensure that development within the Coastal Zone is appropriate and suitably located; that there is a consistent and strategic approach to coastal planning and management; and that there is a clear development assessment framework. Clause 8 of the SEPP lists a number of matters for consideration which are to be taken into account in determining consent for development within the coastal zone. An assessment against these provisions is included in the Table of Compliance at **Appendix O**. Overall, it is considered that the proposed development is consistent with SEPP 71.

7.1.10 North Coast Regional Environmental Plan

The North Coast Regional Environmental Plan (REP) (now a deemed State Environmental Planning Policy) sets objectives and provisions for the consent authority to consider in preparing local environmental plans and in determining development applications. An assessment of proposal against the relevant objectives is contained in the Table of Compliance at **Appendix O**. Overall, the assessment demonstrates that the proposed development is consistent with the relevant objectives within the REP/ deemed SEPP.

7.2 Consistency with Concept Plan

The DGRs require that the consistency of the Project Application with the approved Concept Plan (MP06_0318) for the Kings Forest site be demonstrated. The ongoing development and refinement of the design for the Kings Forest site has necessitated minor amendments to the approved Concept Plan as detailed in the proposed modification to the Concept Plan in Section 4 of this report.

Notwithstanding the modification described in Section 4, the Project Application is substantially consistent with the approved Concept Plan - which was perforce conceptual in nature - as follows:

- The approved overall residential yield and density of 4,500 dwellings can be achieved as demonstrated in the Density Matrix Summary at **Appendix H**.
- The revised layout of the Kings Forest Parkway provide a continuous 'through alignment' reinforcing its distributor road and to the west collector road status, as envisaged in the Concept Plan - see Road Hierarchy plan at **Appendix H**.
- The location of the main area of structured open space has been moved. Nevertheless, as envisaged in the Concept Plan, the proposed areas of active and passive open space link with the proposed internal walkways and cycleways and the external cycle network. The local parks are generally within 400 metres of most dwellings so creating walkable neighbourhoods - see Open Space network plan at **Appendix H**.
- The Potential Bus Route Plan (at **Appendix H**) demonstrates that the majority of the residential areas, with the exception of a small portion of Precincts 5, 7 and 8 are within 400m of a potential bus route, consistent with the Public Transport Plan approved under the Concept Plan.
- The proposed subdivision of Precinct 5 and the construction works in the north east of the Kings Forest site is in accordance with the indicative staging set out within the Concept Plan.
- The proposed dedication of proposed Lot 3 to the National Parks and Wildlife Service is generally in accordance with the area of land identified for future dedication on the Open Space Plan approved under the Concept Plan.

- The proposed detailed sewer and water reticulation systems are generally in accordance with the Sewer Infrastructure and Water Infrastructure Plans approved under the Concept Plan.
- The rural retail development within Precinct 1 is consistent with the adopted development uses within the Concept Plan Development Matrix.
- The objectives established in the Concept Plan for the location of various residential types across the Kings Forest estate have been adopted in relation to the design and layout of Precinct 5.
- The residential subdivision of Precinct 5 provides a range of allotment sizes to facilitate the future construction of the residential types identified within the Kings Forest Development Code.
- The Plan of Development for Precinct 5 and road design for the Kings Forest Parkway provides for the internal walkways and cycleways, as approved within the Pedestrian and Cycle Network Plan.

7.3 Consistency with the Instrument of Approval and Development Code

Notwithstanding the modifications to the Concept Plan in Section 4 in this EAR, the proposal is consistent with the Statement of Commitments and generally consistent with the conditions in the Instrument of Approval. This is demonstrated in the summary table at **Appendix O**.

The Plan of Development for Precinct 5 is generally consistent with controls and guidelines for subdivision layout and the street network within the Kings Forest Development Code, as demonstrated in the table included at **Appendix O**.

7.4 Subdivision Design, Layout and Desired Future Character

This section assesses the design, layout and future character of Precinct 5 in accordance with the relevant matters within the DGRs.

7.4.1 Consistency with the NSW Coastal Policy

The NSW Coastal Policy sets the direction for coastal zone management, planning and conservation and identifies a number of objectives in relation to protecting and enhancing the aesthetic qualities of the coastal zone, ecologically sustainable human settlement. The relevant objectives relating to the proposed development are as follows:

- design and locate development to complement the surrounding environment and recognise good aesthetic qualities (Objective 3.2);
- ensure that future expansion or redevelopment or urban and residential areas including the provision of infrastructure, avoids or minimises impacts on environmentally sensitive areas and cultural heritage;
- promote compact and contained planned urban development in order to avoid ribbon development, unrelated cluster development and continuous urban areas on the coast; and
- provide for choice in both housing and lifestyles.

In consideration of the above objectives, the proposed subdivision design and layout for Precinct 5 is in accordance with the objectives in that:

- it provides a compact and contained residential precinct, which incorporates ecological buffers along the eastern and southern boundaries to ensure that urban development is contained and will not impact upon the areas of high environmental conservation value;

- the Precinct 5 land has been comprehensively assessed and found to be suitable for residential development;
- the impact on the natural environment can be minimised and appropriately managed as demonstrated in the suite of management plans approved under the Concept Plan which have also been updated in accordance with the proposal and are included as part of this Project Application; and
- it facilitates the provision of a range of dwelling types and densities to afford future residents the opportunity of a choice in both housing and lifestyle.

7.4.2 Coastal Design Guidelines for NSW

The Coastal Design Guidelines for NSW (the Guidelines) aim to provide environmentally sustainable design along the NSW coastline. The Guidelines identify new settlements with 25 lots or over as 'New Coastline Settlements'.

A desired future character for such an area includes elements such as relationship to the environment, visual sensitivity, edges to the water and natural areas, streets, buildings and height. The proposed subdivision design and layout of Precinct 5 is consistent with the desired future character for 'New Coastline Settlements' as demonstrated by the assessment prepared by MPS Architects (**Appendix O**).

Furthermore, Part 2 of the Guidelines establishes a set of design principles for coastal settlements to help achieve the desired future character. The application of the design principles for coastal settlements to Precinct 5 are addressed in **Table 6**.

Table 6 – Application of Design Principles for Coastal Settlements

Design Principle	Application in Precinct
Defining the footprint and boundary	The proposed boundary for Precinct 5 is in accordance with the precinct boundaries established by the approved Concept Plan. The eastern and southern boundaries incorporate an ecological buffer to provide separation for bushfire management and protection for the agricultural and Ecological Protection Areas.
Connecting open spaces	The Precinct 5 subdivision layout and Plan of Development incorporate the elements of the Open Space Plan approved under the Concept Plan and the Open Space Network Plan, submitted as part of this Project Application at Appendix H , which illustrates the proposed active and passive open space areas throughout the Kings Forest development. Furthermore, the Landscape Plans for the Stage 1 works (Appendix K) demonstrate that the proposed landscape treatments, interfaces and plantings will deliver high quality and practical open space areas that are unique to the Kings Forest development but integrate with the natural surroundings.
Protecting the natural edges	The proposal incorporates the ecological buffers and Environmental Protection areas established within the Concept Plan. Furthermore, the natural edges of the development will be protected through the implementation of a suite of management plans (as discussed in detail in the proceeding sections).
Reinforcing the street pattern	The street pattern for Precinct 5, is consistent with the objectives for the design principle in that: ▪ it responds to the topography of the site; ▪ it provides the opportunity for views of the neighbourhood park and surrounding environmental protection areas; ▪ it affords the opportunity for high quality landscaping to be provided; and ▪ it is legible and promotes way-finding.
Appropriate buildings for a coastal context	The Project Application does not seek approval for the detailed design of residential buildings.

7.4.3 Far North Coast Regional Strategy

The DGRs requires the Plan of Development for Precinct 5 to demonstrate adoption of the 'neighbourhood planning principles' established in the Far North Coast Regional Strategy. The principles are as follows:

- A range of land uses to provide the right mix of houses, jobs, open space, recreational space and green space.
- Easy access (including public transport where viable) to major town centres with a full range of shops, recreational facilities and services along with smaller village centres and neighbourhood shops.
- Jobs available locally and regionally, reducing the demand for transport services.
- Streets and suburbs planned so that residents can walk to shops for their daily needs.
- A wide range of housing choices to provide for different needs and different incomes. Traditional houses on their own block will be available along with smaller, lower maintenance homes, units and terraces for older people and young singles or couples.
- Conservation lands in and around the development sites to help protect biodiversity and provide open space for recreation.

