Technical Reports Bundle

Updated Senior Living Development Application

GemLife

Skennars Head

Lot 239 DP1201225
67 Skennars Head Road

PLANNERS NORTH, May, 2018

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TECHNICAL REPORT 1

Flora & Fauna Report

PLANNERS NORTH

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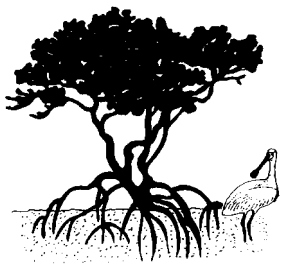

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AMENDED FLORA AND FAUNA SURVEY
LOT 239 DP1201225
67 SKENNARS HEAD ROAD, SKENNARS HEAD

PROPOSED LIVING GEMS SENIORS LIVING

PREPARED FOR
PLANNERS NORTH PTY LTD

May 2018

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SUMMARY

- This flora and fauna survey report has been prepared for Planners North Pty Ltd to accompany a development application and statement of environmental effects ("SEE") for 154 seniors serviced, self-care housing with associated clubhouse, recreation facilities, roads, utility services and environmental protection works.
- The land at 67 Skennars Head Road (Lot 239 DP 1201225) comprises of 11.61 ha and has a road frontage of 293 m. The majority of the land has been used for cattle grazing in the past and comprises of exotic grassland.
- Coastal wetlands mapped under State and Environmental Planning Policy No 14 are located in the west and littoral rainforest occurs as a small remnant.
- The proposal is situated in the eastern part of the site and will require filling, reshaping and contouring of the site. In order to achieve this result, the grassland will be removed together with some paddock trees and the existing landscaped gardens.
- The vulnerable plant, hairy joint grass, *Arthraxon hispidus*, was recorded in several small patches of less than 0.25 m^2. However, surveys undertaken in 2008 identified that this species was once widespread at the site. Hairy joint grass surveys demonstrated that its abundance has decreased dramatically since 2008.
- The proposed development will require the removal of some small patches of hairy joint grass measuring less than 10 m^2. Hairy joint grass is well represented locally. However, small areas will be retained at the site and a substantial compensation or offset program is proposed.
- Compensation plantings and management for vegetation removal will be in excess to contemporary standards. Littoral rainforest will be planted as a buffer to the SEPP 14 wetland and incorporated into landscaping.

SUMMARY

- Broad-leaved paperbark and rainforest species will be incorporated into landscaping and extensive weed control and bush regeneration will be conducted within the SEPP 14 wetland and adjoining remnants.
- The assessment of the potential impact of the proposal concluded that the development would not have a significant effect on threatened species, populations or ecological communities or their habitats and substantial areas of significant habitat will be retained, restored and replanted.

Fig. 1: The site and proposed development

1.0 INTRODUCTION

This flora and fauna survey report has been prepared for Planners North Pty Ltd to accompany a development application and statement of environmental effects ("SEE") for 154 seniors serviced, self-care housing with associated clubhouse, recreation facilities, roads, utility services, environmental management and environmental protection works.

The land at 67 Skennars Head Road (Lot 239 DP 1201225) comprises of 11.61 ha and has a frontage to Skennars Head Road of 293 m (Fig. 1). The land has been used for cattle grazing in the past and is generally grassed and supports a residence. However, 1.2 ha comprises of coastal wetlands mapped under State and Environmental Planning Policy No 14 (Coastal Wetlands) and 0.15 ha comprises of littoral rainforest or rainforest trees.

The proposed development is situated in the eastern part of the site and will require filling, reshaping and contouring of the site. Compensation plantings and management for vegetation removal will be in excess of contemporary standards. Littoral rainforest will be planted as a buffer to the SEPP 14 wetland and incorporated into landscaping. Broad-leaved paperbark will be incorporated in landscaping and extensive weed control and bush regeneration will be conducted within the SEPP 14 wetland and adjoining remnants.

2.0 FIELD SURVEYS

Vegetation surveys targeting vulnerable hairy joint grass, *Arthraxon hispidus*, were undertaken from April to June 2016 and from March

to April 2017. Prior surveys for hairy joint grass were undertaken by Landmark Ecological Services ("Landmark") (2008) (Fig. 2) and by Planit Consulting (2014) (Fig. 3).

The hairy joint grass surveys undertaken in April 2016 by Peter Parker Environmental Consultants Pty Ltd ("PPEC") were along the edges of drainage basins and in semi-saturated land, both of these sites are typical habitat for this species at Lennox Head. These surveys were unproductive so the 2016 search area was refined to include intensive surveys of the sites where hairy joint grass had previously been recorded by Landmark (Fig. 2). The more intensive surveys adopted transects of 1.5 m spacing, whereas the early surveys adopted random transects.

Hairy joint grass was resurveyed by this consultant on 27 and 28 March and 11 April 2017 and by Mr Adam Gosling of Environmental Assessments and Solutions Pty Ltd. This consultant resurveyed all of the areas where it had previously been recorded by Landmark Ecological Consultants by searching in random transects spaced at approximately 5 m intervals. Mr Gosling surveyed the whole of the site, including replicate surveys of the Landmark polygons, and searched in parallel transects spaced at approximately 10 m intervals. Mr Goslings surveys amounted to travelling approximately 10 km over the site, whereas this consultant travelled approximately 2 km.

When hairy joint grass was recorded, either in the Parker or Gosling surveys, a more intensive searching pattern was adopted to determine its density. Density measurements were based on a 1 m^2 plot and were as follows:

- Single or several stems, less than 5% cover m^2
- 6-20% cover m^2;
- Over 20% cover m^2

Hairy joint grass was recorded in 28 locations throughout the site (Fig. 3).

The PPEC 2017 survey was more intensive than that of Landmark and that undertaken in 2016 by PPEC. Despite this survey intensity, hairy joint grass is sparsely distributed in discrete locations. With respect to its density, no 1 m^2 plot had a cover greater than 20% and only six plots had between 6-20% cover. This is in stark contrast to other sites surveyed by this consultant in the locality (e.g., Henderson north) where a cover of over 80% m^2 was not uncommon.

A Getis-Ord Gi* Hot Spot analysis was undertaken of the 2017 survey data (Fig. 4). The Hot Spot Analysis tool calculates the Getis-Ord Gi* statistic (pronounced G-i-star) for each feature in a dataset.

This tool works by looking at each feature within the context of neighbouring features. A feature with a high value is interesting but may not be a statistically significant hot spot. To be a statistically significant hot spot, a feature will have a high value and be surrounded by other features with high values as well. Interestingly, this analysis, *inter alia*, demonstrated the insignificance of isolated occurrences of hairy joint grass in the east of the site and weighted more highly the two records in land to the west which has been preserved for conservation purposes. These results would not be predicted without this analysis.

Surveys of the broad-leaved paperbark, *Melaleuca quinquenervia*, forest, the littoral rainforest, sedgelands and paddock trees were undertaken from April to September 2016. Tree plots, the edge of vegetation and small rainforest remnant were surveyed by Kennedy Surveyors during August and September 2016 and in April 2018 (Fig. 1).

Fauna records were noted during the vegetation surveys. These included records of calling frogs, of birds and of mammals.

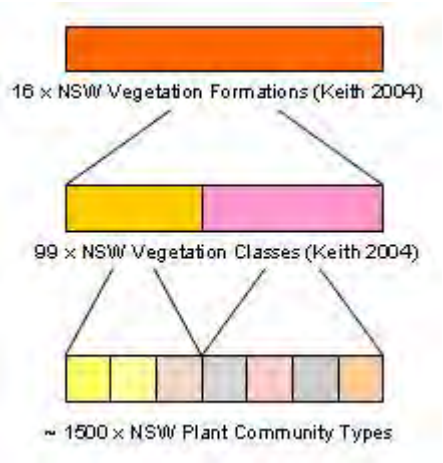
2.1 Air photo interpretation and vegetation transects

Vegetation was mapped over a current aerial photograph (December 2017), sourced from *Nearmap*, geo-referenced and imported into ArcGis software (Ver. 10.4).

Vegetation patterns were ground truthed for accuracy. The Kennedy surveyors data was imported into ArcGis.

2.1.1 Vegetation classification

Vegetation was mapped according to Keith (2004) and the Office of Environment and Heritage ("OEH") Vegetation Information System ("VIS"). This methodology uses the criteria vegetation formation, class and type.



The vegetation classification for native vegetation in NSW incorporates three nested classifications as illustrated. The plant community types and their relationships to vegetation formations and classes are maintained in the OEH VIS database.

2.2 Fauna

The fauna assessment included opportunistic observations and a database review. Threatened species recorded in the OEH BioNet Atlas from 2005 and 1 km from the site are mapped in Fig. 6[1]. Threatened species habitat requirements are addressed in section 6 of this report.

[1] Atlas records were searched under OEH Licence to Peter Parker Environmental Consultants Pty Ltd. The search was undertaken on 19 September 2016.

Fig. 2: Hairy joint grass records (Source: Landmark 2008 over 2016 aerial photo)

Fig. 3: Hairy joint grass surveys and analysis (2016 aerial photo)

Fig. 4: Hairy joint grass surveys Hot Spot analysis

Plate 1: Hairy joint grass located in dense stand of vasey grass (April 2017)

Plate 2: Hairy joint grass habitat in vasey grass (April 2017)

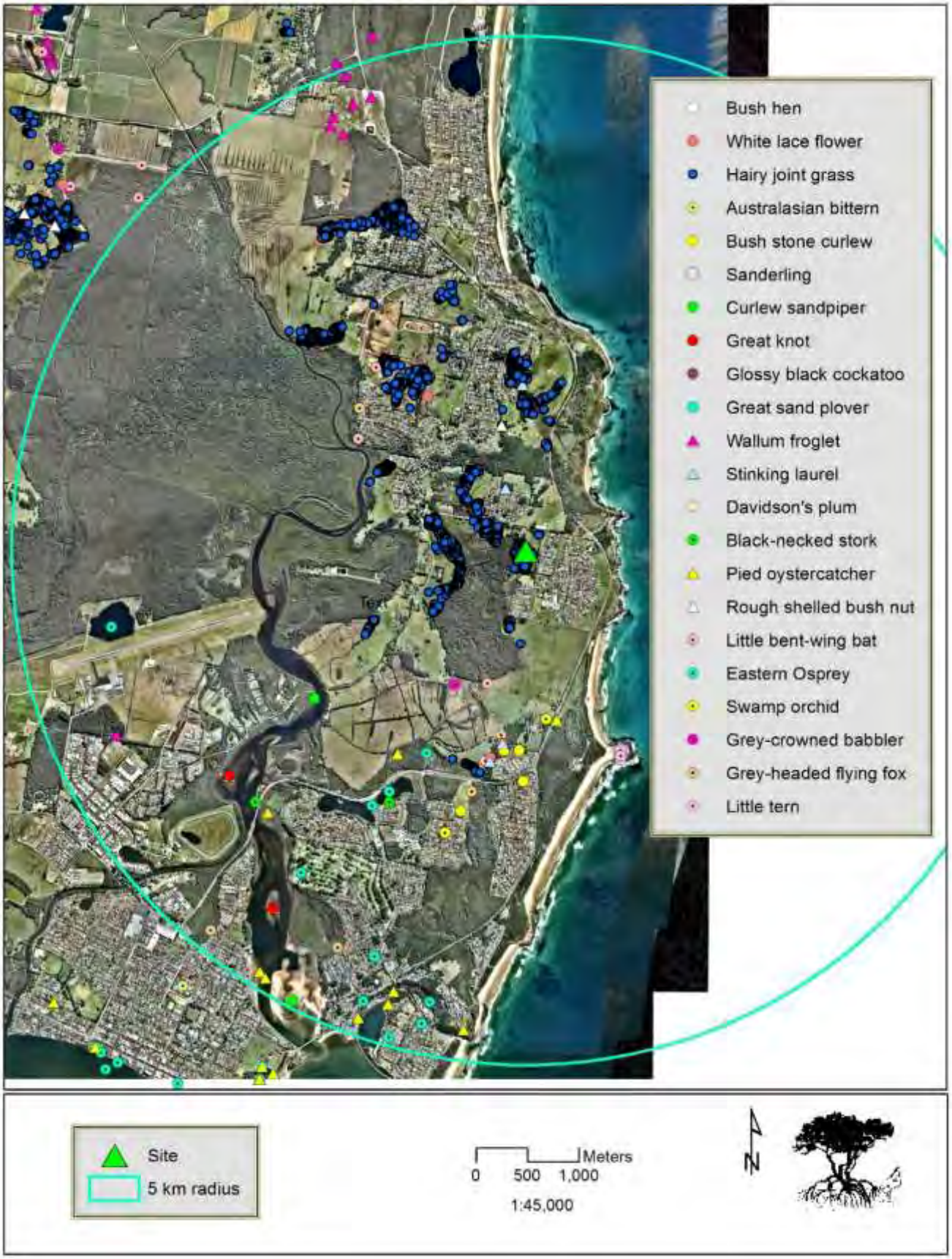


Fig. 5: Threatened species records within 5 km of the site (BioNet Atlas)

Plate 3: Grassland development site (plates 3-14 taken 2016)

Plate 4: Marking and surveying forest edge

Plate 5: Broad-leaved paperbark on forest edge

Plate 6: Sedgeland

Plate 7: Palms regenerating in paperbark forest

Plate 8: Swamp she-oak forest with emergent rainforest species

Plate 9: Camphor laurel control

Plate 10: Camphor laurel growing over existing dwelling

Plate 11: Small rainforest remnant to be removed

Plate 12: Exotic species under powerline easement

Plate 13: Exotic species adjacent to rainforest remnant

Plate 14: Surveying forest edge

3.0 RESULTS

3.1 Vegetation

Vegetation formations, classes and types are listed in Table 4 (Keith, 2004 and Fig. 7) and floristics in Appendix 1.

- Formation: Forested wetland (NR 255)
    - Class: Coastal swamp forests
    - Type: Mid-high to tall swamp she-oak open woodland to forest
    - Community: Swamp she-oak, *Casuarina glauca*, broad-leaved paperbark
- Formation: Forested wetland (NR 217)
- Class: Coastal swamp forests
- Type: Mid-high to tall broad-leaved paperbark open woodland to forest
- Community: Broad-leaved paperbark
- Formation: Freshwater wetlands (NR 150)
    - Class: Coastal floodplain wetlands
    - Type: Coastal freshwater meadows and forblands of lagoons and wetlands
    - Community: Eleocharis spp., Triglochin procerum, water couch (Paspalum distichum), Carex pumila, swamp rice grass, Leersia hexandra
- Formation: Rainforests (NR 273)
    - Class: Littoral rainforest
    - Type: Mid-high tuckeroo - riberry littoral rainforest
    - Community: Tuckeroo, sweet pittosporum, beach acronychia littoral rainforest

Table 1: Definition of vegetation types for northern rivers CMA (Source: OEH Biometric vegetation type database)

Veg Type ID	Vegetation type	Main associated species (modified by author)	Landscape position
NR 255	Swamp oak swamp forest of the coastal lowlands of the north coast	Broad-leaved paperbark, camphor laurel, *Cinnamomum camphora*, bangalow palm, *Archontophoenix cunninghamiana*, sandpaper fig, *Ficus fraseri*	Widespread on poorly drained sites in coastal areas
NR 217	Paperbark swamp forest of the coastal lowlands of the north coast	Broad-leaved paperbark, bangalow palm, common silkpod, *Parsonsia straminea*	On poorly drained sites that may remain waterlogged for considerable periods, and along creek banks
NR 150	Coastal freshwater meadows and forblands of lagoons and wetlands	*Gahnia clarkei*, *Baumea arthrophylla*, *Baumea rubiginosa*, *Baloskion tetraphyllus*, *Eleocharis* spp.	Swamps and lakes on the floodplain
NR 273	Tuckeroo - riberry - yellow tulipwood littoral rainforest of the north coast	Tuckeroo, *Cupaniopsis anacardioides*, riberry *Syzygium luehmannii*, Broad-leaved Lilly Pilly *Acmena hemilampra*, Yellow Tulipwood, *Drypetes australasica*	Protected sites near the coastline

3.1.1 Swamp oak swamp forest of the coastal lowlands of the north coast (NR 255)

This community occurs to the north of the SEPP 14 broad-leaved paperbark forest. This small (0.14 ha) community supports broad-leaved paperbark but differs from the paperbark swamp forest (NR 217) by being dominated by swamp oak and supporting substantial rainforest regeneration (Appendix 1). It has a relatively high level of weed infestation.

Plate 15: Rainforest regeneration in swamp oak forest

3.1.2 Paperbark swamp forest of the coastal lowlands of the north coast (NR 217)

This community is locally widespread occurring on poorly drained sites that remain waterlogged for considerable periods. Broad-leaved paperbark entwined with the climber common silkpod, *Parsonsia straminea*, are the most conspicuous and abundant species throughout this community. It is mapped under SEPP 14 and 1.1 ha occurs at the site.

Plate 16: Broad-leaved paperbark forest

3.1.3 Coastal freshwater meadows and forblands of lagoons and wetlands (NR 150)

This community occurs in drainage basins in the lowest-lying portions of the site. It is dominated by sedges and aquatic plants

(Appendix 1).

Plate 17: Freshwater meadow (sedgeland)

3.1.4 Tuckeroo - riberry - yellow tulipwood littoral rainforest of the north coast (NR 273)

Littoral rainforest occurs in protected sites near the coast. The small (0.08 ha) remnant is impacted by exotic species, exposure (has a large edge-to-area ratio), limb drop and its proximity to an electric transmission cable which requires maintenance clearing.

Plate 18: Littoral rainforest remnant

In addition to the above-listed associations, grassland occurs over the majority of the area proposed for development. Slash pine, *Pinus ellioti*, together with native and exotic regrowth occurs mostly outside of the site adjacent to its eastern frontage.

Grassland was dominated by a variety of exotic species depending on slope, aspect and moisture. For example, the upper slopes were dominated by narrow-leaved carpet grass, *Axonopus fissifolius*, buffalo grass, *Stenotaphrum secundatum*, white clover, *Trifolium repens*, Parramatta grass, *Sporobolus indicus* var. *capensis*, and exotic weeds (see Appendix 1). The more elevated parts of the lower flats were dominated by canary seed grass, *Setaria sphacelata*, and vasey grass, *Paspalum urvillei* whereas slender knotweed, *Periscaria decipiens* and cuphea, *Cuphea carthagenensis*, were more common in depressions.

Hairy joint grass was only recorded in five small patches measuring less than 0.25 m^2 (Plate 17) despite approximately 10 hours of

searching in April 2016. A further search in June 2016 following heavy local flooding failed to re-record the April 2016 observations. The lower flats were inundated with stormwater for several days apparently to the detriment of this species.

Plate 19: Hairy joint grass

Fig. 6: Vegetation

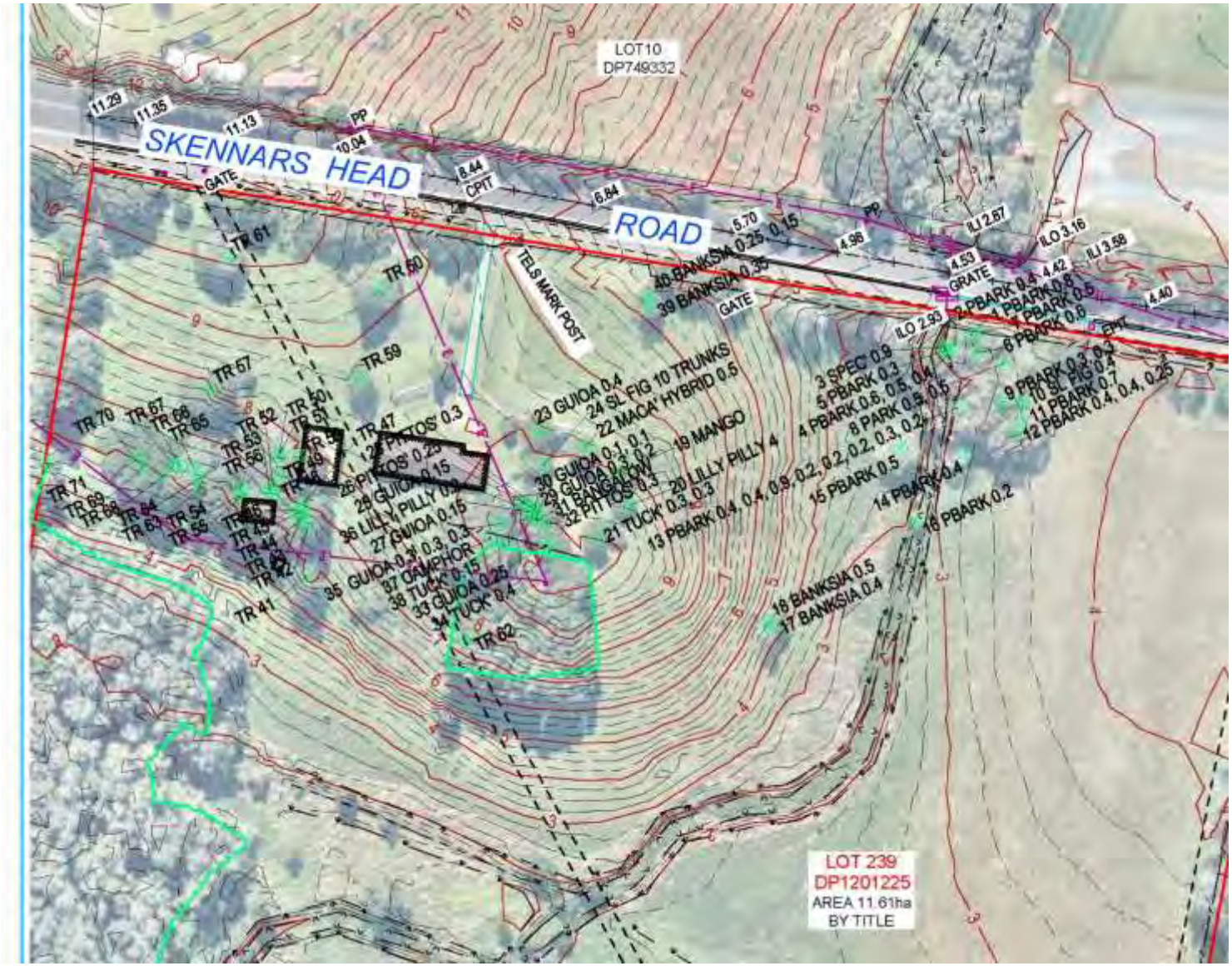


Fig. 7: Tree plots and littoral rainforest (Source: Kennedy Surveyors September 2016)

Table 2: Tree plot results (Source: Kennedy Surveyors)

Tree # and species	Trunk size cm (dbh)	Tree # and species	Trunk size cm (dbh)
1: broad-leaved paperbark	80	23: guioa	40
2: broad-leaved paperbark	40	24: small leaf fig	10 trunks
3: broad-leaved paperbark	90	25: guioa	40
4: broad-leaved paperbark	60/50/40	26: sweet pittosporum	25
5: broad-leaved paperbark	30	27: guioa	15
6: broad-leaved paperbark	60	28: sweet pittosporum	30
7: broad-leaved paperbark	80	29: guioa	30/20
8: broad-leaved paperbark	50/50	30: guioa	10/10
9: broad-leaved paperbark	30/30	31: bangalow palm	
10: small leaf fig	40	32: sweet pittosporum	20
11: broad-leaved paperbark	70	33: guioa	25
12: broad-leaved paperbark	40/40/25	34: tuckeroo	40
13: broad-leaved paperbark	40/40/90/20/20/30/20/20	35: guioa	30/30/30
14: broad-leaved paperbark	40	36: lilly pilly	20
15: broad-leaved paperbark	50	37: camphor laurel	
16: broad-leaved paperbark	20	38: tuckeroo	15
17: coast banksia	40	39: coast banksia	35
18: coast banksia	50	40: coast banksia	25/15
19: mango		41: coast banksia	50/50
20: lilly pilly	4	42: coast banksia	15
21: tuckeroo	30/30	43: guioa	25
22: bush nut hybrid	50	44: guioa	30

Table 2: Tree plot results continued (Source: Kennedy Surveyors)

Tree # and species	Trunk size cm (dbh)	Tree # and species	Trunk size cm (dbh)
45: guioa	40	61: guioa	40
46: guioa	40	62: camphor laurel	
47: guioa	45	63: guioa	25
48: guioa	20/20	64: tuckeroo	30
49: guioa	35	65: camphor laurel	
50: tuckeroo	30	66: tuckeroo	50
51: guioa	40	67: tuckeroo	35
52: guioa	35	68: guioa	20/10
53: tuckeroo	25	69: guioa	35
54: tuckeroo	30	70: tuckeroo	35/35/40
55: tuckeroo	30	71: camphor laurel	
56: tuckeroo	30		
57: camphor laurel			
58: camphor laurel			
59: coast banksia	35		
60: guioa	40/40/40/30		

4.0 Fauna

4.1 Reptiles and frogs

A number of lizards, skinks and frogs were recorded during the flora survey. The eastern grass skink, *Lampropholis delicata*, was recorded in the littoral rainforest remnant and in landscaped areas and the eastern water dragon, *Physignathus lesueurii*, was recorded in the broad-leaved paperbark forest.

No snakes were observed although a number of species are expected to occur based on the nature of fauna habitat. These include the yellow-faced whip snake, *Demansia psammophis,* the carpet python, *Morelia spilota,* red-bellied black snake, *Pseudechis porphyriacus*, and the eastern brown snake, *Pseudonaja textilis* (see Appendix 2: Fauna).

Two frog species were recorded calling, although the number of species expected to occur based on potential habitats would be much higher. Species recorded were the common eastern froglet, *Crinia signifera*, and the striped marsh frog, *Limnodynastes peronei.* These species were recorded from within areas proposed for development and from within the adjoining landscape. Species expected are listed in Appendix 2: Fauna.

4.2 Birds

A variety of forest birds were recorded (refer to Appendix 2: Fauna). The most abundant species was the rainbow lorikeet, *Trichoglossus haematodus*. However, Lewin's honeyeater, *Meliphaga lewinii*, the grey fantail, *Rhipidura fuliginosa,* the white-throated gerygone, *Gerygone olivacea flabelliformis*, and the fig bird, *Sphecotheres*

viridis, were relatively common in the forested parts of the site. The red-backed fairy-wren, *Malurus melanocephalus*, and golden-headed cisticola, *Cisticola exilis*, were common in the grassland. The noisy miner, *Manorina melanocephala*, occurred as small flocks in landscaped areas around the existing dwelling and was noted intimidating other bird species.

4.3 Mammals

The swamp wallaby, *Wallabia bicolour*, was observed and scats were noted in the grassland and in forested areas. The European red fox, *Vulpes vulpes*, is expected to occur and domestic dogs were occasionally observed at the site. Koala scats were not recorded and no potential koala food trees occur at the site. The site supports habitat for a number of microbats, the grey-headed flying fox, Pteropus poliocephalus, and native small mammals such as the bush rat, *Rattus fuscipes* and swamp rat, *Rattus lutreolus*. Other species expected to occur are listed in Appendix 2: Fauna.

5.0 DISCUSSION

5.1 Threatened flora and endangered ecological communities

A search of the Office of Environment and Heritage ("OEH") BioNet Atlas was undertaken for threatened species within are area of 1 km of the site. Not surprisingly, this search revealed an extensive number of hairy joint grass records, most of which originate from the Landmark surveys (2008) which specifically targeted this species. Other species in BioNet include stinking laurel, *Cryptocarya foetida*, which was recorded to the north of the site and the rough-

shelled bush nut, *Macadamia tetraphylla*, was recently recorded by this consultant on the proposed Visions Estate, also to the north of the site. A hybrid bush nut occurs in the garden of the residence located at the site but this species is not listed as threatened.

The vulnerable hairy joint grass was recorded in an area proposed for development. This is further addressed in the statutory consideration in section 6 of this report.

The vegetation associations NR 217 and NR 255 described in this report have the same floristic character as the two endangered ecological communities ("EECs"): Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions and Swamp oak floodplain forest of the NSW north coast, Sydney Basin and South East Corner bioregions as described in the Final Determination of the NSW Scientific Committee ("NSWSC"). For the purpose of this assessment, it is accepted that they are EECs and potential impacts are mitigated and avoided.

The littoral rainforest (NR 273) meets the Final EEC determination for Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions:

> *"The plant species in this ecological community are predominantly rainforest species with evergreen mesic or coriaceous leaves. Several species have compound leaves, and vines may be a major component of the canopy."*
>
> *"Littoral rainforest occurs on both sand dunes and on soils derived from underlying rocks."*

> *"Littoral Rainforest comprises the Cupaniopsis anacardioides – Acmena spp. alliance of Floyd (1990). This alliance as described by Floyd includes five sub-alliances".*
>
> *"The species composition of a site will be influenced by the size of the site, recent rainfall or drought condition and by its disturbance (including fire) history……..The assemblage in individual stands will depend on geographic location, size of stand, degree of exposure, history of disturbance and, if previously disturbed, stage of regeneration."*

Similarly, community NR 150, coastal freshwater meadows and forblands of lagoons and wetlands community is described by the NSWSC as the EEC *"Freshwater Wetland on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions".*

The NSWSC described:

> *"The structure of the community may vary from sedgelands and reedlands to herbfields, and woody species of plants are generally scarce. Typically these wetlands form mosaics with other floodplain communities, and often they include or are associated with ephemeral or semi-permanent standing water."*
>
> *"Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions forms part of a complex of forested wetland and treeless wetland communities found throughout the coastal floodplains of NSW."*

5.2 Threatened fauna

A number of vulnerable fauna species including the pale-vented bush-hen, the Australasian bittern, the rose-crowned fruit dove, the little bent-wing bat, the eastern long-eared bat, the greater broad-nosed bat, the eastern blossom bat, and the grey-headed flying-fox, have suitable habitat components in the western part of the site and in the SEPP 14 areas to the south. These species are addressed in section 6 of this report.

5.3 OEH key habitats and corridors

The OEH has identified the north-east of NSW as one of Australia's biodiversity hot spots and an area where threats, such as habitat loss and fragmentation, are severe. The Key Habitats and Corridors project has adopted a systematic approach to landscape conservation. OEH has mapped part of the site as within a strategic corridor (Fig. 7). The vegetation in the western part of the site lies within this corridor. This vegetation includes the SEPP 14 wetland, the swamp oak forest and remnant littoral rainforest trees.

Fig. 8: OEH key habitat and corridor map

5.4 Amelioration

5.4.1 Avoidance

Strategies for managing the adverse impacts of a project on biological diversity are, in order of priority: avoidance, mitigation and offset. Avoidance and mitigation measures reduce the scale and intensity of the potential impacts of a project on a site's biological diversity. Offsets are then used to address impacts that remain after avoidance and mitigation measures have been put in place (see "*Principles for the Use of Biodiversity Offsets in NSW*", Office of Environment and Heritage 2016 http://www.environment.nsw.gov.au/biodivoffsets/oehoffsetprincip.htm).