The layout and design of Precinct 5 is in accordance with the 'neighbourhood planning principles' in that:

- a range different size allotments are provided which will facilitate the provision of an appropriate mix of houses and recreational space;
- the Kings Forest Parkway and internal road network within Precinct 5 facilitates access to Tweed Coast Road and nearby town centres, as well as the future town centre within the Kings Forest estate;
- the majority of the residential allotments proposed within Precinct 5 will be within 400m of a bus route, thus providing easy access to public transport;
- the rural retail and future employment and town centre areas (the subject of future development applications) provide the opportunity for local jobs;
- the proposed mix of allotment sizes within Precinct 5 and the proponent's commitment to affordable housing provision (as discussed in Section 7.5, demonstrates that future residents will have a range of housing choices. The Development Matrix Summary, prepared by MPS at **Appendix H** also demonstrates that a range of housing choices is provided across the entire Kings Forest Estate;
- the suite of updated management plans (as discussed in subsequent sections of this report) will ensure that the proposed development retains, conserves and manages the ecological buffer areas and Environmental Protection areas surrounding Precinct 5; and
- the provision of the neighbourhood park will provide sufficient open space to serve the recreational requirements of the Precinct 5 residents.

7.4.4 Urban Design

In addition to the above, the proposed subdivision pattern for Precinct 5 provides a street layout and a range of orthogonal lots which facilitate the following urban design outcomes:

- the provision of a range of dwelling types in compliance with the Kings Forest Development Code;
- easy and legible pedestrian access from the proposed allotments to the neighbourhood park, the potential bus route and proposed Town Centre;
- views from dwellings across the park and bushland areas;
- variation in built form and an interesting streetscape; and.

Detailed design guidelines for the future dwellings within Precinct 5, prepared by the proponent, are included at **Appendix P**. A section 88B Instrument will be attached to the land title of each proposed residential allotment within Precinct 5 requiring any future dwelling to be designed in accordance with the design guidelines.

This matter is included as a draft Statement of Commitment.

7.5 Affordable Housing

Tweed LGA is categorised as one of 25 LGAs in NSW which has a 'high' need for affordable housing. The need relates to housing for both rental and purchase, however the most significant need is for affordable rental accommodation for existing low and very low income households in the locality.

In order to assess the need for affordable housing within the Kings Forest Estate, Hill PDA was commissioned to prepare an Affordable Housing Study (**Appendix Q**). The study includes an assessment of housing affordability within the local Tweed Heads area and provides a strategy for the provision of affordable housing within the Kings Forest development.

Demographic profile of Kings Forest

The Concept Plan included a description of the future demographic characteristics of the Kings Forest development. It concluded that Kings Forest will essentially mirror the demographic profile of new development along the Tweed coastal strip, the key components being:

- a growing share of residents employed as managers and/or professionals and a declining proportion employed as clerical, sales and service workers;
- an ageing population and a growing proportion of residents within the lowest income bracket (\$0-\$299/ week);
- a declining dwelling occupancy rate (i.e. the current average is 2.37 compared with the State average 2.6);
- an increasing demand for smaller dwellings; and
- three bedroom dwellings continuing to represent the greatest proportion of homes, with, however the proportion of 1 and 2 bedroom dwellings increasing.

Hill PDA's analysis anticipates that the demographic characteristics of Tweed LGA and Tweed Heads will continue to change with the ongoing influx of residents from the South-East Queensland Growth Area and the Greater Sydney Metropolitan Strategy. This in turn is expected to result in a growing need for housing and diversity of household types.

Housing Affordability

In order to meet the housing needs of the Tweed Heads locality, a supply of different dwelling types within a range of prices is required. It is considered that the Kings Forest development supports this need in the following ways:

- the provision of up to 4,500 new dwellings will generate greater housing choice;
- the development proposes a broad mix of dwelling types and densities to cater for the increasing population of smaller households and an ageing population; and
- the Kings Forest development will seek to attract a range of household types which will meet a range of household incomes, with property prices anticipated to be between \$300,000 to \$600,000 and additional products above this range dependant on factors such as site characteristics.

Hill PDA's financial modelling has, however, found that without subsidy the proposed development at Kings Forest cannot provide for lower income households.

Affordable Housing Strategy

In light of its findings in regard to demographic profile and housing affordability, Hill PDA considers that affordable housing can be provided within Kings Forest by:

- providing a mix of housing types and sizes at market price for households earning the higher end of the moderate to high income bracket (as at 2012) as it is considered that by 2012, households within this bracket could afford to purchase the entry level dwelling type, based on the indicative starting price of \$300,000; and
- providing subsidised housing for rent for low to moderate incomes.

In regard to the provision of subsidised housing, Project 28 Pty Ltd has submitted a National Rental Affordable Housing Scheme (NRAS) application and will use its best endeavours to secure NRAS funding. Subject to a successful application for NRAS funding, Project 28 will:

- provide between 1% and 3% of housing (45-135 dwellings) within the Kings Forest site as affordable housing for rent for a minimum of 10 years;
- provide dwellings at a minimum 20% discounted market rent to eligible low and moderate income households for the entire 10 year period, in keeping with NRAS requirements;
- prioritise smaller dwellings as affordable rental dwellings to meet the highest need group;
- locate affordable housing in proximity to the proposed centres to provide access to services and transport for high need users; and
- provide timely delivery of housing.

This matter is addressed in the draft Statement of Commitments.

7.6 Visual Impact

7.6.1 Rural Retail Development - Precinct 1

The only element of the proposed development (the subject of this application) that will be visible from Tweed Coast Road will be the rural retail development within Precinct 1. A Visual Impact Assessment, prepared by MPS Architects is included at **Appendix R**. It evaluates how the proposed development will be viewed from Tweed Coast Road and surrounding development, and provides recommendations for mitigation measures to minimise any visual impacts.

Existing Conditions

Precinct 1 is a triangular shaped site, bounded by Tweed Coast Road to the west, agricultural land currently used as a tree plantation to the north and a 50m wide ecological buffer zone situated between the development and an Ecological Protection Area to the south-east.

The surrounding land is relatively flat, with the exception of a hill rising to the east. Surrounding development is limited to a narrow strip of houses located on the western side of Tweed Coast Road set behind a stand of trees.

Assessment

The proposed rural retail development is likely only to be visible by motorists and passersby on Tweed Coast Road and the residents in the houses on the western side of Tweed Coast Road.

As shown in the photomontages included within the Visual Impact Assessment, the rural retail development will be seen from the dwellings on the western side of Tweed Coast Road. However, the impact is considered to be reasonable for the following reasons:

- the rural retail development is set back from Tweed Coast Road and is not considered to be overbearing in scale;
- the buildings have been designed to a height of RL12.7m AHD which is considerably lower than the trees located on the hill to the east of the site (RL 18m AHD), therefore the green backdrop reduces the visual impact of the development;
- the separation between the dwellings and proposed development (approximately 50m from the nearest dwelling to site boundary) is considered to be sufficient to not cause adverse impacts on amenity;
- the buildings have been designed with materials and finishes that have a subdued palette to blend with the surrounding vegetation;
- the views of the proposed development are screened by existing trees; and
- the views of the proposed development from the northern and southern approaches on Tweed Coast Road are relatively obscured by existing trees and vegetation along the road.

Management

To further reduce the impact on views from the northern and southern approaches and the residential dwellings, landscaping as illustrated on the Landscape Plan (**Appendix J**) is proposed. The landscaping works comprise columnar trees and low scale shrubs and ground covers within planting beds along the Tweed Coast Road boundary, and additional trees and shrub planting within the car park to soften the appearance of the development. Overall, MPS Architects consider that the rural retail development within Precinct 1 not will give rise to an unacceptable visual impacts.

7.6.2 Acoustic Fencing - Precinct 5

The dual carriageway road is the main access route into Kings Forest from the Tweed Coast Road. It is the primary distributor road in the estate and along the Precinct 5 boundary includes two main intersection points providing access to the proposed town centre, Precinct 3 community facilities and the Precinct 5 residential neighbourhood. An acoustic fence is required along approximately one kilometre of the Precinct 5 interface with the road to mitigate the impacts of traffic noise on future residential development. The visual impact of this wall has been assessed by the Place Design Group as summarised below (see **Appendix S**).

Proposed Development

The wall is intended to be 2 metres high and constructed of 19mm thickness lapped timber palings (40% overlap) and stained a dark brown/black so that it visually recedes. It will have a timber sleeper base with a capped railing. One metre wide decorative pillars will abut the fence at regular intervals and at key pedestrian and vehicular entry points. A 4m wide landscape strip is proposed in front of the acoustic fence (and wider in some key locations). The fence is to be softened through partial, rather than full screening, with a varied and layered planting pattern consisting of a mix of exotic and native species. The planting will screen most of the fence, but provide some exposure to the decorative pillars. See **Appendix K** for images of the wall, design details and proposed landscaping).