This proposal avoids impacting on littoral rainforest, SEPP 14 wetlands, the broad-leaved paperbark forest, the swamp oak forest and the freshwater wetlands.

5.4.2 Offsets

An offsets package can involve direct offsets or other compensatory measures. Direct offsets may provide a measurable conservation gain for the affected components of biological diversity, such as threatened species, populations or ecological communities. Principle 8 of the *Principles for the Use of Biodiversity Offsets in NSW* requires that offsets should be agreed prior to the impact occurring. Offsets should minimise ecological risks from time-lags and the feasibility of the offset actions should be demonstrated prior to the approval of the impact.

Council requested that offsetting for hairy joint grass should be the historical records of Landmark combined with records obtained by Peter Parker Environmental Consultants Pty Ltd ("PPEC") (Fig. 8).

The Landmark hairy joint grass survey and the PPEC records are illustrated in Figs. 2 and 8. Within the development area they are highlighted in Fig. 2 and amount to 1,844 m2. The more recent PPEC records are small discreet occurrences amounting to less than 10 m2; excluding where they overlap with the Landmark records. Hairy joint grass is also retained on the site in conservation precincts.

The Landmark hairy joint grass records plus the PPEC records amounts to around 1,850 m2. Compensation is provided by 7,200 m^2 of littoral rainforest, 1,700 m^2 of freshwater wetland and 2,013 m^2 of broad-leaved paperbark and rainforest landscape plantings (Fig. 1). An additional 1,600 m^2 plantings of rainforest species will be undertaken within the settlement pond (see diagrammatic representation in engineering drawings).

In total, plantings amount to around 12,500 m^2 which is an offset ratio of just under 7:1.

Fig. 9: Hairy joint grass records used for offset calculations

5.4.3 Reafforestation and weed control

It is proposed that weed control in the SEPP 14 wetland and all other retained bushland areas be conducted by qualified bush regenerators. This will be described in a vegetation management plan ("VMP") and subject to a condition of development consent. Management actions include planting, assisted regeneration, weed control and fencing.

6.0 STATUTORY CONSIDERATIONS

6.1 Environmental Planning and Assessment Act 1979

For the purposes of the *Environmental Planning and Assessment Act 1979* ("EPA Act") and, in particular, in the administration of sections 78A, 79B, 79C, 111 and 112, the following must be taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

- Each of the factors listed below under sections 5A a-g; and
- Any assessment guidelines[2].

S.5A (a)

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

2 For the purpose of this assessment the *Threatened species assessment guidelines, the assessment of significance* have been adopted. Publ. DECC 2007

In assessing the likelihood that a *viable local population* of a species will be placed at risk of extinction from this proposal the following factors have been considered:

- the proposal's likely impact upon the key habitat components essential to the species' lifecycle; and
- the size of the local population in comparison with that which is proposed to be removed/modified.

A study area of 5 km around the site was adopted after discussions with Council.

The Guidelines provide the following advice:

"The assessment of the local population may be extended to include individuals beyond the study area if it can be clearly demonstrated that contiguous or interconnecting parts of the population continue beyond the study area, according to the following definitions:

The local population of a threatened plant species comprises those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area.

The local population of resident fauna species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area.

The local population of migratory or nomadic fauna species comprises those individuals that are likely to occur in the study area from time to time."

Flora

Hairy joint grass

Hairy joint grass was recorded within both an area proposed for development and an area proposed for conservation.

This species is sparsely distributed and not considered viable[3] at the site for the following reasons:

- Hairy joint grass has declined dramatically from the time of the 2008 Landmark survey to the present; and
- Its ability to regenerate and spread across the site is impeded by dense canary seed grass and vasey grass.

The dramatic decline of hairy joint grass over the last nine years is apparent. This is attributed to the colonisation of the site by exotic species such as canary seed and vasey grass. It is unlikely that hairy joint grass will persist due to its complete disappearance over most parts of its previous range at the site and its decline over such a short time frame i.e., from 2008 to 2017.

The Guidelines state that:

> *"Demonstrating that a population is not viable would require considerable effort and study. Therefore any known or presumed local population should be assumed to be viable unless the contrary can be conclusively demonstrated through analysis of local ecological information, records, references and knowledge of species' behaviour and habitat, or through a comprehensive on-site ecological study.*

[3] Viable: the capacity to successfully complete each stage of the life cycle under normal conditions. (Source: Threatened species assessment guidelines)

Hairy joint grass surveys demonstrate the dramatic decline of this species at the site. It may persist in small isolated patches but given the current threatening processes and the sparseness in its distribution its survival in the medium term (e.g., over the next decade) is questionable.

Should this species be considered to be viable by Council, it is unlikely that its loss at the site would be result in *an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.* The reasoning behind this proposition is as follows:

- it occurs in part of the site proposed for conservation;
- it is widespread and abundant locally (in the Lennox Head area); and
- its spatial extent and density at the site is negligible in the context of its local population.

Square-stem spike rush

The square-stem spike rush is a tufted perennial plant distinguished by its slender four-angled stem and broad spikelet on top of the stem. Stems grow 30 to 100 cm tall and are 1 – 1.5 mm in diameter. The leaves are at the base of the stem and are not very conspicuous, being reduced to tubular sheaths. The spikelet is 10 – 20 mm long and 3.5 – 5mm in diameter and seeds are contained within the spikelet and are a shining yellow or brown colour, approximately 1.5 mm long and 1 mm wide. This species was not recorded at the site despite searches being undertaken in potential habitat. Moreover, all potential habitat will be preserved within conservation areas.

http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10265.

Swamp orchid

This orchid has flower stems up to 2 m tall and large broad leaves with a pleated appearance, both arising from a fleshy bulb near ground level. The large, showy flowers, with up to 20 per stem, have four petals which are white on the outside and brown with white or yellow veins on the inside. The central tongue of the flower is pink and yellow with lobes slightly curved inwards http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10610. This species was not recorded at the site despite searches being undertaken during its flowering period when it would have been conspicuous. Moreover, all potential habitat will be preserved within conservation areas.

Frogs

Wallum froglet

This species is confined to the wallum heaths which include the "acid" paper-bark swamps and fernlands.

The wallum froglet extends along the coast from south-eastern Queensland to around Sydney. The wallum froglet is conspicuous and abundant in the heathland to the north and south of the site depending on survey timing of and recent rainfall.

This species was not recorded and marginal habitat in the broad-leaved paperbark wetland will be retained for conservation purposes. Thus, *a viable local population of the species is likely to be placed at risk of extinction.*

Birds

Pale-vented bush-hen

The pale-vented bush-hen frequents swamps, flooded grasslands and rainforest fringes along Australia's eastern and northern coastline (RAOU Atlas map 053). This species appears to still be common throughout its range. However, its secretive nature makes population estimation difficult (Pringle 1985). It has a coastal distribution in the northern part of New South Wales.

The pale-vented bush-hen is impacted by the clearing of riparian vegetation and predation by dogs and cats. Potential bush hen habitat is located in the SEPP 14 wetland and surrounding landscape including the sedgelands (Freshwater wetlands) and saturated grasslands. Impacts on this species are likely to be minimal due to the separation between the proposed development and potential habitat and a prohibition on dogs and cats.

Australasian bittern

This species has been recorded approximately 800 m to the south of the site on the SEPP 14 wetland periphery. The Australasian bittern is a moderately large (70 cm in length) heron-like wetland bird with mottled and streaked brown plumage, which provides camouflage in its reedbed habitat. The species has a dark streak down each side of the neck, a pale throat, and olive legs. It inhabits temperate freshwater wetlands and occasionally estuarine reedbeds. This

species favours permanent shallow wetlands, or edges of pools and waterways, with tall, dense vegetation such as sedges, rushes and reeds on muddy or peaty substrate. The Australasian bittern is considered sedentary in permanent habitat. However, the species can also be irruptive and dispersive in response to changing water levels and is suspected to make short-range seasonal (post-breeding) movements. Breeding pairs are solitary and territorial, occupying relatively large home ranges of 40-50 ha and therefore occurring at low densities (http://www.environment.nsw.gov.au/resources/nature/schedules/AusBittern.pdf).

This local population of this species is unlikely to be affected by the proposal as no potential habitat will be disturbed or modified and no dogs or cats will be permitted.

Rose-crowned fruit dove

The rose-crowned fruit-dove is a small (22-24.5 cm) frugivorous bird that is largely confined to rainforest. Its' distinctive colouration includes a rose crown, a blue head, a dark green back and abdomen and a yellow tail-tip. It frequents rainforests, monsoon and paperbark forests, eucalypt woodlands, vine groves, fruit orchids, camphor laurel and broad-leaved privet regrowth.

The rose-crowned fruit-dove migrates altitudinally, moving to coastal and near-coastal areas during the winter months (pers. obs.) and is likely to occur in the littoral rainforest and possibly the swamp oak forest. The proposed development is unlikely to impact on this species as its' potential habitat at the site will be enhanced by additional rainforest plantings which will include figs.

Bush stone curlew

The bush stone-curlew stands between 50 and 60 cm tall with long legs and a mottled brown, white and grey plumage. It is nocturnal and tends to lie or stand motionless in woodlands during the day. Its presence is most often indicated by its distinctive whistling and wailing 'weer-lo' calls after dark (DEC 2006).

Breeding pairs have been recorded by this consultant at Angel's Beach Estate within 5 km of the site. They are considered to be highly mobile as described in the bush stone-curlew recovery plan. Breeding pairs were reported in the recovery plan as flying long foraging distances and using communal roost sites. They had large home ranges of up to 337 hectares. During the breeding season, home ranges contracted to approximately 39 hectares (Gates 2001 in DEC 2006). It has been suggested that these birds could be first time breeders searching for a suitable breeding territory or that young birds breeding for the first time may not immediately establish year-round territories or that suitable habitat was limited.

The important structural elements of bush stone-curlew habitat appear to be: a low sparse ground cover, some fallen timber and leaf litter, a general lack of a shrubby understory and open woodland (DEC 2006).

Most studies of the species have been in modified environments where native vegetation exists in small, isolated remnants and introduced predators are present (eg Johnson and Baker-Gabb 1994, Davey 2005, Price 2004 in DEC 2006). Thus, habitat characteristics of the species is likely to be an adaptation for survival in disturbed and modified environments (DEC 2006).

Foxes can kill adult bush stone-curlews as well as chicks. Observations of landholders suggest that nesting success and juvenile survivorship increases when predators are excluded or removed from breeding habitat (Johnson & Baker-Gabb 1994 in DEC 2006). Other threatening process include, timber removal, fire, grazing, alteration in land use intensity and a combination of these factors.

It is unlikely that the proposed development will significantly impact on the bush stone-curlew as potential habitat will not be modified or removed and no dogs will be permitted.

Glossy black cockatoo

The glossy black cockatoo is a small blackish brown bird with a broad bulbous bill and a low round crest. The female is distinguished from the male by irregular yellowish patterns on the head, crest and/or neck. The female also has a red tail panel, edged with yellow and usually barred black.

The glossy black cockatoo frequents open forests and woodlands extending into semi-arid areas and occurs in loose groups of two to 20 birds. This species feeds almost exclusively on the fruits of sheoaks.

The glossy black cockatoo requires large tracts of undisturbed or minimally disturbed woodland with nest hollows and an adequate supply of sheoak seed (Brouwer and Garnett 1990). Potential feeding sites at the site were noted but suitable trees species are all to be retained in conservation areas.

Black-necked stork

The black-necked stork is the only species of stork found in Australia. The distinctive black-and-white waterbird stands an impressive 1.3 m tall and has a wingspan of around 2m. The head and neck are black with an iridescent green and purple sheen. The massive bill, short tail and parts of the wings are also black and the long legs are a conspicuous orange-red to bright red. The rest of the body is white.

Black-necked storks are usually seen singly or in pairs in NSW, occasionally in loose family groups. In flight, they may intersperse their slow, heavy wingbeats with short glides, or soar on thermals.

In Australia, Black-necked Storks are widespread in coastal and subcoastal northern and eastern Australia, as far south as central NSW (although vagrants may occur further south or inland, well away from breeding areas). In NSW, the species becomes increasingly uncommon south of the Clarence Valley, and rarely occurs south of Sydney. Since 1995, breeding has been recorded as far south as Buladelah.

This species frequents floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10275. Except for during localized flooding, there is no open water bodies at the site to provide for foraging sites. Moreover, these potential habitats will be preserved and enhanced by this proposal.

Grey-crowned babbler

The grey-crowned babbler is the largest of the four Australian babblers, reaching to 30 cm long. Its distinctive bill is scimitar-shaped, long and heavy. The broad white eyebrow and a pale grey crown-stripe are other distinguishing characters. A dark band passes from the bill through the eye, separating the pale throat and brow to giving a 'masked' look.

The eastern subspecies (*temporalis* occurs from Cape York south through Queensland, NSW and Victoria and formerly to the south east of South Australia. In NSW, the eastern sub-species occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Balranald. It also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW.

This species occurs in open box-gum woodlands on the slopes, box-cypress-pine and open box woodlands on alluvial plains and woodlands on fertile soils in coastal regions http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10660.

Suitable habitat does not occur at the site.

Little bent-wing bat

The little bent-wing bat is characterised by an exceptionally long terminal segment of the third finger. This placental flying mammal is greyish black to fawn-brown above and paler below.

The little bent-wing bat occurs in a wide range of forest types ranging from rainforest to warm temperate wet and dry sclerophyll

forests. It frequents the coastal ranges of eastern Australia from the central coast of NSW to Cape York and utilises caves, old mines and a variety of structures such as buildings and stormwater drains as roosts.

This species forages on small insects below the tree canopy of wooded habitat and relies on a limited number of caves for maternity and hibernation roosts. Adult females move from widely scattered roosts to specific nursery caves with the onset of spring. These sites are often shared with the common bent-wing bat to raise cave temperatures that are necessary to raise young (Dwyer 1983b; Baudinette *et al.* 1994).

The proposed development is unlikely to impact on this species due to the retention of suitable habitat and lack of maternity sites.

Eastern long-eared bat

The eastern long-eared bat occurs along the coastal ranges of eastern and northern Australia from the north coast of NSW to northern Western Australia. This species frequents rainforests, riparian lowland subtropical rainforest and wet and swamp eucalypt forest, extending into adjacent moist eucalypt forest and coastal banksia woodlands.

This species roosts in tree hollows, the hanging foliage of palms, in dense clumps of foliage of rainforest trees, under bark and in shallow depressions on trunks and branches, among epiphytes, in the roots of strangler figs, among dead fronds of tree ferns and less often in buildings. It is unlikely that the proposal will significantly impact on this species as roosting sites are unlikely to be substantially modified or disturbed. Moreover, the regeneration of

littoral rainforest will include substantial plantings of bangalow palms, a known roosting site for this species.

Greater broad-nosed bat

The greater broad-nosed bat is a winged placental mammal with a broad squarish head and sparsely-haired muzzle with glandular swellings. This species has dark reddish-brown fur above and is slightly paler below.

The greater broad-nosed bat extends along the coast from Maryborough in Queensland to Orbost in Victoria (Klippel 1992). Its' preferred habitat is along creek systems of the Border Ranges. However, it has been recorded in low numbers in near-coastal habitat.

The greater broad-nosed bat forages on slow-flying beetles and uses creeks or small rivers as corridors. It forages in open areas at the edges of forests or tree-lined creeks and utilises tree hollows for diurnal roosting sites. It has been recorded roosting in small dead stags (pers. obs.), tree hollows and in roof spaces in old buildings. This bat is a large species requiring a greater feeding range than other insectivorous species.