Assessment

Due to the flat topography of the site, the acoustic fence and associated landscape will only be visible from the public realm along the Kings Forest Parkway, and most prominent from the west bound entry carriageways and pedestrian pathway along the road. The fence will also be visible as the back fence within the residential lots. As detailed in the Place Design report the impact will be minimal for the following reasons:

- The acoustic fence and associated landscape will be viewed by local residents, visitors and others travelling through the estate by car or on foot. As this type of view is consistent with public expectations of a residential subdivision landscape, viewer sensitivity is considered to be low.
- The dominant landscape element along the Kings Forest Parkway will be the very tall native pine trees creating a boulevard effect, with the mass planting in the median also creating a strong visual feature at ground level. The acoustic fence and associated landscape treatment will appear as a secondary element in the landscape being set back from the carriageway and relatively low height in comparison with other elements (trees and houses).
- For pedestrians using the pathway, the detail and variety in planting will be more noticeable than sections of the exposed acoustic fence which will recede into the background due to the dark colour and shadowing.
- In time, the planting will serve to screen much of the timber fence. The decorative pillars will become a feature in the landscape softened with low plantings which will provide accent and variety and break up the potential monotony of the long fence line.

Overall, the acoustic fence and associated planting is considered appropriate in the context and will not detract from the overall character or function of the entry road and residential landscape.

No management or mitigation is proposed.

7.6.3 Acoustic Fencing - Tweed Coast Road

Twelve houses are situated outside of the Kings Forest site, along Old Bogangar Road on the western side of Tweed Coast Road. Old Bogangar Road is an old road, which runs parallel to, and is separated from, Tweed Coast Road by a vegetated buffer area which currently provides privacy and a visual buffer for the existing houses. Whilst neither the houses nor the buffer area are within the Kings Forest site boundary, new acoustic fences instead of the existing fences are proposed within the buffer area to mitigate the impacts of an increase in traffic noise on the existing houses. The visual impact of this fencing has been assessed by the Place Design Group as summarised below (see **Appendix S**).

Proposed Development

The acoustic fence will comprise two sections to be located in the middle of the buffer area and separated by the Old Bogangar Road entrance. The northern section will be approximately 110m in length and the southern section approximately 177m to the Pine Ridge Road intersection. It will then traverse Old Bogangar Road and run west along the southern boundary of 254 Old Bogangar Road (the southernmost residential allotment). Each section of the buffer will be 2.5m high and will reflect the design of the acoustic fencing proposed for Precinct 5, as described in Section 7.6.2 above. It will be constructed from earth berms, 19mm lapped timber fencing (40% overlap), and 6mm FC sheet and masonry, to provide a dark brown/ black fence with 1m wide decorative pillars situated at regular intervals.

A variety of native shrubs to soften the appearance of the acoustic fence will be provided along the eastern side of the fences, and at the returns of the fence at the Old Bogangar Road entrance as shown in Figures 8-10 within **Appendix S**. Furthermore the existing mature trees located on the western side of the fences will be retained where practicable. Land owners consent is being sought for works within the Tweed Coast Road road reserve.

Assessment

The acoustic fencing is only likely to be visible from motorists and passersby on Tweed Coast Road and the existing houses along Old Bogangar Road. As detailed in the Place Design Report, the impact will be minimal for the following reasons:

- When viewed by motorists and passersby, the acoustic fences will only be viewed for a very short time, therefore the viewing sensitivity in this respect will be low.
- Whilst the viewing sensitivity will be higher for the existing residents, the proposed fence is in a similar location to the existing fence, and as such will be partially screened by existing vegetation and screened by proposed planting along the southern return section. It will also be a dark and neutral colour so that it recedes into the background, be less visually prominent and be neater and more consistent in appearance than the existing wire mesh fence.
- The replacement of the fence provides the opportunity to improve the existing visual amenity and quality of the rural landscape character.

Management

The exact location and detailed design of the acoustic fence is yet to be determined. In order to ensure that the acoustic fencing will not give rise to any adverse visual impacts, the following measures will be undertaken to determine the detailed design:

- A detailed tree survey will be undertaken and where the fence can be set back in amongst the buffer planting, it will be. No mature vegetation will be removed (with the exception of the radiata pines or other environmental weed species) to install the acoustic fence.
- The colour of the fence will be dark and the face of the fence will be articulated with a variety of materials to break up the monotony along its length.
- Additional buffer planting will be provided along the full length of Old Bogangar Road to screen the fence from view. The planting will comprise native species and include a single row of shrubs along Tweed Coast Road where the fence is located on the western side of the buffer.

7.7 Infrastructure and Utilities

The ability of the Kings Forest site to be serviced by water, sewer, electricity and telecommunications services was addressed by the Concept Plan, which demonstrated that the site could be suitably serviced. The development proposed within Precincts 1 and 5 can also be suitably serviced as explained below.

7.7.1 Water

An existing 600mm diameter trunk main, crosses the Kings Forest site in an east-west direction from the Duranbah Reservoir complex located to the south-west, through the proposed Golf Course area, where it connects to a 450mm diameter main that acts as the main coastal distributor.

The proposed extension to the 450mm diameter water main will service Precincts 1 and 5 and as described in the Engineering Services Report, prepared by Mortons Urban Solutions (**Appendix D**) the 600mm trunk main which connects to the 450mm diameter main has capacity for the initial phases of the Kings Forest development (including Precincts 1 and 5).

In regard to water supply, the Duranbah Reservoir complex will service the Kings Forest development. It comprises a 5ML and a 7.5ML reservoir and has an allocation for a third 7.5ML reservoir.

It is considered that the existing Duranbah Reservoir complex has sufficient capacity to service the Precinct 5 development, however, it is anticipated that the additional 7.5ML reservoir will be required before 2018 to meet the water demand for the Kings Forest development and growth within the localised South Tweed Coast area.

Management

In order to determine the exact timing for the provision of the 7.5ML reservoir, and to ensure that the development of dwellings within Precinct 5 does not hydraulically affect the surrounding residential areas further analysis in regard to the timing and required reservoir size will be undertaken prior to the commencement of construction of the dwellings within Precinct 5.

This matter is addressed in the draft Statement of Commitments.

7.7.2 Sewerage

The current sewerage system on the site consists of a 225mm diameter rising main which runs along Old Bogangar Road and Chinderah Road to an existing pump station (Pump Station 4008). From Pump Station 4008 the flow is diverted into Council's existing 150mm diameter rising main which runs to the Kingscliff treatment plant.

A standpipe exists at the high point near the intersection of Old Bogangar Road and Cudgen Road to reduce the flow rate in the pipe system under normal flow conditions, and prevent motor overload. Under wet weather conditions, the system has the capacity to pressurise over its entire length, and operates as a rising main. Under dry weather conditions, the system operates as a pumped rising main to the standpipe, and then as a gravity flow system to the treatment plant.

The proposed sewer reticulation system for Precinct 5 and Regional Pump Station is designed to connect to the existing 225mm rising main and ultimately discharge to the Kingscliff Treatment Plant. The overall capacity of the present system however is primarily governed by the 150mm diameter rising main located downstream of Pump Station 4008. However with the development of a site in nearby Salt, a new rising main is to be constructed and upon completion the existing 150mm diameter rising main and Pump Station 4008 will be disconnected. Notwithstanding this, Mortons Urban Solutions (**Appendix D**) confirms that there is still some capacity within the 150mm rising main to accommodate the flow from the first stage of the Kings Forest development (including the Precincts 1 and 5).

7.7.3 Electricity

Country Energy provides electricity to the Tweed region. As set out in the Concept Plan, it is estimated that the Kings Forest development will require a peak electrical load of about 20-25 MW, based upon 4500 dwellings and associated commercial and service industries.

Country Energy has made plans to augment the electricity network to meet future demand which requires a new substation to be constructed on the site. Subject to agreement with Country Energy, a new substation is to be constructed within the Environmental Protection area located to the south of Precinct 2 or at another suitable location as agreed with Country Energy.

7.7.4 Telecommunications

An assessment of the telecommunications infrastructure in the locality of Kings Forest was undertaken by Telstra to inform the Concept Plan. Telstra advised that it has incorporated the forecast demand from Kings Forest into planning for the area and will progressively upgrade telecommunications infrastructure to meet demand.