The proposed development is unlikely to impact on this species due to the retention of suitable habitat and its' extensive home range.

Eastern blossom bat

The eastern blossom bat is a small winged placental mammal that feeds on nectar. It has a long thin brush-like tongue and a slim pointed muzzle. Its long soft reddish-brown fur extends to the ankle. It is paler below and flecked with white.

The common blossom bat forages extensively in coastal heaths and coast banksia woodland and usually roosts in proximity to these feeding sites.

The eastern blossom bat has been recorded east of the ranges from Cape York in Queensland to the mid-north coast of NSW to approximately Taree where littoral rainforest and heath occur in close proximity. Rainforests, unlike more open habitats, are important for roosting purposes enabling bats to maintain a stable body temperature (Law 1993).

This species may occur at the site due to the presence of suitable food and roost trees. However, it is unlikely to be impacted due to the retention of the broad-leaved paper bark forest and the replanting of extensive areas of littoral rainforest.

Grey-headed flying- fox

The grey-headed flying-fox feeds on the blossom of eucalypts, paperbarks, turpentine and native and introduced fruits.

This species is distributed along the eastern Australian coastline from Gladstone in Queensland to south Gippsland and Melbourne in Victoria. It rarely travels more than 200 km inland. This species is commonly observed throughout the Shire, particularly at sunset. The proposed development is unlikely to impact on this species due to the retention of the broad-leaved paperbarks and the considerable reafforestation of littoral rainforest vegetation which will include rainforest figs.

S5A (a) conclusion

This report has mapped areas of threatened species habitat and highlighted potential impacts on threatened species. It also

addresses mitigation measures which will lead to long-term improvements in site biodiversity. These include the enhancement of wildlife corridors and the planting of littoral rainforest, the restoration of degraded areas through weed control, plantings and managed habitat offsets. Accordingly, the proposed development is unlikely to *have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.*

S.5A (b)

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

No endangered populations, listed under Part 2 of Schedule 1 of the TSC Act, occur within the vicinity of the subdivision site. Thus, the action proposed will not cause *a viable local population of the species to be placed at risk of extinction*.

S.5A (c)

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

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

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its

local occurrence is likely to be placed at risk of extinction,

Littoral rainforest and broad-leaved paperbark swamp forest EECs occur at the site. These have been surveyed and preserved for conservation. Thus, the development of the site will not *have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction* nor will any proposed action *substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

S.5A (d)

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

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

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

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

With respect to s.5A (i), the flora and fauna assessment identified and mapped areas of varying conservation significance and described the extent of habitat modification proposed.

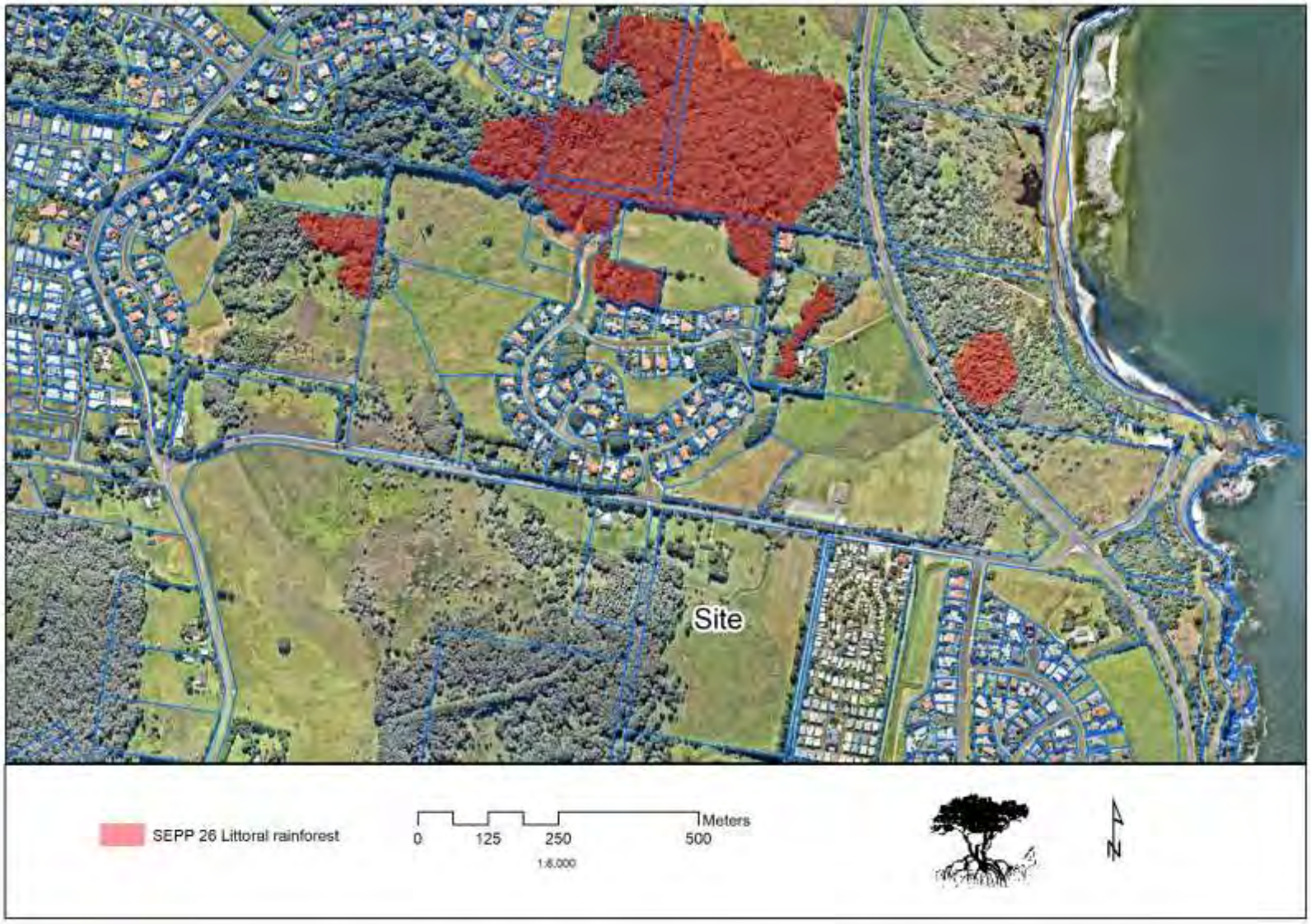


Fig. 10: SEPP 26 littoral rainforest proximal to the site

The proposed development will require the removal of less than 10 m^2 of hairy joint grass, isolated paddock trees and landscaping comprising of native and exotic vegetation around the existing residence. Thus, *the extent to which habitat is likely to be removed or modified as a result of the action proposed* is negligable in the context of the proposed amelioration and mitigation works.

With respect to s.5A (ii), the habitat proposed for removal is currently isolated and comprises and fragmented. Thus, an *area of habitat is unlikely to become fragmented or isolated from other areas of habitat as a result of the proposed action.*

With respect to s.5A (iii), the area of habitat removed is insufficient to be important in the context of this test. Accordingly, the proposal will not significantly affect the *long-term survival of the species, population or ecological community in the locality*.

S.5A (e)

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

The site does not contain any area which has been identified and declared as critical habitat under Part 3 of the TSC Act. Therefore, critical habitat will not be affected by the proposed development.

S.5A (f)

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

The priorities action statement and associated *Saving our Species* conservation projects have replaced the need for recovery plans. So, recovery plans are no longer being developed (http://www.environment.nsw.gov.au/threatenedspecies/RecoveryPl

ans.htm.). However, a threat abatement plan for predation by the European red fox has been developed and this action is incorporated into the BioBanking credit calculator.

The NSW threatened species priority action statement ("PAS") (DECCW 2007) advises that:

"Habitat loss or modification for urban development and agricultural practices has been a major factor in the decline of many native plants and animals. Rehabilitation and regeneration of modified or lost habitat can help many threatened species continue to survive in the wild. Actions include planting local native plants to provide food, shelter and roosting sites, or bush regeneration to reduce the impact on native plants from weeds."

Offsets include the reafforestation of littoral rainforest and maintenance weeding of SEPP 14 wetlands and surrounding areas. These activities are consistent with the PAS.

S.5A (g)

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

Threatening processes gazetted pursuant to the TSC Act are as follows:

- Aggressive exclusion of birds from woodland and forest habitat by abundant noisy miners, *Manorina melanocephala*;
- Alteration of habitat following subsidence due to longwall mining;
- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands (as described in the final

determination of the Scientific Committee to list the threatening process);

- Anthropogenic climate change;
- Bushrock removal;
- Clearing of native vegetation. Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss, or long-term modification, of the structure, composition and ecological function of a stand or stands;
- Competition and grazing by the feral European rabbit, *Oryctolagus cuniculus*;
- Competition and habitat degradation by feral goats, *Capra hircus*;
- Competition from feral honey bees, *Apis mellifera*;
- Death or injury to marine species following capture in shark control programs on ocean beaches;
- Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments;
- Forest eucalypt dieback associated with over-abundant psyllids and bell miners;
- Herbivory and environmental degradation caused by feral deer;
- High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition. High frequency fire is defined as two or more successive fires close enough together in time to interfere with or limit the ability of plants or animals to recruit new individuals into a population, or for plants to build up a seed-bank of sufficient size to maintain the population through the next fire;
- Importation of red imported fire ants, *Solenopsis invicta*;
- Infection by Psittacine Circoviral (beak and feather) disease affecting endangered psittacine species and populations;
- Infection of frogs by amphibian chytrid causing the disease, chytridiomycosis;

- Infection of native plants by the fungus, *Phytophthora cinnamomi*;
- Introduction and establishment of exotic rust fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae;
- Introduction of the large earth bumblebee, *Bombus terrestris;*
- Invasion and establishment of exotic vines and scramblers;
- Loss or degradation (or both) of sites used for hill-topping by butterflies. Hill-topping in butterflies is a complex behaviour that often facilitates mating between sexes. Many butterfly species appear to congregate on hill-tops or ridges that are usually higher than the surrounding landscape. These sites may range in area from a few square metres to several hectares;
- Invasion and establishment of scotch broom, *Cytisus scoparius*;
- Invasion and establishment of the cane toad, *Bufo marinus*;
- Invasion, establishment and spread of Lantana;
- Invasion of native plant communities by African olive, *Olea europaea* L. subsp. *cuspidate*;
- Invasion of native plant communities by bitou bush, *Chrysanthemoides monilifera*. The ability of bitou bush to become the overwhelming dominant in invaded ecological communities threatens all plant communities within its' distribution;
- Invasion of native plant communities by exotic perennial grasses;
- Invasion of the yellow crazy ant, *Anoplolepis gracilipes,* into NSW;
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants;
- Loss of hollow-bearing trees;
- Predation by the mosquito fish, *Gambusia holbrooki*;
- Predation by the European red fox, *Vulpes vulpes*;

- Predation by the feral cat, *Felix cattus*. Predation by the feral cat has been implicated in the extinction and decline of many species of birds on islands around Australia and in the early extinction of up to seven species of small mammals on the Australian mainland;
- Predation by the ship rat, *Rattus rattus*, on Lord Howe Island; and
- Removal of dead wood and dead trees.

The development has been designed to retain the natural overland flow regime so that the recipient wetlands will remain charged.

The removal of native vegetation proposed is described in this report. This removal does not meet the criteria *clearing of native vegetation*.

Ground asparagus, *Protasparagus aethiopicus,* and other exotic scramblers together with philodendron, *Philodendron* sp., are well established in bushland remnants. These will be controlled through active bushland managed by trained bush regenerators.

- Invasion and establishment of the cane toad.

The proposed development will reduce the large grassed areas which are suitable cane toad habitat. The proposal to revegetate substantial areas of the site will mitigate cane toad impacts.

- Invasion, establishment and spread of lantana.

Lantana is well established at the site. The proposal to revegetate substantial areas of the site and control weeds will mitigate its impact.

- Invasion of native plant communities by exotic perennial grasses

Exotic perennial grasses are well established at the site (see grassland description in body of this report). The proposed development will occur on sites occupied by exotic perennial grasses.

- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants

The design of the proposal includes a perimeter road between high conservation assets and the dwellings. This mitigates the disposal of garden weeds into sensitive bushland areas.

The offset proposals contained in this report will substantially mitigate any increase in threatening processes.

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APPENDIX 1:

VEGETATION

Scientific name ** introduced or naturalised*	Common name
FERNS	
ASPLENIACEAE	
Asplenium australasicum	bird's-nest fern
BLECHNACEAE	
Blechnum indicum	swamp water fern
Blechnum patersoni	strap water fern
DENNSTAEDTIACEAE	
Histiopteris incisa	bat's-wing fern
Pteridium esculentum	bracken
DICKSONIACEAE	
Calochlaena dubia	common ground fern
NEPHROLEPIDACEAE	
Nephrolepis cordifolia	fishbone fern
GYMNOSPERMS (Conifers)	
PINACEAE	
**Pinus elliotii*	slash pine
ANGIOSPERMS (Flowering plants) Monocotyledons (palms, palm-lilies and cycads)	
AGAVACEAE	
Cordyline congesta 1(2RC-) 7	toothed palm-lily
**Cordyline fruticosa* (cultivar)	
AMARYLLIDACEAE	
**Clivea* sp.	ornamental lily
ARACEAE	
Alocasia brisbanensis	cunjevoi
**Monstera deliciosa*	monstera
ARECACEAE	
Archontophoenix cunninghamiana	bangalow palm
Livistona australis	cabbage palm
**Syagrus romanzoffianum*	queen or cocos palm
ARIFLORAE	
Philodendron sp.	philodendron
ASPARAGACEAE	
**Asparagus africanus*	climbing asparagus fern
**Protasparagus aethiopicus*	ground asparagus
COMMELINACEAE	
Commelina cyanea	scurvy weed
CYPERACEAE	
Baumea articulata	jointed twig-rush

Scientific name	Common name
** introduced or naturalised*	
Baumea juncea	bare twig-rush
Baumea teretifolia	a sedge
Carex appressa	
Chorizandra sphaerocephala	
Cyperus brevifolius	Mullumbimby couch
**Cyperus eragrostis*	umbrella sedge
Eleocharis dulcis	a spike-rush
Gahnia clarkei	tall sawsedge
FLAGELLARIACEAE	
Flagellaria indica	whip vine
JUNCACEAE	
Juncus usitatus	tussock rush
Juncus vaginatus	a rush
LUZURIAGACEAE	
Eustrephus latifolius var. latifolius	wombat berry
Geitonoplesium cymosum	scrambling lily
POACEAE	
Arthraxon hispidus (Sch. 2)	hairy joint-grass
**Axonopus fissifolius*	narrow-leaved carpet grass
**Cenchrus clandestinum*	kikuyu
**Chloris gayana*	Rhode's grass
Digitaria didactyla	Queensland blue couch
Hemarthria uncinata var. *uncinata*	matgrass
Imperata cylindrica var. *major*	blady grass
Leersia hexandra	swamp rice grass
Oplismenus imbecillis	basket grass
Ottochloa gracillima	forest grass
**Paspalum distichum*	water couch
**Paspalum urvillei*	vasey grass
**Paspalum mandiocanum*	broad-leaved paspalum (warrel grass)
Phragmites australis	common reed
**Setaria sphacelata*	canary seed grass
**Sporobolus indicus* var. *capensis*	Parramatta grass
**Stenotaphrum secundatum*	buffalo grass
RESTIONACEAE	
Baloskion tetraphyllum	feather plant
SMILACACEAE	
Smilax australis	austral sarsparilla
XANTHORRHOEACEAE	
Lomandra longifolia	matrush
Dicotyledons	
AMARANTHACEAE	
**Iresine herbstii*	beefstake plant
ANACARDIACEAE	
**Mangifera indica*	mango

Scientific name	Common name
** introduced or naturalised*	
APIACEAE	
Centella asiatica	centella
**Hydrocotyle bonariensis*	hydrocotyle
APOCYNACEAE	
Parsonsia straminea	common silkpod
ARALIACEAE	
Schefflera actinophylla	umbrella tree
ASCLEPIADACEAE	
**Asclepias curvassica*	redhead cotton bush
Marsdenia rostrata	common milk vine
ASTERACEAE	
**Ageratum houstonianum*	blue billygoat weed
**Biddens pilosa*	cobbler's pegs
**Ceratogyne australis*	carrot weed
**Cirsium vulgare*	spear thistle
**coast wattle*	bitou bush
**Conyza albida*	tall fleabane
**Delairea odorata*	Cape ivy
** Hypochoeris radicata*	flatweed
**Senecio lautus*	fireweed
CAESALPINIACEAE	
**Senna pendula* var. *glabrata*	Easter cassia
CASUARINACEAE	
Allocasuarina torulosa	forest oak
Casuarina glauca	swamp she-oak
Casuarina equisitifolia var. incarna	horse-tail oak
DRACAENACEAE	
**Dracena draco*	dragon tree
ELAEOCARPACEAE	
Elaeocarpus reticulatus	blueberry ash
Elaeocarpus williamsianus (Sch. 1 TSC Act)	hairy quandong
EUPHORBIACEAE	
Glochidion sumatranum	umbrella cheese tree
Macaranga tanarius	macaranga
FABACEAE	
Subfamily FABOIDEAE	
Austrosteenisia glabristyla	giant blood vine
LAURACEAE	
**Cinnamomum camphora*	camphor laurel
Cryptocarya triplinervis var. *triplinervis*	three-veined cryptocarya
Neolitsea australiensis	green bollygum
LYTHRACEAE	

Scientific name	Common name
** introduced or naturalised*	
**Cuphea carthagenensis*	cuphea
**Lagerstroemia indica*	crepe myrtle
MAGNOLIACEAE	
**Magnolia* sp	magnolia
MALVACEAE	
Hibiscus heterophyllus	native rosella
**Sida rhombifolia*	Paddy's lucerne
MENISPERMACEAE	
Stephania japonica var. *discolour*	snake vine
MIMOSOIDEAE	
Acacia melanoxylon	blackwood
MORACEAE	
Ficus fraseri	sandpaper fig
Ficus obliqua var. *obliqua*	small-leaved fig
Ficus watkinsiana	strangler fig
MYRTACEAE	
Acmena hemilampra	broad-leaved lilly pilly
Archirhodomyrtus beckleri	rose myrtle
Callistemon sp.	bottlebrush
Callistemon saligna	pink-tipped bottlebrush
Eucalyptus grandis	flooded gum
Melaleuca quinquenervia	broad-leaved paperbark
Syzygium oleosum	blue lilly pilly
Syzygium smithii	lilly pilly
OCHNACEAE	
**Ochna serrulata*	ochna
OLEACEAE	
**Ligustrum sinense*	small-leaved privet
PASSIFLORACEAE	
**Passiflora subpeltata*	white passionflower
PITTOSPORACEAE	
Pittosporum undulatum	sweet pittosporum
PLANTAGINACEAE	
**Plantago gaudichaudii*	narrow-leaf plantain
POLYGONACEAE	
Periscaria decipiens	slender knotweed
PROTEACEAE	
Banksia integrifolia var. *integrifolia*	coast banksia
Buckinghamia celsissima	ivory curl
Stenocarpus sinuatus	firewheel tree

Scientific name	Common name
** introduced or naturalised*	
RUTACEAE	
Acronychia imperforata	beach acronychia
Flindersia schottiana	cudgerie
Mellicope elleryana 8S	pink euodia
**Murraya paniculata*	murraya
SAPINDACEAE	
Cupaniopsis anarcardioides	tuckeroo
Guioa semiglauca	guioa
SOLANACEAE	
**Solanum capsicioides*	devil's apple
**Solanum mauritianum*	wild tobacco
**Solanum nigrum*	blackberry nightshade
VERBENACEAE	
** Lantana camara*	lantana
VITIDACEAE	
Cissus antarctica	watervine

APPENDIX 2:

FAUNA

Scientific name	Common name	Recorded	Expected
* : introduced species; # threatened species			
MAMMALS			
CANIDAE			
*Canis familaris**	dog	x	
*Vulpes vulpes**	fox		x
FELIDAE			
*Felis catus**	feral cat		x
MACROPODIDAE			
Wallabia bicolor	swamp wallaby	x	
MOLOSSIDAE			
Mormopterus sp. 1			x
Austronomus australis	white-striped free-tail bat		x
MURIDAE			
Hydromys chrysogaster	water rat		x
*Mus musculus**	house mouse		x
Rattus fuscipes	bush rat		x
Rattus lutreolus	swamp rat		x
*Rattus rattus**	black rat		x
PERAMELIDAE			
Isoodon macrourus	northern brown bandicoot		x
Perameles nasuta	long-nosed bandicoot		x
PETAURIDAE			
Petaurus breviceps	sugar glider		x
Pseudocheirus peregrinus	common ringtail possum		x
PHALANGERIDAE			
Trichosurus vulpecula	common brushtail possum		x
PTEROPODIDAE			
Nyctimene robinsoni	Queensland tube-nosed bat		x
Pteropus alecto	black flying-fox		x
Pteropus poliocephalus #	grey-headed flying-fox		x
Pteropus scapulatus	little red flying-fox		x
Syconycteris australis #	common blossom-bat		x
RHINOLOPHIDAE			
Rhinolophus megaphyllus	eastern horse-shoe bat		x
TACHYGLOSSIDAE			
Tachyglossus aculeatus	short-beaked echidna		x
VESPERTILIONIDAE			
Chalinolobus gouldii	Gould's wattled bat		x
Chalinolobus morio	chocolate wattled bat		x
Miniopterus australis #	little bent-wing bat		x
Nyctophilus bifax #	eastern long-eared bat		x
Nyctophilus gouldi	Gould's long-eared bat		x
Scoteanax rueppellii#	greater broad-nosed bat		x
Scotorepens orion	eastern broad-nosed bat		x
Vespadelus pumilus	eastern forest bat		x
BIRDS			
ACANTHIZIDAE			
Gerygone olivacea	white-throated gerygone		x
Sericornis frontalis	white-browed scrubwren		x

Scientific name	Common name	Recorded	Expected
* : introduced species; # threatened species			
ACCIPITRIDAE			
Accipiter cirrhocephalus	collared sparrowhawk		
Accipiter fasciatus	brown goshawk		
Accipiter novaehollandiae	grey goshawk		x
Aquila audax	wedge-tailed eagle		x
Aviceda subcristata	pacific baza		x
Circus approximans	swamp harrier		x
Haliaeetus leucogaster	white-bellied sea-eagle		x
Milvus sphenurus	whistling kite		x
ALCEDINIDAE			
Alcedo azurea	azure kingfisher		x
Dacelo novaeguineae	laughing kookaburra	x	
Todiramphus sanctus	sacred kingfisher		x
APODIDAE			
Hirundapus caudacutus	white-throated needletail		x
ARDEIDAE			
Ardea novaehollandiae	white-faced heron		x
CAMPEPHAGIDAE			
Coracina novaehollindiae	black-faced cuckoo-shrike	x	
Coracina tenuirostris	cicadabird		x
Lalage leucomela	varied triller		x
CHARADRIIDAE			
Vanellus miles	masked lapwing	x	
CICONIIDAE			
Botaurus poiciloptilus#	Australasian bittern		x
CLIMACTERIDAE			
Cormobates leucophaea	white-throated treecreeper		x
COLUMBIDAE			
Columba leucomela	white-headed pigeon		x
Columba livia *	feral pigeon		x
Geopelia humeralis	bar-shouldered dove		x
Geophaps lophotes	crested pigeon		x
Leucosarcia melanoleuca	wonga pidgeon		x
Lopholaimus antarcticus	topknot pigeon		x
Macropygia amboinensis	brown cuckoo-dove		x
Ptilinopus regina#	rose-crowned fruit-dove		x
CORVIDAE			
Corvus orru	torresian crow	x	
CRACTICIDAE			
Cracticus nigrogularis	pied butcherbird	x	
Cracticus torquatus	grey butcherbird	x	
Gymnorhina tibicen	Australian magpie	x	
Strepera graculina	pied currawong	x	
CUCULIDAE			
Cacomantis flabelliformis	fan-tailed cuckoo		x
Cacomantis variolosus	brush cuckoo		x
Centropus phasianinus	pheasant coucal		x
Chrysococcyx basalis	horsfield's bronze-cuckoo		x
Chrysococcyx lucidus	shining bronze-cuckoo		x
Chrysococcyx minutillus	little bronze-cuckoo		x
Cuculus pallidus	pallid cuckoo		x

Scientific name * : introduced species; # threatened species	Common name	Recorded	Expected
Cuculus saturatus	oriental cuckoo		x
Eudynamys scolopacea	common koel		x
Scythrops novaehollandiae	channel-billed cuckoo		x
DICAEIDAE			
Dicaeum hirundinaceum	mistletoe bird		x
DICRURIDAE			
Dicrurus bracteatus	spangled drongo		x
GRALLINIDAE			
Grallina cyanoleuca	Australian magpie-lark		x
HIRUNDINIDAE			
Hirundo neoxena	welcome swallow		x
MALURIDAE			
Malurus cyaneus	superb fairy-wren		x
Malurus lamberti	variegated fairy-wren		x
Malurus melanocephalus	red-backed fairy-wren	x	
MEGAPODIIDAE			
Alectura lathami	Australian brush-turkey	x	
MELIPHAGIDAE			
Acanthorhynchus tenuirostris	eastern spinebill		x
Anthochaera carunculata	red wattlebird		x
Anthochaera chrysoptera	brush (little) wattlebird		x
Entomyzon cyanotis	blue-faced honeyeater		x
Lichenostomus chrysops	yellow-faced honeyeater		x
Lichmera indistincta	brown honeyeater		x
Manorina melanocephala	noisy miner	x	
Meliphaga lewinii	Lewin's honeyeater	x	
Melithreptus albogularis	white-throated honeyeater		x
Myzomela sanguinolenta	scarlet honeyeater		x
Philemon citreogularis	little friarbird		x
Philemon corniculatus	noisy friarbird		x
Phylidonyris nigra	white-cheeked honeyeater		x
MEROPIDAE			
Merops ornatus	rainbow bee-eater		x
ORIOLIDAE			
Oriolus sagittatus	olive-backed oriole	x	
Sphecotheres viridis	figbird	x	
ORTHONYCHIDAE			
Psophodes olivaceus	eastern whipbird	x	
PACHYCEPHALIDAE			
Colluricincla harmonica	grey shrike-thrush	x	
Colluricincla megarhyncha	little shrike-thrush		x
Eopsaltria australis	eastern yellow robin		x
Myiagra rubecula	leaden flycatcher		x
Pachycephala pectoralis	golden whistler		x
Pachycephala rufiventris	rufous whistler		x
Rhipidura fuliginosa	grey fantail	x	
Rhipidura leucophrys	willie-wagtail	x	
Rhipidura rufifrons	rufous fantail		x
PHASIANIDAE			
Coturnix ypsilophora	brown quail		x

Scientific name * : introduced species; # threatened species	Common name	Recorded	Expected
PLATALEIDAE			
Threskiornis molucca	Australian white ibis		x
Threskiornis spinicollis	straw-necked ibis		x
PLOCEIDAE			
Lonchura castaneothorax	chestnut-breasted mannikin		x
Neochmia temporalis	red-browed finch		x
PODARGIDAE			
Podargus strigoides	tawny frogmouth		x
PSITTACIDAE			
Alisterus scapularis	Australian king parrot		x
Cacatua galerita	sulphur-crested cockatoo		x
Cacatua roseicapilla	galah		x
Calyptorhynchus funereus	yellow-tailed black cockatoo		x
Platycercus eximius	eastern rosella		x
Trichoglossus chlorolepiotus	scaly-breasted lorikeet	x	
Trichoglossus haematodus	rainbow lorikeet	x	
PTILONORHYNCHIDAE			
Ailoroedus crassirostris	green catbird		x
Ptilonorhynchus violaceus	satin bowerbird		x
Sericulus chrysocephalus	regent bowerbird		x
RALLIDAE			
Amaurornis moluccanus #	pale-vented bush-hen		x
Dryolimnas pectoralis	Lewin's rail		x
STRIGIDAE			
Ninox boobook	southern boobook		x
Tyto alba	barn owl		x
SYLVIIDAE			
Cisticola exilis	golden-headed cisticola	x	
REPTILES			
AGAMIDAE			
Physignathus lesueurii	eastern water dragon	x	
Pogona barbata	bearded dragon		x
BOIDAE			
Morelia spilota	carpet python		x
COLUBRIDAE			
Boiga irregularis	brown tree snake		x
Dendrelaphis punctulata	green tree snake		x
ELAPIDAE			
Rhinoplocephalos nigrescens	eastern small-eyed snake		x
Demansia psammophis	yellow-faced whip snake		x
Pseudechis porphyriacus	red-bellied blacksnake		x
Pseudonaja textilis	eastern brown snake		x
Tropidechis carinatus	rough-scaled snake		x
Vermicella annulata	bandy-bandy		x
PYGOPODIDAE			
Lialis burtonis	Burton's snake lizard		x
Pygopus lepidopodus	common scaly-foot		x
SCINCIDAE			
Eulamprus quoyii	eastern water skink		x
Lampropholis delicata	eastern grass skink	x	

Scientific name * : introduced species; # threatened species	Common name	Recorded	Expected
AMPHIBIANS			
BUFONIDAE			
*Chaunus marinus**	cane toad	x	
HYLIDAE			
L. dentata	bleating tree frog		x
L. fallax	eastern dwarf frog		x
L. gracilenta	dainty green tree frog		x
L. nasuta	rocket frog		x
L. peronii	Peron's tree frog		x
L. tyleri	laughing tree frog		x
MYOBATRACHIDAE			
Crinia signifera	common eastern froglet	x	
Limnodynastes peronii	striped marsh frog	x	
Uperoleia tyleri	Tyler's toadlet		x

TECHNICAL REPORT 2

Civil Engineering Report

Site Engineering Assessment
67 Skennars Head Road, Skennars Head, NSW

Living Gems
c/- Planners North

Planit
May 2018
Document No: J107-RPT02

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Project Details

Project Name:	67 Skennars Head Road
Client:	Living Gems C/- Planners North
Client Project Manager:	Adrian Puljich, Steve Connelly
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Planit Reference:	J107-RPT02

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CONTENTS

EXECUTIVE SUMMARY

The purpose of this assessment is to identify the civil engineering requirements to support the development at 67 Skennars Head Road, Skennars Head NSW including: earthworks, roads, drainage, water and sewer reticulation, gas, power and telecommunications to ensure that the development can be serviced adequately.

The proposed development consists of a 147-lot (excluding the manager's residence) seniors living village. The site has been identified as an area requiring an Acid Sulfate management plan prior to construction.
Access to the development will be gained directly from Skennars Head Road via a new driveway approximately 175m east of the Henderson Drive intersection. The entrance is located near the beginning of an assent westward on Skennars Head road and complies with relevant sight line requirements. The site has been identified in an area subject to flooding. As such, a detailed flood assessment for the proposed development footprint has been requested through Ballina Shire Council and further detailed flooding assessments have been undertaken by BMT WBM. The details of this assessment have been provided in Appendix E.