7.7.5 Accommodation for NSW Ambulance, SES and Fire & Rescue NSW

In consultation with the relevant NSW emergency services providers, in the future the proponent will provide suitable sites within Precinct 2 for bases for NSW Ambulance, Fire & Rescue NSW and State Emergency Services. NSW Police has notified the proponent that it does not require a station site within Kings Forest. The provision of suitable sites for the aforementioned services within Precinct 2 will be identified within a future development application.

This matter is addressed in the draft Statement of Commitments.

7.8 Traffic and Accessibility

Carter Rytenschild Group (CRG) has prepared a Traffic Impact Assessment of the proposed development (refer to **Appendix T**). In particular it provides a detailed assessment of the intersection of Tweed Coast Road with the proposed Kings Road Parkway and the proposed rural retail development.

7.8.1 Tweed Coast Road Intersection Performance

Existing Conditions

The existing access into the Kings Forest site is from Tweed Coast Road via Depot Road. The rural retail development is also accessed directly from the Tweed Coast Road. Currently Depot Road has minimal traffic and Tweed Coast Road carries in the order of 8,000 vehicles per day.

Assessment

This Project Application has further refined the proposed density of each of the precincts and on this basis, CRG has recalculated the estimated traffic generation of the Kings Forest Estate. Compared with the original calculations determined by Philip Bell & Partners, which estimated a generation of 6.9 daily trips per dwelling or 0.7 peak hour trips per dwelling, the revised calculations found that the proposed residential component will generate less than originally anticipated with only 4.5 daily vehicle trips per dwelling or 0.45 peak hour vehicle trips per dwelling on the external road network. Furthermore, the proposed rural retail development will generate only 244 trips per hour during the afternoon peak.

In light of the traffic generation estimations, CRG undertook a SIDRA analysis to determine how the proposed increase in traffic will impact upon the performance of the proposed intersections with Tweed Coast Road.

The SIDRA analysis confirmed that the proposed Kings Forest Parkway/ Tweed Coast Road intersection will operate satisfactorily up until the Kings Forest development reaches 1,680 lots (expected to occur in 2019). At this time, the intersection will be required to be signalised and two through-lanes provided in Tweed Coast Road at the intersection. In relation to the rural retail development, the SIDRA analysis confirmed that the Precinct 1/ Tweed Coast Road intersection will operate satisfactorily up to 2019. It is anticipated, however, that while the intersection will eventually reach capacity, the future signalisation of the Kings Forest Parkway/ Tweed Coast Road intersection will create gaps in the traffic flow which will enable drivers to turn out of the rural retail development in a satisfactory manner.

Overall, it is considered that the proposed development within Precincts 1 and 5, will not give rise to any adverse impacts upon the traffic flow along Tweed Coast Road or result in any unacceptable delays at the proposed intersections.

Management

To monitor the exact timing of the signalisation of the Kings Forest Parkway/ Tweed Coast Road intersection, it is proposed that the growth of background traffic be reviewed as part of each future Development Application submitted for subsequent stages of the project.

This matter is addressed in the draft Statement of Commitments.

7.8.2 Cyclist and Pedestrian Access

The Open Space Network Plan at **Appendix H** illustrates the existing cycle network within the vicinity of the site, the proposed links to the existing network and the proposed internal walkways and cycleways within and across the Kings Forest site. Furthermore the plan demonstrates that the majority of the proposed residential allotments within Precinct 5, are within 400m of the central neighbourhood park and within 800m of Precincts 2,3 and 4. Overall, it is considered that the proposed residential allotments within Precinct 5 will have a high level of cyclist and pedestrian access.

7.8.3 Kings Forest Parkway

The Road Hierarchy Plan at **Appendix H**, demonstrates that the Kings Forest Parkway will be a four lane dual carriageway, leading from Tweed Coast Road to Precinct 6, where it will narrow to a two lane 'neighbourhood connector' road with an 11m carriageway and 5m wide on-street parking reserve on each side. CRG confirms that this road design will be able to carry in excess of the traffic volumes forecast for the Kings Forest Parkway.

7.8.4 Precinct 5

Access into Precinct 5 will be controlled by two roundabouts located on the western boundary of the Precinct. The main entrance into Precinct 5 is from the northernmost roundabout, which is anticipated to carry the highest traffic volumes within the entire Kings Forest Estate.

To determine the anticipated level of performance of this roundabout, CRG undertook SIDRA analysis, assuming ultimate traffic conditions. The analysis confirmed that the roundabout will operate at a Level of Service A during peak periods, with total average vehicle delays of less than 10 seconds and queue lengths of less than 5 vehicle lengths on all approaches. Overall, it is concluded that all roundabouts on the Kings Forest Parkway and in particular at the Precinct 5 entrance will operate satisfactorily at the 'ultimate' development conditions.

7.8.5 Public Transport

AMCORD – A National Resource Document for Residential Development, specifies the relevant public transport planning objectives for residential development. Amongst other things, it recommends that not less than 90% of dwellings be within 400m of an existing or proposed bus route, or 500m from the nearest existing or proposed bus stop (i.e. 5 min walk time).

As demonstrated on the Potential Bus Route Plan (**Appendix H**), the majority of Precinct 5 is within 400m of a potential bus route, with the exception of a small portion within the south-eastern corner. It is considered therefore that the Precinct 5 development is consistent with the AMCORD recommendations.

Furthermore, CRG confirm that the internal road network has been designed in accordance with Council's standard requirements and the roads can generally facilitate bus access. The provision of bus services within Kings Forest development will be negotiated between the proponent, Project 28 Pty Ltd and the relevant bus service provider when the development reaches a critical mass to be able to sustain a bus service.

7.9 Noise

Noise intrusion from Tweed Coast Road, the future Kings Forest Parkway, future commercial development within Precinct 4 and construction activities has the potential to adversely impact upon the amenity of future residents within Precinct 5 and the strip of houses on the western side of Tweed Coast Road.

An Environmental Noise Impact Assessment prepared by CRG (**Appendix U**) examined the noise impacts of the existing and future road traffic, future commercial activities and construction activities, and is summarised below.

7.9.1 Road Traffic Noise

Assessment

The assessment found that the predicted noise levels at the existing dwellings along Tweed Coast Road and within the Precinct 5 site currently exceed the adopted noise criteria. Furthermore, the traffic generated from the development of the dwellings within Precinct 5 will further increase the traffic noise levels by approximately 2dB. Traffic noise is also predicted to exceed the internal noise criteria within the future dwellings along Kings Forest Parkway within Precinct 5.

Management

Given that the existing and predicted road traffic noise is above the adopted noise criteria, noise attenuation measures are required. To enable the proposed dwellings within Precinct 5 and the existing dwellings on the western side of Tweed Coast Road to generally comply with the adopted noise criteria the following measures will be implemented by the proposal:

- construction of a 2.5m high acoustic barrier fronting the Tweed Coast Road to reduce the impact of noise from Tweed Coast Road on the dwellings on the western side of Tweed Coast Road; and
- construction of 1.8m and 2.0m high acoustic barriers (above the adjacent pad level height, free of gaps and holes and constructed using the materials recommended within the Noise Impact Assessment) along the Kings Forest Parkway frontage, as illustrated on the Plan of Development (**Appendix H**) to reduce the impact of noise on the proposed dwellings within Precinct 5;

Furthermore, once building plans for the proposed dwellings along the Kings Forest Parkway are finalised, further assessment of habitable spaces will be undertaken to determine the extent of acoustic building shell treatments required to achieve the 'maximum' internal noise criteria.

This matter is addressed in the draft Statement of Commitments.

7.9.2 Commercial Activity Noise

Assessment

The noise sources associated with the future operation of a Town Centre in Precinct 4 and Community Facilities within Precinct 3 have the potential to impact upon the amenity of the future residents within Precinct 5.

Given that Precinct 4 will be developed subsequently to the construction of the Kings Forest Parkway acoustic treatments, CRG considers that no additional noise attenuation is required. Accordingly it is considered that the predicted noise levels from commercial noise sources will be within the adopted noise criteria with the exception of waste collection and deliveries. CRG considers however, that these activities are unlikely to cause annoyance given that they are generally infrequent and of short duration. Overall, the noise impacts associated with future commercial activities within Precinct 4 are not expected to adversely impact upon the amenity of future residents within Precinct 5.

Management

In order to confirm CGR's conclusions, future development applications proposed within Precincts 3 and 4 will assess the acoustic impacts associated with the proposed development and provide additional acoustic treatments/ mitigation measures where necessary.

This matter is addressed in the draft Statement of Commitments.

7.9.3 Construction Noise

Assessment

The noise generated from construction works on the Kings Forest site have the potential to adversely impact upon the amenity of the residents within the dwellings on the western side of Tweed Coast Road. Furthermore, once dwellings are constructed and occupied within Precinct 5, noise generated from the construction of additional dwellings in subsequent development stages may also impact on residential amenity of the occupants of the dwellings in Precinct 5.

CRG's adopted noise criteria for construction works is 60 dB(A) and the analysis has found that the noise levels will be a maximum of 61dB, but will generally be below the 60dB threshold. Overall, it is anticipated that the construction works proposed within this proposal will not significantly impact upon the existing dwellings situated on the western side of Tweed Coast Road.

Management

In order to manage the construction noise the following measures will be implemented:

- Construction works will be restricted to:
 - Monday - Friday: 7am - 6pm;
 - Saturday: 8am - 1pm.

- A noise management plan will be prepared and implemented prior to commencement of construction works. The noise management plan will include the following measures;
 - contacting occupants of the existing dwellings on the western side of Tweed Coast Road, at the earliest possible time before site work begins and explain the nature of the construction stages and the duration of noisier activities;
 - ensuring all equipment is in good working order, and that mobile plant commence work as far from the dwellings as possible in the mornings;
 - locating fixed plant as far from neighbouring property boundaries as possible; and
 - locating fixed plant behind buildings or materials stockpiles to take advantage of acoustical screening from physical barriers.

These measures are incorporated into the draft Statement of Commitments.

7.10 Contamination

For the Concept Plan, Gilbert + Sutherland conducted a review of a number of contamination studies undertaken between 1992 and 2003 for the Kings Forest site. This preliminary assessment identified a number of areas adjacent to and within the site which had potential for contamination. The areas are listed below and identified in **Figure 6**:

- a capped, decommissioned Council landfill site (known as Old Bogangar Road Landfill);
- northern and southern banana plantations;
- a fuel storage area and former nursery;
- a former orchard; and
- a former cattle dip site.

Assessment

In accordance with the DGRs and Concept Plan Approval, Gilbert + Sutherland has undertaken detailed site investigations for the six identified sites and prepared an assessment report (**Appendix V**). The investigations included the drilling and analysis of a total of 43 soil boreholes.

The soil samples taken from the identified sites were analysed based on the proximity of the sample to a potentially contaminating activity and the contaminants of potential concern related to that activity. Overall, the samples were tested for:

- NEPM 8 heavy metals;
- Benzene, Toluene, Ethylbenzene and total Xylene (BTEX);
- Polycyclic Aromatic Hydrocarbons (PAH);
- Total Petroleum Hydrocarbons (TPH); and
- Organochlorine (OC) and organophosphorus (OP) pesticides.

The results of the testing found that no heavy metals associated with agricultural, horticultural and fuels storage activities were recorded in samples exceeding the NSW Health-Base Investigation Levels for urban residential sites. However the following were identified:

- Concentrations of arsenic within three boreholes (BH37, BH39 and BH42) taken from the southern Banana Plantation area marginally exceed the National Environment Protection Measure (NEPM) Environmental Investigation Level (EIL) and phytotoxicity-based investigation level.
- Concentrations of TPH within two boreholes (BH03 and BH 04) taken from the Fuel Storage site exceeded the Health Investigation Level (HIL) for standard residential purposes.

The identified arsenic contamination is considered to be only marginally above the EIL and consistent with background arsenic concentrations. On this basis Gilbert + Sutherland considers that these concentrations do not present a health risk or a constraint to future residential development. No remediation of this area is therefore proposed.

In relation to the TPH concentrations within the Fuel Storage site, Gilbert + Sutherland considers that this can readily be remediated and therefore does not present a constraint to the proposed development.

In addition to the above, minor contamination has occurred within the Fuel Storage Site as a result of the use of the above ground storage tank (AST) for refuelling machinery over a period of time.

The capped landfill site adjacent to the proposed development was assessed as it was considered that it had potential to contaminate groundwater within Kings Forest. Results of the assessment found that the groundwater associated with the landfill site would have no significant impact upon the proposed development given that groundwater flows in a westerly direction from the Kings Forest site towards and through to the western side of the landfill site, and the land use adjacent to the landfill will be community infrastructure and the risk of groundwater extraction and possible leachate would be manageable. Groundwater impact on the landfill site are considered in Section 7.15.

Moreover, as detailed in the Concept Plan, previous detailed investigations of the Cattle Dip Site identified contamination associated with dipping operations. A Remediation Action Plan (RAP) has been prepared for this land covering remediation actions such as on-site containment, treatment and off-site disposal.

Overall, Gilbert + Sutherland, considers the potentially contaminated areas to be manageable and that further remediation of these areas prior to development is achievable and would render the areas suitable for their intended end use.

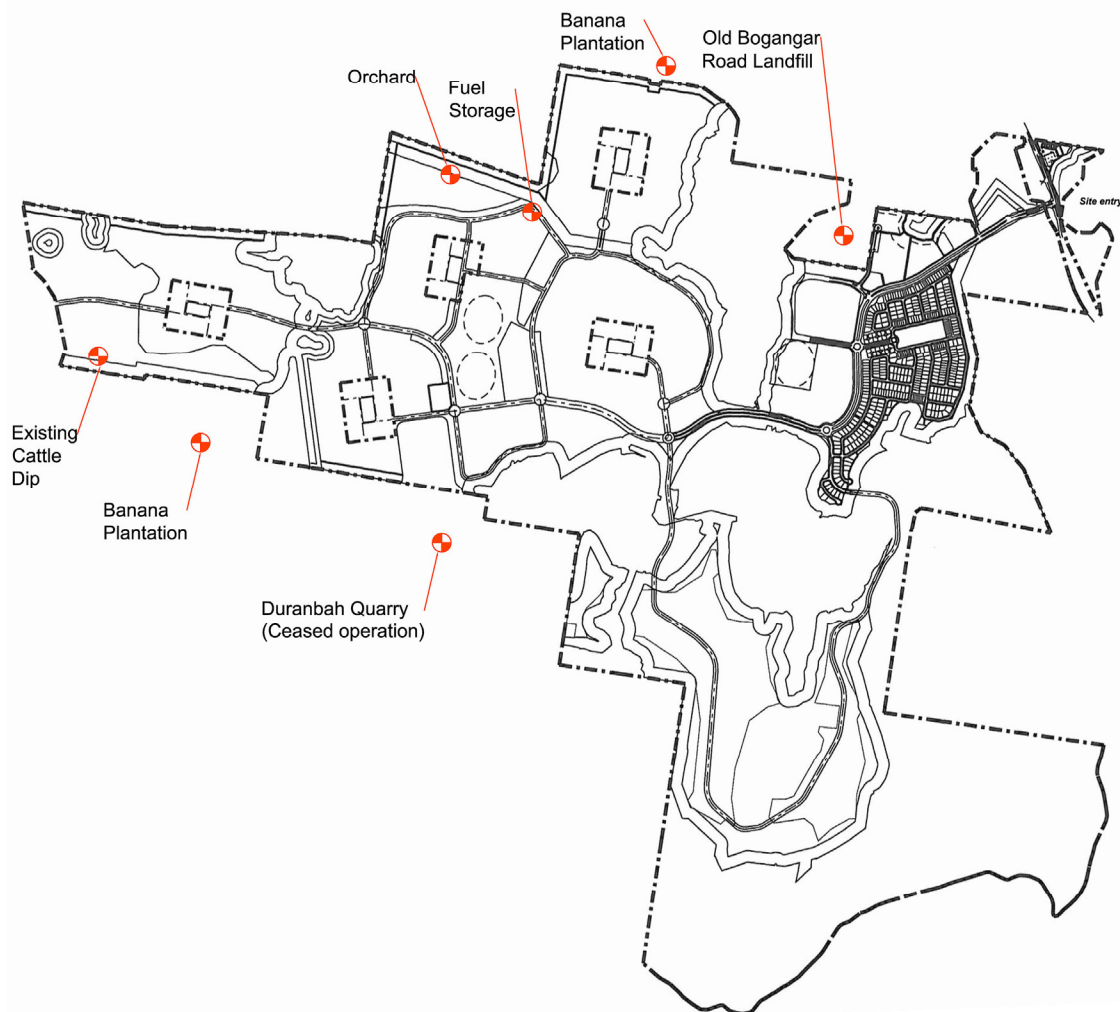


Figure 6 – Identified contamination sites (Source: Gilbert + Sutherland)

Management

Given that the project involves bulk earthworks across the entire Kings Forest site, prior to the commencement of any earthworks, Project 28 will undertake the following to manage the contamination identified above:

- **Fuel storage site:** Excavation of soils beneath the AST and validation of samples of the excavated material collected from the base and walls of the removed AST footprint.
- **Cattle Dip site:** Undertake further delineation studies of contamination prior to remediation of the site; and remediation of the site, in accordance with an updated RAP (if required).