Ballina Shire Council provides reticulated water supply to residential customers within the local area and has sufficient storage capacity to cater for the development. However, part of the existing water supply network that leads to the site may need to be augmented to cater for additional demand growth within the system.
BSC also locally provide reticulated recycled water and there is provision to connect the proposed development to the recycled water supply. An existing 200mm water main is located within the development site running diagonally from the north-western boundary to the eastern boundary. It is proposed to relocate this main outside the northern and eastern site boundaries.

The majority of the subject site requires fill in order to achieve the minimum floor levels designated by BSC. Each of the lots has been designed to a minimum pad height of R.L 2.8. It is proposed that the entire eastern boundary of the site is lifted to achieve a minimum fall of 0.5% fall to the west into the SEPP 14 wetland. The site currently falls towards the south-western boundary and contains an open drain collecting runoff from a large external catchment. To convey the existing stormwater through the subject site it is proposed to leave the waterway unaltered with the exemption of two proposed road crossings. A 1200mm wide by 900mm high box culvert is proposed to convey the stormwater at the two road crossings.

BSC provides reticulated sewer to residential customers within the local area and have existing sewerage assets located to the north of the proposed development boundary, however a gravity sewer service is not available to the proposed development site due to existing site levels. It is proposed that a new sewer pump station is constructed on the development site. All lots are connected to this pump station via the internal sewer reticulation system. A sewer rising main will connect the pump station to either the existing sewer pump station in Skennars Head Road if Council are able to cater for the proposed additional flows within their proposed augmentation design works, or alternatively the sewer rising main would need to continue out to North Creek Road and discharge directly to the Lennox Head Waste Water Treatment Plant.

Essential Energy has advised that there are two existing power feeder lines in the area that have the potential to service the development. Telstra is the main telecommunications service supplier to the project area and have been contacted in regard to servicing the development. Telstra has subsequently suggested that NBN would be required for the proposed development.

Based on the results of the engineering assessment and the information provided by the relevant authorities in this assessment, it was concluded that the proposed development can be adequately serviced in an economical and sustainable manner.

1. INTRODUCTION SITE ASSESSMENT AND CONSTRAINTS

1.1. SITE DESCRIPTION

The subject site (Figure 1) is located at Skennars Head, NSW within the Ballina Shire Council (BSC) local government area. The site is legally described as Lot 239 on DP1201225 and will from here on be referred to as 67 Skennars Head Road. The site has a total area of 11.6ha and is located approximately 3.2km to the south of Lennox Head Town Centre and 6km to the North of Ballina CBD. The site currently contains a single dwelling, sheds and corresponding driveway (with access off Skennars Head Road), a SEPP 14 Wetland in the South West and open paddock for the remainder. The subject site also contains a waterway subject to a controlled activity permit running from its northern boundary through to the SEPP 14 wetland to the west. Directly adjacent to the site is: a holiday park (east), a primary school (south), a nature reserve (west) and sporting fields (north, across Skennars head Road). Situated parallel to the western boundary on the subject site are a nature reserve, wetlands and a bushfire buffer zone. Accordingly, the area suitable for development is 7.63ha (~2/3^{rds} of the total site) with only 6.5ha suitable for habitable dwellings. The site has a moderately steep hill on the north-western corner with the top of the hill at RL10mAHD. The remainder of the site is flat at RL 0.5mAHD – 3mAHD.

Figure 1 | **Proposed Development Site**

1.2. DEVELOPMENT DESCRIPTION

The proposed seniors living development consists of:

- 148 residential lots: predominantly with 14m street frontages and 270m^2 in plan area including an:
  - On-site manager's residence;
  - 147 seniors living residential lots.

- Internal roads network consisting of approximately 165m of 9m wide road carriageway with intermittent median island (including entry statement with queuing length), 239m of 6.5m wide road carriageway, 135m of 6.0m wide road carriageway, 205m of 6m wide fire trail, and 1459m of 5.5m wide road carriageway;
- Visitor car parking: approximately 795m^2 in total area;
- Two truck turnarounds of 390 m^2 in total area;
- On-site clubhouse: total roof area is approximately 1690m^2;
- Tennis Court: total area is approximately 616m^2

It is proposed that the access is established approximately midway along the sites northern boundary bordering Skennars Head Road approximately 55m to the east of the existing vehicle crossover.

Civil plans for the site are included in Appendix A. To confirm the location of existing services, a 'Dial Before You Dig' search has been requested within the vicinity of the 67 Skennars Head Road development area. The results are included in Appendix B.

1.3. ENGINEERING CONSTRAINTS

1.3.1 Geotechnical Information

A geotechnical report has been conducted as a part of the development Application process for the subject site. The findings of the investigation were sand to sandy clay across most of the site beneath the topsoil. However, the entire site is vulnerable to 60-110mm of settlement from a period of 2 – 4 years. Measures to decrease the magnitude and time of this settlement will need to be addressed during the detailed design phase. Refer to the Geotechnical, Acid Sulfate Soil and Phase 1 Environmental Site Assessments prepared by Coffey for more information on the soils present.

Acid Sulphate Soils (ASS) mapping is included in the Ballina Local Environmental Plan (LEP) 2012 (Figure 2). It is evident that ASS may be present on the subject site.

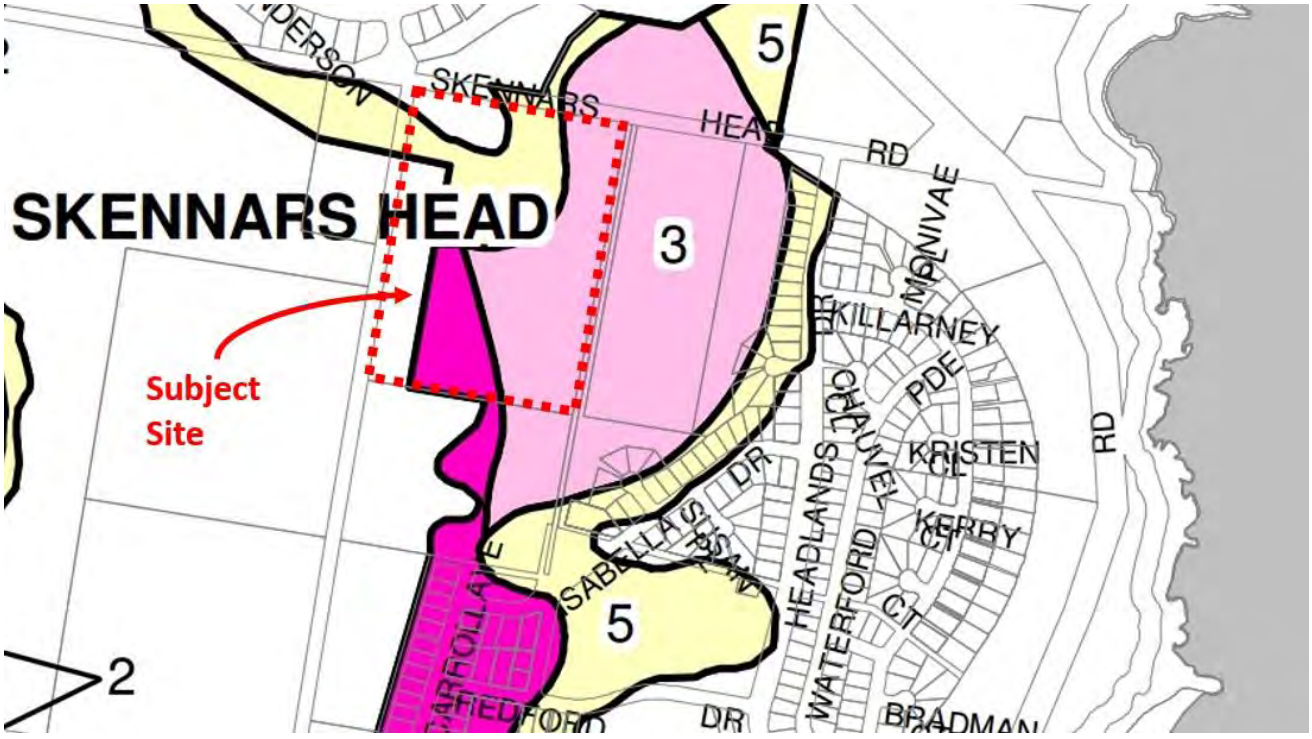


Figure 2 | **Presence of Acid Sulphate Soils in Tweed Shire Council**

Risk levels on site are classified as 'class 2' and 'class 3'. In Accordance with the 2012 Development Control Plan a geotechnical investigation including soil classification in accordance with AS2870.1 has been completed as part of the Development Application process. An Acid Sulfate Management plan was deemed necessary as a result of the investigation.

1.3.2 Flooding

BSC have advised that the subject site is situated within a high flood risk area (refer Figure 3). The site is zoned as Rural (RU1) according to the 2012 LEP. Based on table 3.1 in the 2012 DCP Chapter 2b – Floodplain Management, the 2100 Climate Change scenario applies when determining anticipated flood levels. The flood planning level for the subject site for a 100 year flooding event FPL2 according to this scenario is 2.3mAHD (refer Figure 4) and an FPL1 of 2.1mAHD (refer Figure 5).

According to Schedule D in the DCP Chapter 2b, the habitable floor level is based on the FPL2 flood level with 500mm of additional freeboard. The minimum habitable floor level on site is 2.8m AHD. The non-habitable clubhouse and recreational facilities are required to achieve the 2100 FPL1 Climate Change scenario. With no freeboard requirements, the minimum floor level required is at least 2.1m AHD. In addition, any car parking on site including residential garages are required to achieve the 2100 FPL1 level of 2.1m AHD as a minimum.

To achieve these minimum levels while maintaining overland flow paths, varying levels of fill averaging 1350mm to be placed across the developed area. Refer to chapter 2 for proposed earthworks.

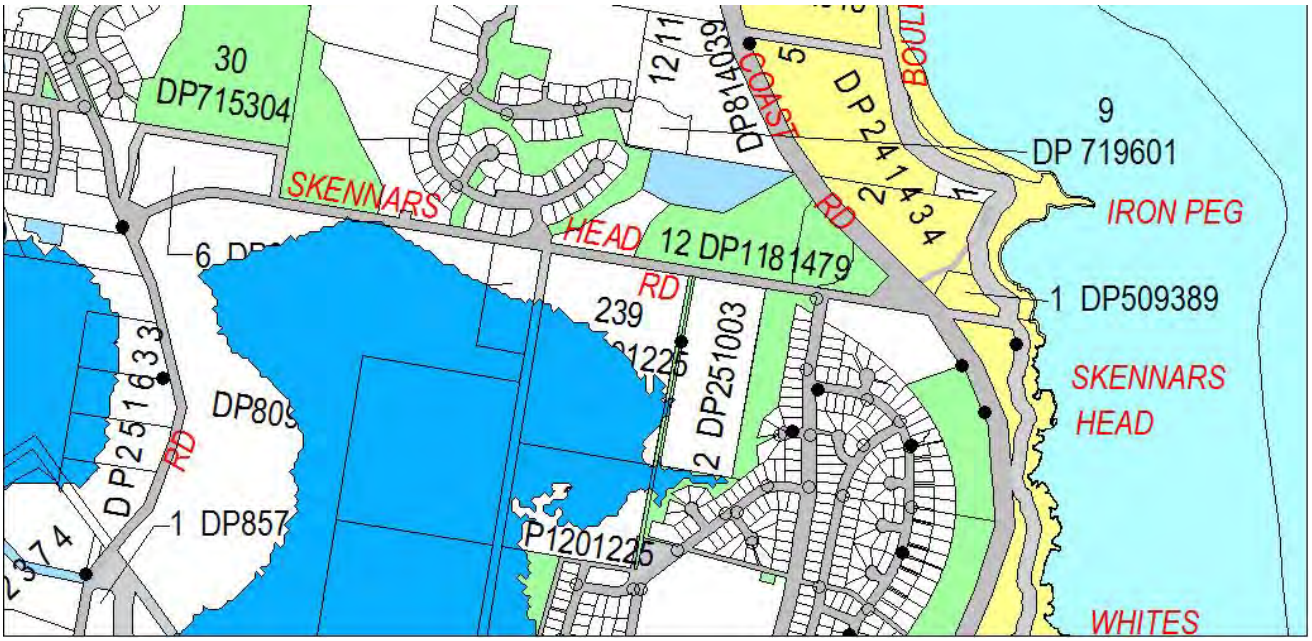


Figure 3 | Flood Prone Areas within the Vicinity of the Subject Site

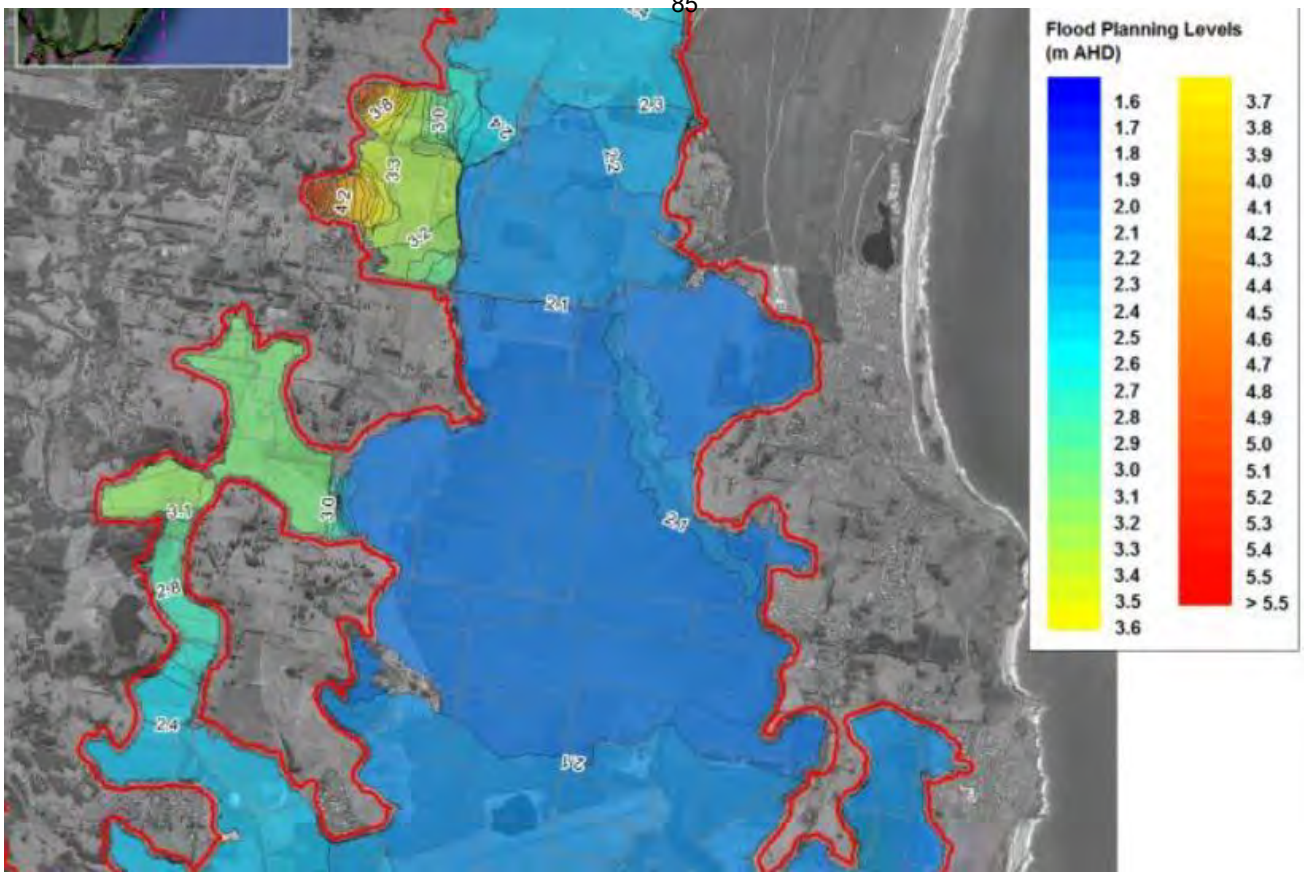


Figure 4 | 2100 FPL2 Flood Planning Levels Within the Vicinity of the Subject Site