These matters are addressed in the draft Statement of Commitments.

7.11 Radiation

The Kings Forest site has been historically used for sand mining and distinctive areas of disturbance are found within the eastern portion of the site.

Sand mining activity has the potential to give rise to radiation impacts. Accordingly, Gilbert + Sutherland has undertaken a quantitative radiation assessment to assess the potential for radiation within the disturbed areas on the site (refer to **Appendix V**). As part of their assessment they undertook:

- a review of the Aspect North Ltd *Assessment of Disturbance from Historical Aerial Photo Record, Stage 2 Kings Forest* August 2005; and
- a preliminary investigation of surface radiation levels and boreholes across the site.

Assessment

The quantitative radiation assessment comprised a site inspection, surface radiation survey and sub-surface investigation (24 boreholes), across four investigation areas as identified in Figure 10468.7.5 within the assessment report.

The surface radiation surveys found:

- no surface radiation levels recorded across the four survey areas exceed the remediation trigger guideline for dwellings, schools, businesses and industries where occupancies by the same people occurs on a day to day basis;
- the surface radiation levels within the four survey areas were generally considered to be representative of natural background radiation levels.

The sub-surface radiation survey found:

- no sub-surface derived gross radiation levels recorded across the four survey areas exceeded the remediation trigger guideline limit for dwellings, schools, businesses and industries where occupancies by the same people occurs on a day to day basis;
- all sub-surface derived gross radiation levels were consistent with background radiation levels for the survey mater and natural background levels with the exception of BH11 and BH12 (located within Survey Area 4), which recorded levels slightly above natural background levels.

Furthermore, Gilbert + Sutherland confirms that all areas potentially disturbed by sand mining exploration or extraction have been identified and no radioactivity has been identified at levels that would create a health risk.

Overall, given the above findings, it is considered that no further investigation is necessary and no mitigation measures are required.

7.12 Acid Sulfate Soils

Acid Sulfate Soils (ASS) investigations and testing undertaken for the Concept Plan identified the presence of both potential and actual ASS throughout the Kings Forest site at depths from near the surface level to 13m below the surface.

In order to support this Project Application, Gilbert + Sutherland has undertaken a further Acid Sulfate Soils assessment (**Appendix W**) to determine the extent and spatial variability of ASS at the site and estimate the overall acid generating potential of the material to be excavated and the neutralisation capacity required.

Assessment

The assessment was informed by a soil survey and Acid Sulfate Soil Assessment of the entire site conducted in June 1998 and supplementary drilling and soil sampling undertaken between May and August 2007. A total of 367 samples were taken across the site. The analysis revealed that 174 samples were considered to be either actual or potential Acid Sulfate Soils. Of these 82 samples were located within beach ridge sand areas and 92 within the wetland areas.

Figure 10468.2.3 within the Assessment Report identifies the potential acid sulfate soils and the borehole locations. As shown, the works proposed within the Project Application will encounter potential ASS materials requiring treatment. However, Gilbert + Sutherland anticipate that the management of ASS in accordance with standard procedures and practices will ensure the risks are controlled and any acidic materials excavated are fully treated and placed to minimise any adverse environmental impacts.

Management

In order to appropriately treat and manage ASS on the site, a detailed Acid Sulfate Soils Management Plan will be prepared and approved by the Department of Planning prior to the approval of construction certificate applications. The management will be achieved through lime neutralisation techniques including the following:

- all soils will be investigated for acid sulfate generating potential, in accordance with Acid Sulfate Soil Management Advisory Committee (ASSMAC) guidelines prior to disturbance;
- ASS treatment pads will be prepared prior to disturbance of any potential ASS. They will be constructed from relatively impermeable material and will contain any acidic leachate generated, prior to, or during the treatment process;
- all excavated ASS material will be spread in the treatment pad and allowed to dry, prior to lime being added (at a rate based on laboratory analysis) and incorporated into the soil; and
- validation sampling and analysis will be undertaken to ensure that the material is appropriately treated, prior to being used for fill.

These matters are addressed in the draft Statement of Commitments

7.13 Bushfire Impacts

A Bushfire Risk Assessment has been undertaken by Bushfiresafe (Aust) Pty Ltd for proposed development in accordance with the requirements of Planning for Bushfire Protection 2006 (PBP), Part 3A of the EP&A Act and section 100B of the *Rural Fires Act 1997* (RFA) (**Appendix X**). Sections 7.13.1 and 7.13.2 provide an assessment of the bushfire risk for the rural retail development at Precinct 1 and proposed residential subdivision at Precinct 5.

7.13.1 Rural Retail Development

Assessment

The rural retail development is situated to the north-west of an Environmental Protection area, as shown on the Precinct Plan at **Appendix H**. The dominant vegetation is bushfire prone and poses a bushfire threat to the rural retail development. Bushfiresafe classifies the land to the south and east of Precinct 1 as Subtropical Floodplain Forest. In order for the development to meet the requirements of the PBP, the establishment of an Asset Protection Zone (APZ) of 20m to the south and east is required.

Furthermore, as the vegetation occurs on a flat slope and a minimum separation of 35m is achievable from the vegetation, the Bushfire Attack Categories for Buildings A and B are as follows:

- Building A - BAL 40; and
- Building B - BAL 19.

Management

A number of strategies will be necessary to manage the identified bushfire risk to ensure that the proposed rural retail development will meet the requirements of the PBP and section 100B of the RFA. Project 28 Pty Ltd will implement these strategies as outlined in the Bushfire Management Plan at **Appendix X**.

This matter is reflected in the draft Statement of Commitments.

7.13.2 Precinct 5

Assessment

Precinct 5 is currently cleared of all over-storey vegetation and is managed as grazing land. It is, however, located adjacent to two Environmental Protection areas within the Kings Forest site and an area of grassland located outside of the Kings Forest site, as shown on the plans at **Appendix H**. These areas are all considered to contain potential bushfire prone vegetation. Bushfiresafe has classified the Environmental Protection area to the north-east as Open Forest, the Environmental Protection area to the south-east as Subtropical Floodplain Forest and the grassland to the east as Tall Heath. As a result of these classifications, in order to meet the PBP, the establishment of the following Asset Protection Zones are required:

- East - 15m;
- North and West - 10m; and
- South - 20m.

Along the eastern perimeter of Precinct 5 the required APZ is provided by a combination of roads, multi-use pathways and other land developed and managed as an APZ.

The required APZ for the northern and western parts of the site will be achieved with the Kings Forest Parkway which is between 34.6m - 40.6m wide.

The 20m APZ required for the south-eastern part of the Precinct will be achieved through the provision of a pedestrian footpath and the utilisation of the part of the buffer located nearest to the residential allotments. The 20m APZ required for the allotments at the southern end of the Precinct will be located within the 50m ecological buffer zone. A 6m fire trail is required to be constructed within the APZ surrounding two proposed allotments to enable fire fighters access to the bushland interface to these allotments. This is illustrated on the plans at **Appendix X**.

An assessment of the Bushfire Attack Categories applicable to the future dwelling construction has also been undertaken. The resultant Bushfire Attack categories for are shown on the plans within **Appendix X**.

Dwellings which are between 21m and 31m from the bushfire prone vegetation will need to be constructed to BAL 29 and the dwellings between 31m and 100m will need to be constructed to BAL 19. All other dwellings within Precinct 5 are not required to be constructed to a Bushfire Attack category.

Management

To ensure that the future residential development within Precinct 5 will meet the requirements of the PBP and section 100B of the RFA, a number of strategies will be necessary to manage the identified bushfire risk. Project 28 Pty Ltd will implement these strategies as outlined in the Bushfire Management Plan at **Appendix X**.

This matter is reflected in the draft Statement of Commitments.

7.14 Geotechnical Conditions

The Concept Plan included a broad assessment of the geotechnical conditions likely to affect the development potential of the Kings Forest site. The assessment found that the geotechnical constraints generally corresponded with the SEPP 14 Wetland areas and the areas which had slopes exceeding 20%.

In accordance with the Statement of Commitments included within the Concept Plan and the DGRs, a detailed Geotechnical Assessment has been undertaken in relation to the proposed earthworks and Precinct 5 development (**Appendix Y**).

Existing Conditions

The key geotechnical features of the Kings Forest site, as set out in the Concept Plan EAR are as follows:

- the site is generally low lying and of extremely low relief (<9m). Slopes range from 0% on the low lying to steep (40%) on the low hill areas, with average slopes generally moderately inclined (approximately 12-15%);
- the low lying areas are generally composed of beach ridge plain comprising of Pleistocene sands; and
- two areas within the western part of the site, and one area within the Environmental Protection Zone to the south of the proposed golf course have slopes exceeding 20%.

The Precinct 5 area is generally flat, low lying pastoral land covered with short slashed grass. It contains numerous drainage gullies and areas of high relief along the western and north-western boundaries.

Assessment

Fieldwork investigations across the entire Kings Forest site comprised 39 CPT probes pushed into the soil to refusal, 11 deep borehole drills and 9 shallow borehole drills to 6m or refusal.

The results of the investigations are set out in Table 1 within the Geotechnical Assessment (**Appendix Y**) and indicate variable subsurface conditions, however the majority of the borehole samples comprises generally loose to very dense sand and indurated sand from surface to depth. Within Precinct 5, the subsurface conditions were found to generally comprise topsoil between 0.0-0.1m; loose to very dense sand between 0.1-5m or depth; indurated sand between 1.8m - 12m or depth, with depth measuring between 6m - 20m.

In addition, a slope stability assessment of the entire Kings Forest site including the high relief areas was undertaken. The assessment did not observe any physical evidence of previous movement, seepage or soil creep during the fieldwork investigations.

The existing subsurface conditions, proposed earthworks across the site and areas of natural slope on the site can impact upon the development potential of the site.

Taking these factors into account, Cardno Bowler's assessment considers that:

- with the exception of the top soil stratum, all materials encountered during the investigation are considered acceptable for use as structural fill, subject to any pre-treatment being carried out prior to fill placement; and
- the stability of the site is acceptable for the proposed usage.

Cardno Bowler, however also consider that a number of measures are needed to be implemented to preserve the soil profile and it's stability.

Management

In order to ensure that the proposed earthworks and construction works will not adversely impact upon the site's soil profile or stability, Project 28 Pty Ltd will implement the recommendations set out within the Geotechnical Assessment. These recommendations consider site preparation, trafficability, excavatability, structural fill placement, batter slopes, building footings, settlement, the lake, and existing drains.

Furthermore a Site Based Management Plan prepared by Gilbert + Sutherland (**Appendix Z**) identifies and describes strategies for the management of site constraints and their likely impacts during, amongst other things, the pre-bulk earthworks, bulk earthworks, landform stabilisation, civil construction and operational phases of the project. The strategies within the Site Based Management Plan will be implemented to ensure that the bulk earthworks and civil construction works are managed in an environmentally responsible manner and facilitate the detection of potential or emerging changes in site conditions to allow for construction methods to be adjusted accordingly.

These matters are reflected in the draft Statement of Commitments.

7.15 Groundwater Impacts

The bulk earthworks and residential development of Precinct 5 has the potential to have an adverse impact upon the existing groundwater flow regimes and the groundwater quality across the site. Accordingly, a Groundwater Assessment (**Appendix AA**) has been undertaken by Gilbert + Sutherland to assess the groundwater impacts associated with the bulk earthworks and development of Precinct 5. There are three main sensitive receptors associated with the development:

- the SEPP 14 wetlands;
- Environmental Protection areas, including the Cudgen Nature Reserve; and
- the capped Bogangar landfill site.

Assessment

A total of 51 groundwater bores and 9 surface water boards were installed within the residential precincts, (Precincts 4 - 13 and Precinct 14) between 2005 and 2009. The existing groundwater levels and groundwater quality results are identified on the plans within the Groundwater Assessment Report (**Appendix AA**). In particular, the monitoring data indicated that:

- during dry times, groundwater levels fall and the site drains at a relatively constant rate;
- groundwater flow paths are dominated by the surface drainage pattern and the underlying indurated sands;
- groundwater flows from the centre of Precinct 5 in a south-westerly direction toward the north-south drainage line adjacent to the western boundary, Blacks Creek adjacent to the southern boundary, and easterly towards the Cudgen Nature Reserve;
- soil permeability in Precinct 5 ranges from 3.3m day⁻¹ in the southern area to 28.6m day⁻¹ in the northern area;

- a groundwater mound in the southern section of the southern precinct area forces flows in the southern catchment toward Cudgen Lake and flows in the northern catchment towards Blacks Creek and the adjacent wetland areas;
- permeability in the southern precinct area ranges between 7-10 day⁻¹; and
- groundwater in the western portion of the site generally follows the topography and flows towards Blacks Creek.

In light of these findings, the assessment of the proposed bulk earthworks and residential development of Precinct 5 identifies the likely impacts as:

- localised and minor changes on the groundwater flow regimes in the vicinity of drainage infrastructure;
- minor alterations in the groundwater level; and
- a significant reduction in groundwater recharge as a result of the increase of impermeable areas.

The likely impacts of the bulk earthworks on Precincts 6-11, including the excavation of the lake, as a detention area, are identified as:

- changes in local groundwater flows;
- impacts on the acid sulfate soils; and
- a potential to diminish the groundwater quality.

Furthermore, the likely impacts of the bulk earthworks on the southern precincts (Precincts 12, 13 and 14) are identified as:

- localised and minor changes to the pre-development groundwater flow regime of the low lying areas within the northern portion of the southern precinct area; and
- disturbance or in-situ oxidation of acid sulfate soils during the construction phase within the low lying areas.

Notwithstanding the above, Gilbert + Sutherland consider that each of the issues identified are readily anticipated and manageable, in particular:

- The residential development at Precinct 5 will not change the flow regime and the groundwater will still flow towards the SEPP 14 wetlands.
- The residential development of Precinct 5 will not adversely affect the groundwater level within the Cudgen Nature Reserve due to the presence of the stormwater swale within the ecological buffer (see Section 7.23 of this report). Moreover, given the groundwater velocities adjacent to Precinct 5, the placement of the bio retention swale 10m further east within the buffer delivers recharge to the nature reserve 41 days sooner, so mitigating the impact of extended dry periods (refer to Section 4.4 of the Groundwater Assessment).
- There are no acid sulfate soils within the Precinct 5 site and the works will not cause any reduction in the groundwater level in the acid sulfate soils associated with the SEPP 14 Wetlands.
- A minor reduction in the groundwater level in the northern portion of the southern precinct area is anticipated, however this can be managed appropriately to ensure no adverse impacts are generated.
- The SEPP 14 wetlands may be subject to minor changes in groundwater regime, however the works to the southern precincts pose a very low level risk to the wetlands and the changes can appropriately be managed.
- The development will not impact upon the groundwater regime of the Bogangar landfill site.

Management

In order to manage the potential impacts to ensure that the development does not generate any adverse environmental impacts on the groundwater flow regime, groundwater quality, SEPP 14 Wetlands or Environmental Protection areas on the site, Project 28 will implement all the strategies set out within the Groundwater Management Plan, prepared by Gilbert + Sutherland (**Appendix BB**).

In conjunction with the Site Based Management Plan (**Appendix Z**) the Groundwater Management Plan establishes the responsibilities and procedures for the management of groundwater during the pre-bulk earthworks, bulk earthworks, landform, stabilisation phase, civil construction, maintenance and operational life of the project.

This matter is addressed in the draft Statement of Commitments.

7.16 Flooding

A preliminary flood assessment of the site was undertaken for the Concept Plan. In accordance with the Concept Plan Statement of Commitments and DGRs, a further Flooding and Flood Management Assessment, prepared by Gilbert + Sutherland is included at **Appendix CC**. This report is based upon the findings of the preliminary modelling and assessment, but includes consideration of the following elements:

- a sea level rise scenario of 0.91m;
- a 10% increase in rainfall intensity;
- the detailed flood modelling results from Tweed-Byron Coastal Creek Flood Study;
- consideration of a freeboard of 0.5m; and
- the application of the principle of risk-based approach to the development so that residents remain safe for all flood events up to and including the Probable Maximum Flood (PMF) event.

Existing Conditions

The site is subject to flood inundation from both local catchment runoff and run-off from Cudgen Creek, and is also influenced by potential sea level rise, storm surge and climate change effects. Figure 10468.1.7 within the Flooding and Flood Management Assessment identifies the areas of the Kings Forest site which are currently subject to inundation during the ARI 100 year event. Precincts 1 and 5 are not currently subject to inundation.