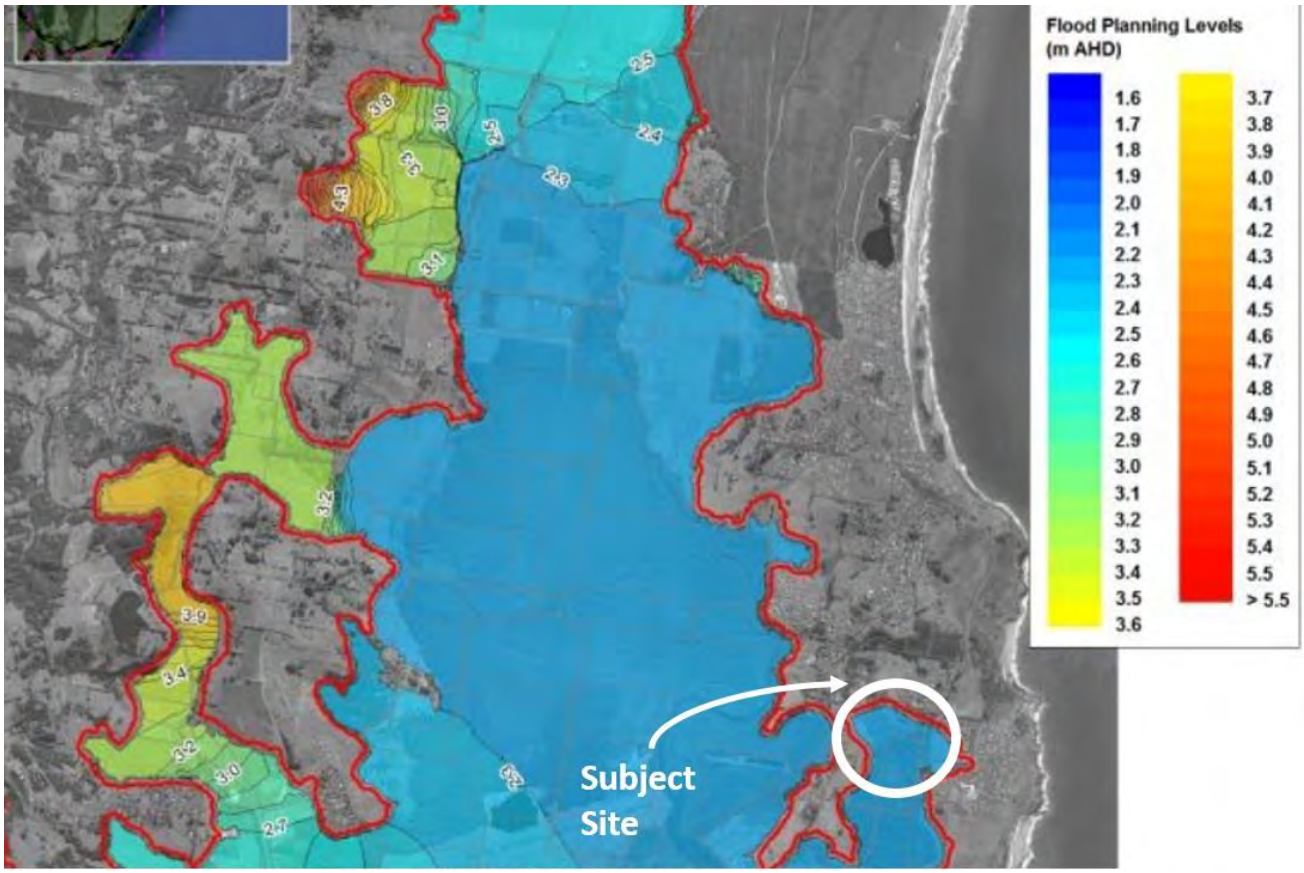


Figure 5 | 2100 FPL1 Flood Planning Levels Within the Vicinity of the Subject Site

A detailed flood assessment for the proposed development footprint has been undertaken through Ballina Shire Council and further detailed flood assessment works undertaken by BMT WBM to assess the impact of the development on the adjacent SEPP14 wetlands. The details of this assessment are provided in Appendix E. Refer to Appendix C for Flood Planning Levels within the Vicinity of the Subject Site.

1.3.3 Drainage

For information on stormwater drainage refer to Planit Consulting report J107-RPT03 Stormwater Management Plan. In summary, the subject site falls towards the south western boundary and contains an open drain collecting runoff from an external catchment consisting of Skennars Head Road, upstream residential lots and the Skennars Head Sporting Fields. To convey the existing stormwater through the subject site it is proposed to leave the waterway unaltered with the exemption of two proposed road crossings. A 1200mm wide by 900mm high box culvert is proposed to convey the stormwater at the two road crossings.

The current legal point of discharge is located at the western boundary of the site where the open channel drain currently discharges to the existing wetland. It is proposed to discharge all stormwater to this wetland by directing flows from the development into a single bioretention basin and having treated flows infiltrate to the groundwater with larger events discharging to the existing swale.

All runoff generated by the development is to be treated in accordance with the standards set by Chapter 2, section 3.9 and 3B of the DCP prior to discharge.

1.3.4 Services Relocation

An existing 200mm water main is located within the development site running diagonally from the north-western boundary to the eastern boundary. To assist in optimising the proposed development layout, it is proposed to relocate this main along the northern and eastern boundary. Refer to Figure 6 for the approximate location of the existing and proposed water main. Refer to Appendix A Drawing J107-19 & Drawing J107-20 for more detail.

Figure 6 | Proposed Relocation of Existing Water Main.

1.3.5 Design Specifications

The engineering design for 67 Skennars Head Road shall be in accordance with the following documents and specifications:

- Northern Rivers Local Government Development Specifications;
- Ballina Shire Council Development Control Plan (DCP) 2012;
- Ballina Shire Council Local Environmental Plan (LEP) 2012;
- Ballina Shire Council Stormwater Management Standards for Development 2012
- All relevant WSA and WSUD standards; and
- All relevant Australian Standards.

2. EARTHWORKS

2.1. BULK EARTHWORKS

The majority of the subject site requires fill in order to achieve the minimum floor levels designated by BSC. A conservative approach has been taken in design and it has been assumed that no finished floor level will be set below an R.L of 2.8 (allowing for a freeboard of 500mm above the designated flood level.) As such, each of the lots has been designed to a minimum pad height of R.L 2.8.

It is proposed that the entire eastern boundary of the site is lifted to achieve a minimum fall of 0.5% fall to the west into the SEPP 14 wetland. The levels set in appendix A drawing J107-005 Overall Layout Plan represent the minimum earthwork levels required to achieve minimum cover for stormwater pipes discharging into the wetland as well as ensuring overland flow paths will be contained wholly in the road reserve.

There are two additional major earthwork constraints on site and include tying levels into a portion of littoral rainforest being preserved adjacent the existing dwelling. The proposed earthwork levels will need to tie into the existing levels to prevent any cutting or filling around any of the tree protection zones. The other major constraint is tying into the 20m Riparian exclusion zone that is to remain unaltered. The roads over the existing waterway are designed approximately 1.5 m above the invert of the existing waterway to ensure a 900mm box culvert can pass underneath the road with an additional 600mm vertical clearance on top for any service or utilities crossing. Corresponding levels may require retaining or steep batters outside the riparian footprint.

The proposed design surface has been adopted to tie into the key features mentioned above while still minimising the amount of imported fill required. An opportunity to minorly reduce earthworks exists by creating artificial undulations in the road south of the existing waterway. However, this will compromise the rideability of the road, heighten the potential of stormwater overtopping the roads into adjacent dwellings and conflict with section D1.10 of NRLG's Geometric Road Design Specification. Due to existing low levels across most the site, significant bulk earthworks are required to achieve the required finished floor levels (Refer Appendix A, drawing 0015: 'Earthworks Cut/Fill Plan'). Preliminary Earthworks volumes are presented in Table 1.

Table 1 | Bulk Earthwork Volumes

Bulk Earthwork Volumes	
Area of Works	74100 m^2
Cut Volume	1950 m^3
Fill Volume	90900 m^3
Fill Balance	**88950 m^3**

The cut fill volumes above reflect the volumes from the existing surface to the completed design surface and do not account for any boxing out of roads or basins, trenching or building pads.

Retaining walls may be required along the southern and eastern boundaries of the site in order to prevent the batter encroaching on council's parcel of land. Retaining may be also required outside the footprint of the 20m riparian buffer zone and at the rear of lots 158-170.

2.2. TRENCHES FOR SERVICES AND UTILITIES

Trench excavation is required throughout the site to varying depths to service sewer, water, stormwater, electrical, communications and telecommunications. Pending the outcome of an Acid Sulfate Soils Management Plan any trench spoil appears suitable to be re-used on site as engineering fill. Trenches for stormwater lines vary between an R.L of 0.60m AHD – 8.7m AHD with a maximum trench depth of 2.1m to the proposed finished surface. Sewer trenches vary between -0.3m AHD – 9.0m AHD with a maximum trench depth of 3.5m to the proposed finish surface level. All other services to be installed to the depths according to Northern Rivers Standard Drawing R-10 and the relevant electrical and communication providers specifications.

3. STORMWATER CONVEYANCE

3.1. SUMMARY

A Stormwater Management Plan has been prepared by Planit Consulting to support the proposed development. A summary of the findings is provided below.

3.2. STORMWATER DRAINAGE

The subject site contains a waterway subject to a controlled activity permit running from its northern boundary through to the SEPP 14 wetland to the west. To convey the existing stormwater through the subject site it is proposed to leave the waterway unaltered with the exemption of two proposed road crossings. A 1200mm wide by 900mm high box culvert is proposed to convey the stormwater at the two road crossings.

It is proposed that on-site runoff is directed to one of three discharge points. The first to the existing riparian corridor adjacent the existing culvert crossing Skennars Head Rd into the subject site. The second to the riparian corridor centrally to the site via a proposed bioretention basin. Finally, the southern proposed fire trail will sheet flow to the south into the existing drainage channel running parallel to the southern boundary.

3.3. ON-SITE DETENTION

The site will utilise stormwater detention to mitigate the Q5 to Q100 storm event for storms ranging in duration from 5 minutes to 3 hours in accordance with the Northern Rivers Local Governments Stormwater Design Guidelines. The basin will require a volume of approximately 2200m^3 to achieve the predevelopment flows. This has been provided to WBM BMT for their detailed local and regional flood analysis.

3.4. STORMWATER QUALITY

The proposed stormwater management strategy for the developed case was found to provide adequate pollutant removal efficiencies with respect to chapter 2 of BSC's 2012 Development Control Plan (DCP). This treatment train contains a basin with a 630m^2 bioretention footprint, a GPT, and 35 Lineal meters of 0.60m wide bioretention swales.

3.5. SEDIMENT AND EROSION CONTROL

Sediment and erosion shall be controlled using suitable management techniques in accordance with 'Soils and Construction Volume 1 – Managing Urban Stormwater' Landcom and includes the use of silt fences, filter bags, diversion drains, rock check dams, stabilised site access, vehicle wash down areas and three Type F sediment basins.

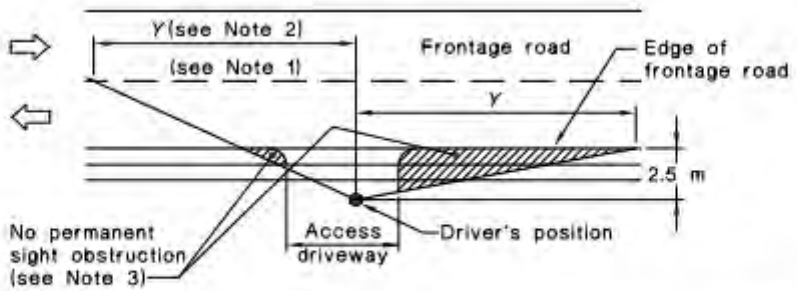
4. ROADWORKS AND ACCESS

4.1. EXTERNAL ROADWORKS

Access to the development will be gained directly from Skennars Head Road via a new driveway access approximately 175m east of the Henderson Drive intersection. The access is proposed at the bottom of a decent on Skennars Head road starting from a crest point approximately flush with the Skennars Head Road and Henderson Drive intersection grading down at a maximum of 8% to the low point in the road where the 900mm Drainage culvert crosses the road. There are two secondary access/ egress intersections proposed to Skennars Head Road to be used exclusively by emergency services or in the event of evacuation located on the western and eastern boundary of the site adjacent to the public reserve DP846639.

According to Table 2 below taken from AS2890.1 for Sight Distance at Access Driveway Exits the critical approach sight distance (approaching from the west) is a minimum 55m. The recommended Safe sight distance (sighting cars to the west) is 65m and recommended desirable 5 second gap is 83m. If the access driveway is to be designed as an intersection rather than a driveway access these required sight distances would increase. However, we currently achieve 86m site distance to the west from 1.15m height satisfying all recommended distances specified in AS2890.1.

Table 2 | Site Distance at Access Driveway (cars)



Frontage road speed (Note 4) km/h	Distance (Y) along frontage road m		
	Access driveways other than domestic (Note 5)		Domestic property access (Note 6)
	Desirable 5 s gap	Minimum SSD	
40	55	35	30
50	69	45	40
60	83	65	55
70	97	85	70
80	111	105	95
90	125	130	Use values from 2nd and 3rd columns
100	139	160	
110	153	190	

Full access details are to be finalised as part of the detailed design.

4.2. INTERNAL ROADWORKS

The internal Road network has been designed to an 'Access St' road type with intersections, vertical and horizontal geometry based on a speed limit of 30km/hr. The internal roadways vary in grade from 0.5% to 8% within the development with most roads generally less than 1% longitudinal grade. Refer to Appendix A drawings J107-0010 to J107-0014 for the road longitudinal sections.

Road profiles, widths and service allocations adopted for the development have been based on the Bushfire Engineering Brief, NSW Street Opening Conference Guide to Codes and Practises for Street Openings and the Northern Rivers Design Guidelines.

The preliminary pavement design has been based on Northern Rivers Pavement Specification D2, Northern Rivers Asphaltic Concrete Specification C245 and the City of gold Coast Planning policy 11 Section 3 contained in table 4 seen below. Without any CBR tests conducted during the geotechnical investigation the subgrade was assumed to be 5-10 (typical of predominately sandy soils) with an estimated 600 VPD corresponding to a minimum pavement thickness of 320mm. As engineering fill with a CBR <10 is likely required under all roads the ultimate pavement thickness may be reduced considerably during the detailed design stage.