Assessment

The Flood Assessment considers the impact of flooding on the Kings Forest site following completion of the proposed bulk earthworks and creation of the residential pad levels. The assessment confirms that the proposed earthworks will provide flood immunity as follows:

- Precinct 5 will be at RL 4.5m AHD, which is approximately 1.1m above the ARI 100 year high climate change level and 1.3m above the 10% increase in rainfall intensity climate change level;
- the proposed Golf Course and southern precincts (Precincts 12, 13 and 14) will be around RL 4.35m AHD, which is approximately 0.95m above the ARI 100 year high climate change level and 1.2m above the 10% increase in rainfall intensity climate change level;
- the mid-western precincts will have indicative pad levels between RL4.5m and RL5m AHD which is approximately 1.1m to 1.6m above the ARI 100 year high climate change level and 1.8m to 1.3m above the 10% increase in rainfall intensity climate change level;
- the far western precincts will have indicative pad levels of RL 5m which is approximately 0.7m above both the ARI 100 year high climate change and 10% increase in rainfall intensity climate change levels;

- all residential roads will be set approximately 500mm lower than the residential pad minimum levels and will therefore be above the ARI 100 year high climate change levels and well above the 10% increase in rainfall intensity climate change level;
- the proposed roads within Precinct 5 will all be trafficable for all events up to and including the 100 year climate change flood and for the ARI 500 years existing situation design flood.

The flood modelling results indicate, however, that two localised areas within the north-western part of the site are likely to have peaks occurring 6-9 hours following long duration storm events. This behaviour is considered to be different from the remainder of the general floodplain which is expected to have a slow peak (i.e. 30 hours or more). As such, these areas which comprise a small section of waterway near Reardons Road and another near the Tropical Fruit World are required to be specifically catered for in planning evacuation routes to flood free land.

Furthermore, Gilbert + Sutherland's evaluation of the availability and design of evacuation routes during rare and extreme floods and the extent of inundation from PMF flood levels has found that the majority of slab on ground dwellings would experience above floor flooding to a depth of approximately 550 - 650mm, however appropriate and safe evacuation routes can be provided.

Management

In order to provide flood immunity to Precinct 5 and the future residential precincts, Project 28 Pty Ltd will undertake the bulk earthworks, as explained in Section 3.2.

The only effective strategy to counter the potential effects of the design PMF flood levels, is the implementation of a well structured flood warning and evacuation strategy.

To ensure the safety of residents in the event of a larger flood, in conjunction with Council, SES and Police, Project 28 will prepare and seek to incorporate an evacuation response plan for Kings Forest into the Local Disaster Plan. The evacuation response plan will include the following alert level and activation sequencing:

- **Alert Level One:** Actual rainfall exceeds the 100 year ARI design and it is continuing to rain:
 - activation of evacuation response plan.
- **Alert Level Two:** Actual flood level reaches or exceeds the design ARI 100 year flood in less than 24 hours and the water level is still rising:
 - activation of evacuation notices to residents to be on standby and prepare for evacuation;
 - evacuation of sick, elderly and at risk groups; and
 - early voluntary evacuation to begin as soon as possible after reaching this stage.
- **Alert Level Three:** If the actual rainfall exceeds the ARI 500 year design rainfall or water level is still increasing and rate of rise data indicates less than 6-8 hours before roads or bridges will be cut:
 - general evacuation to commence.

These matters are addressed in the draft Statement of Commitments.

7.17 Water Cycle Management

An Integrated Water Cycle Management Strategy for Kings Forest was prepared and approved under the Concept Plan. That report was conceptual in nature and was intended to guide and inform the further investigation and selection of systems and devices for inclusion in future residential development in Kings Forest.

To supplement that report, Gilbert + Sutherland has since prepared an Integrated Water Cycle Management Plan (IWCMP)(**Appendix DD**) to further assess the applicability of those systems and devices and to provide recommendations for their inclusion within Precinct 5. The IWCMP includes a number of concepts for stormwater management and re-use, reduction in potable water demand, reduction in wastewater generation, and for recycling of water. These have been analysed and modelled (where appropriate) to inform the integrated water cycle management (IWCM) strategy for Precinct 5.

The following concepts, amongst others, were investigated:

- Installation of rainwater storage tanks in single and attached dwelling lots for the collection, storage and reuse of rainwater for toilet flushing, laundry cold water and outdoor uses. The capture and reuse of rainwater reduces the demand for potable water and the volume and rate of runoff during storms.
- Implementation of the principles of Water Sensitive Urban Design (WSUD) to provide treatment of stormwater run-off from the development, by means of bio-retention trenches within selected road reserves and a bio-retention swale systems along the eastern boundary of Precinct 5.
- Groundwater recharge through infiltration during and following rainfall events by means of the above bio-retention devices .

Precinct 1

It is intended that stormwater runoff from Precinct 1 will be treated before release by means of a treatment train that complies with the requirements of TSC's Development Design Specification D7, Stormwater Quality. A suitable gross pollutant trap will be installed to capture sediment and hydrocarbons from the paved areas. It is also intended that rainwater storage tanks will be provided generally in accordance with TSC's Rainwater Tank Policy and that the stored water would be used for toilet flushing and external uses. In addition to the above, an Overall Water Management Plan detailing all water-related environmental advice, strategies, monitoring and management measures is included at **Appendix EE**.

Precinct 5

As a result of the above investigation, the IWCM strategy for Precinct 5 will include the following components:

- Rainwater storage tanks on each allotment to supply water for external uses, toilet flushing and laundry cold water as required by, and described in, the Kings Forest Development Code.
- The implementation of NSW BASIX requirements and the inclusion of three star WELS rated fixtures to reduce water demand.
- Inclusion of WSUD elements - specifically bio-retention basins and trenches - for the management of stormwater runoff as described in the IWCMP report . A continuous bio-retention system will be constructed along the eastern edge of Precinct 5, while the main entry road is to be constructed with pavements falling towards bio-retention trenches in the median strip (see **Figure 6**). The bio-retention swales will be landscaped and planted out as rain gardens preferably using plant species endemic to the area.
- Reduction in the generation of wastewater by the use of Reduced Infiltration Gravity Sewers (RIGS).

7.17.1 Stormwater Quality

As part of the above Integrated Water Cycle Management Plan (**Appendix DD**), Gilbert + Sutherland prepared a supplementary stormwater assessment for Precinct 5. The assessment included a base case stormwater quality analysis and the modelling of four treatment trains to estimate the average annual pollutant loads in stormwater runoff.

Assessment

Runoff from the site generally flows easterly or southerly via a number of unnamed ephemeral gullies, agricultural drains and the SEPP 14 Wetlands into Cudgen Creek.

The assessment remodelled the base case scenario for Precinct 5 to estimate the volumes and quantities of suspended sediment, nitrogen and phosphorus predicted to be exported from Precinct 5 in its undeveloped and developed states. Furthermore, the stormwater treatment train options outlined in the Concept Plan were refined to suit the particular characteristics of the Precinct 5 site (i.e. low lying relief, sandy soils and proximity of the ground water) and modelled. The treatment train determined to be most appropriate for Precinct 5 includes:

- rainwater storage tanks on each allotment;
- bio-retention trenches within selected road reserves; and
- bio-retention swale systems along the eastern boundary of the precinct (see **Appendix OO**).

Bio-retention swales within the buffer along the eastern boundary were selected as they simultaneously achieve stormwater quality treatment and recharge the groundwater in the vicinity of the Cudgen Nature Reserve which includes groundwater dependent ecosystems. Groundwater recharge within the buffer is necessary to mitigate the potential changes to the existing hydrological regime identified in the groundwater assessment.

Computer modeling demonstrates that the proposed treatment measures have the capacity to reduce the average annual suspended sediment and total phosphorus loads to levels lower than the levels within the base case; that best practice pollutant load reduction targets would be achieved; and that the quality of the run-off would be acceptable.

The proposed treatment train complies with Tweed Shire Council's 'Development Design Specification D7, Stormwater Quality'.

Management

In order to ensure that the quality of the stormwater run-off is adequately treated, a system of bio-retention basins and trenches will be implemented, as shown in **Figure 7**. In addition, the Stormwater Management Plan, prepared by Gilbert+ Sutherland (**Appendix FF**) will be implemented. It provides and establishes the responsibilities and procedures for the management of erosion, sediment and stormwater during the construction, maintenance and operational stages of the development.

Furthermore, within Precinct 1, stormwater runoff will be treated before release by means of a gross pollutant trap to capture sediment and hydrocarbons from the paved areas. Rain water be will captured and re-used for toilet flushing and external uses.

This matter is addressed in the draft Statement of Commitments.