Table 3 | Residential Streets – Minimum Pavement thickness (mm)

Refer Council's Standard Drawing N° 03-02-001

CBR of Subgrade	Road Classification		
	Access Street		Collector Street
	0 – 400 VPD	401 – 750 VPD	3000 VPD
1	660*	725*	800*
2	480	525 *	590*
3	390	420	475
4	330	360	405
5	290	320	360
6	265	285	325
7	240	260	290
8	225	245	275
9	210	225	260
10	200	220	240
11	200	205	230
12	200	200	220
13	200	200	210
14	200	200	200
15	200	200	200
Minimum Course Thickness (mm)			
Asphalt Surfacing	25	25	25
Base Course Class 1B – CBR 60	100	100	100
Sub-Base Class 2 – CBR 45	100	100	100
Below Sub-Base Class 3 – CBR 15	100	100	100

* *The pavement thickness in this range may be reduced subject to appropriate subgrade strengthening or incorporation of a modified design utilising cement treated gravels being approved by Council.*

VPD = Vehicles Per Day

Notes:

1. *CBR shall be the 4 day soaked CBR value at 100% Standard Compaction and OMC and tested using a 4.5Kg surcharge weight.*
2. *The total pavement thickness is in millimetres and includes the Asphalt Surfacing.*
3. *Notwithstanding the Minimum Pavement Thickness tabulated, it is mandatory that:*
   - *If the minimum thickness of Class 2 material cannot be achieved, then Class 1 material shall be used for the full pavement depth. The same requirement applies for Class 3 material.*
   - *For pavement construction, refer to Council's Standard Specification SS7 – Unbound Pavements.*

5. SERVICES ASSESSMENT

5.1. WATER

BSC provides reticulated water supply to residential customers within the local area and is responsible for all reticulated water supply to the development.

Water reticulation is available via an existing 150mm water main located along the northern boundary of the proposed development. A 200mm main is also present running diagonally across the development site from the north-western boundary to the eastern boundary. It is proposed that this water main is relocated as part of the civil works. Refer Appendix A Drawing J107-19 & Drawing J107-20 for more details.

Table 4 shows the increased demand on the water supply network as a result of the proposed development based on the estimated flows and number of residents as per NRLG specification D11 – Water Supply and WSA-02 V2.3. For the purposes of this assessment we have assessed the site as being a 'Home Unit/Mobile Home' category.

Table 4 |Water Supply Design Flow

Water Supply Design Flow	
Peak Daily Demand	850L/d/EP
Home Unit (1 ET)	0.75 x 3.2 EP
Communal Space (Assume Club catering for 100 occupants) & Sports Facilities	40 EP
Total Development size (148 x House + 1 x Communal Space)	395EP
Total Development Demand	335,750 L/day
Total Flow – Peak Day	3.89 L/s

Currently, the demand from the site (1ET) is 850L/day or 0.03L/s. Based on our discussions and advice from Ballina Shire Council we understand that there are some supply restrictions with their existing water reticulation network upstream of the proposed development. The water reservoir that supplies this area of Ballina Shire Council has sufficient storage capacity to adequately cater for the development, however part of the existing water supply network that leads to the site needs to be augmented to cater for additional demand growth within the system.

Ballina Shire Council advised that the proposed development has not been accounted for within their current DCP and if it was to proceed an amendment would need to be made to include the site.

Internal water reticulation is to be provided to service the lots. It is proposed that the internal reticulation network is connected into the existing water main located in Skennars Head Road with a secondary connection point located on the relocated 200mm main to the east of the development as indicated on the proposed layout plans. Refer to Appendix A Drawing J107-19 & Drawing J107-20 for more details.

5.2. SEWER

BSC provides reticulated sewer to residential customers within the local area and is responsible for all reticulated sewer in the area surrounding the proposed development. BSC have existing sewerage assets located to the north of the proposed development boundary, however due to the fall across the site from the north to the south the existing infrastructure does not provide any gravity sewer service to the proposed development site.

Council have advised that the current existing sewer system that comprises of gravity mains and sewer pump stations is currently operating at maximum capacity and cannot accommodate for any additional flow into the system without augmentation. Council are currently in the process of planning to commence the design process for the augmentation of their existing pump station located opposite the proposed development site to increase its capacity, however as the proposed development site is not within council's current DCP no allowance has been made to cater for flows generated by the proposed development into the station.

The existing pump station transfers flows out to the Lennox Head Waste Water Treatment Plant located to the west of the site off North Creek Road.

As the site is not serviced by any existing gravity sewer assets an internal gravitational sewer network is to be provided to service the individual lots. It is proposed that a new sewer pump station is constructed on the development site. All lots are connected to this pump station via the internal sewer reticulation system. A sewer rising main along will connect the pump station to either the existing sewer pump station in Skennars Head Road if Council are able to cater for the proposed additional flows within their proposed augmentation design works, or alternatively the sewer rising main would need to continue out to North Creek Road and discharge directly to the Lennox Head Waste Water Treatment Plant. Refer to Appendix A Drawing J107-19 & Drawing J107-20 for the layout of the internal sewer network and proposed connection points.

Table 5 shows the increased demand on the sewer reticulation network resulting from the proposed development.

Table 5 | Sewer Reticulation Design Flow

Sewerage Design Flow	
ADWF 0.0021 x 451 EP	0.82 L/s
PDWF (d x ADWF where d = 4.4)	3.6 L/s
GWI (7.8ha x 0.025 L/s/ha x 50%	0.1 L/s
IIF (0.028 x Aeff x C x I)	4.4 L/s
Design Flow (PDWF + GWI + IIF)	**8.1 L/s**

Refer to Appendix D for detailed sewerage calculations. Detailed hydraulic modelling may be required as part of the detailed design to confirm the capacity of the proposed new station if it is agreed to connect the proposed development into Council's existing station and incorporate it with the proposed augmentation design works.

5.3. RECYCLED WATER

BSC now provide a reticulated recycled water supply to residential customers within the local area and there is a recycled water main located in Skennars Head Road at the northern end of the site. This recycled water supply is available for use within the proposed development.

5.4. POWER

Essential Energy is the main service authority for power supply in the region and is responsible for building, operating and maintaining the electricity network within the proximity of Ballina shire Council. Power is available via the overhead power network on Skennars Head Road.

Previously, Essential Energy has advised that there are two existing power feeder lines in the area that have the potential to service the development. One feeder line is approaching capacity. However, some of its load can be transferred over to the second feeder line to free up capacity for the development

In order to undertake a detailed assessment of the works required, Essential Energy require an estimate of the total KVA or Load in Amps for the proposed development. This information would be provided in an application request to essential Energy. All electrical designs must be carried out by a level 3 designer.

5.5. GAS

No gas reticulation services were found based on the survey and information provided. Planit Consulting is not aware of any plans to make reticulated gas available to the development site. Any requirements for gas to be provided for the proposed dwellings will require bottled gas supply that will be maintained and serviced by the landowner.

5.6. TELECOMMUNICATIONS

Telstra is the main telecommunications service supplier to the project area. Telstra service is available via the existing network along Skennars Head Road. Preliminary information provided by Telstra shows that there is the normal copper service within Skennars Head Road. Optic fibre is present within the vicinity of the subject site. Telstra has been contacted to determine if they are willing to service the development but no information has been received to date.

6. CONCLUSION

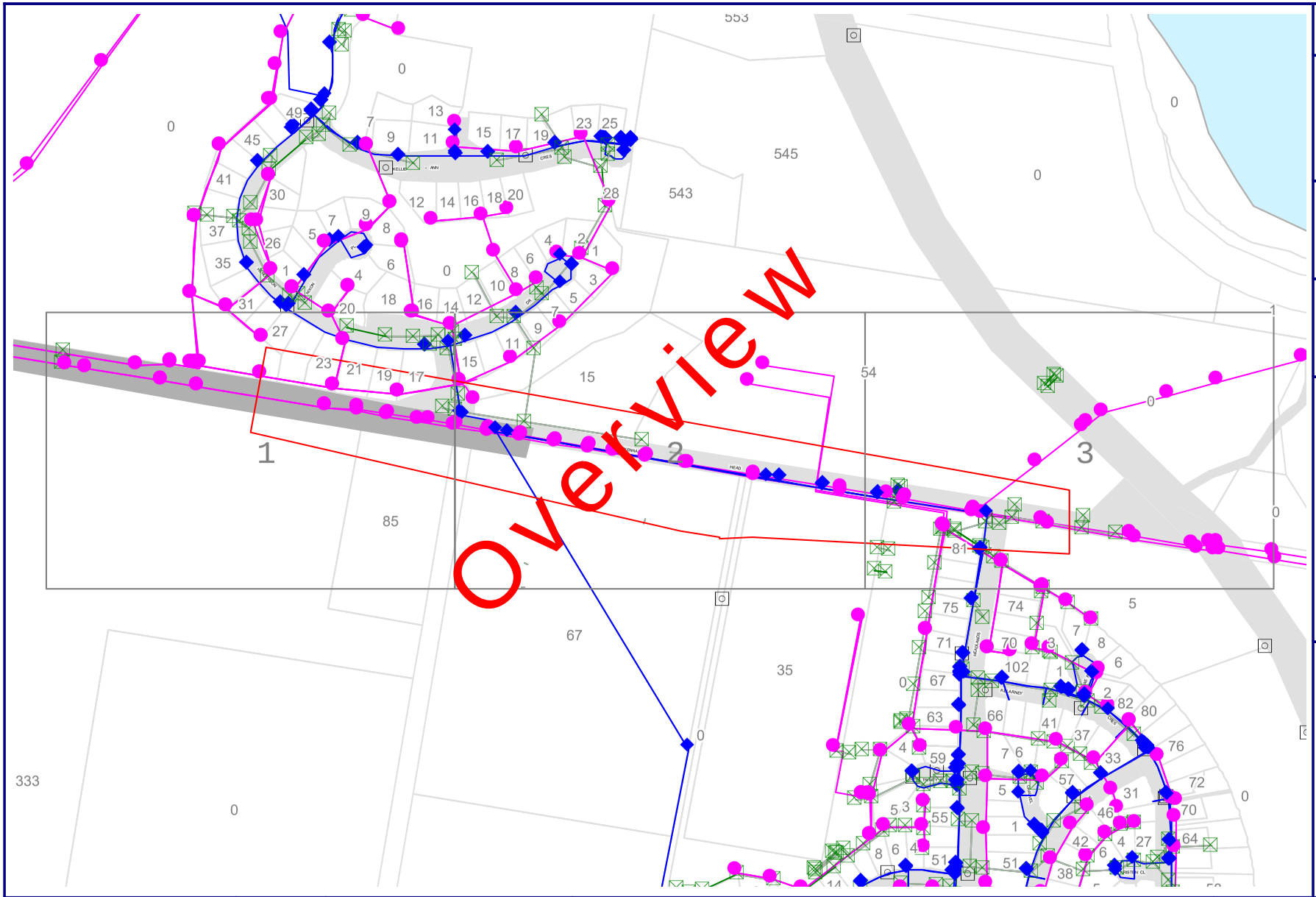
Based on the assessment of the site the proposed development can be adequately serviced with some augmentation of the existing utility service infrastructure.

The site can be developed in a manner that adequately complies with the appropriate standards and guidelines. We therefor believe there are no engineering constraints that have been identified that would prevent this proposed development from proceeding.

APPENDIX A | CIVIL ENGINEERING PLANS

NOTE:
REFER TO DA PLAN SET FOR THESE DRAWINGS

APPENDIX B | DIAL BEFORE YOU DIG PLANS



Legend

WATER

- Water
- Recycled Water

SEWER

- Sewer

STORMWATER

- Stormwater

OTHER

- Information not complete
- SCIMS Survey Control Point
- Property Boundary ID: House Number
- Road Reserve
- Rivers

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N W E S Not to scale

Affected Infrastructure :	Council Assets
DBYD Sequence Number :	51535283
DBYD Job Number :	10424929
Location of Works :	67 Skennars Head Road, Skennars Head, NSW, 2478

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Civil Services Group
(02) 6686 4444
www.ballina.nsw.gov.au

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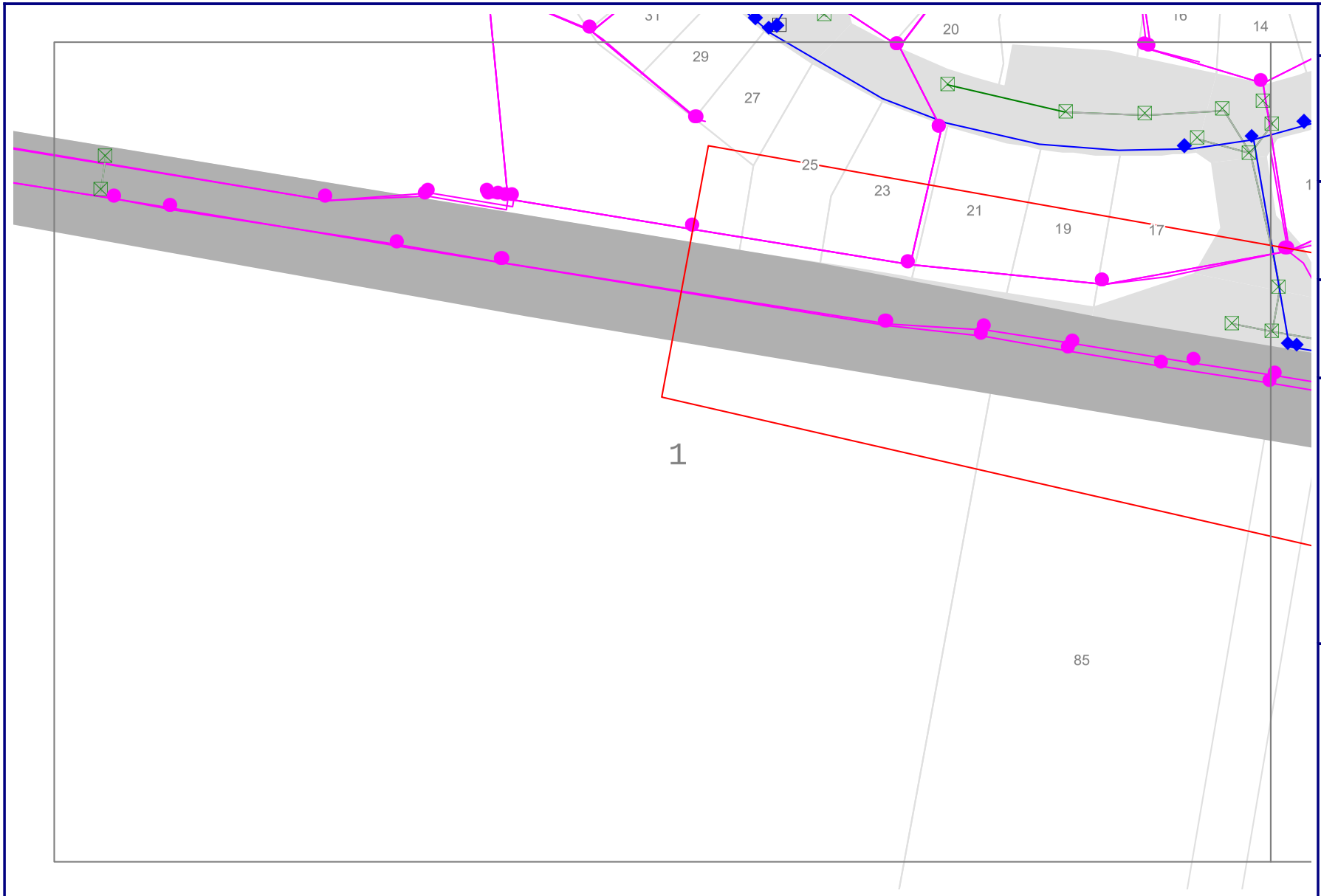

Legend

WATER

- Water
- Recycled Water

SEWER

- Sewer

STORMWATER

- Stormwater

OTHER

- Information not complete
- SCIMS Survey Control Point
- Property Boundary ID: House Number (4)
- Road Reserve
- Rivers

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N W E S
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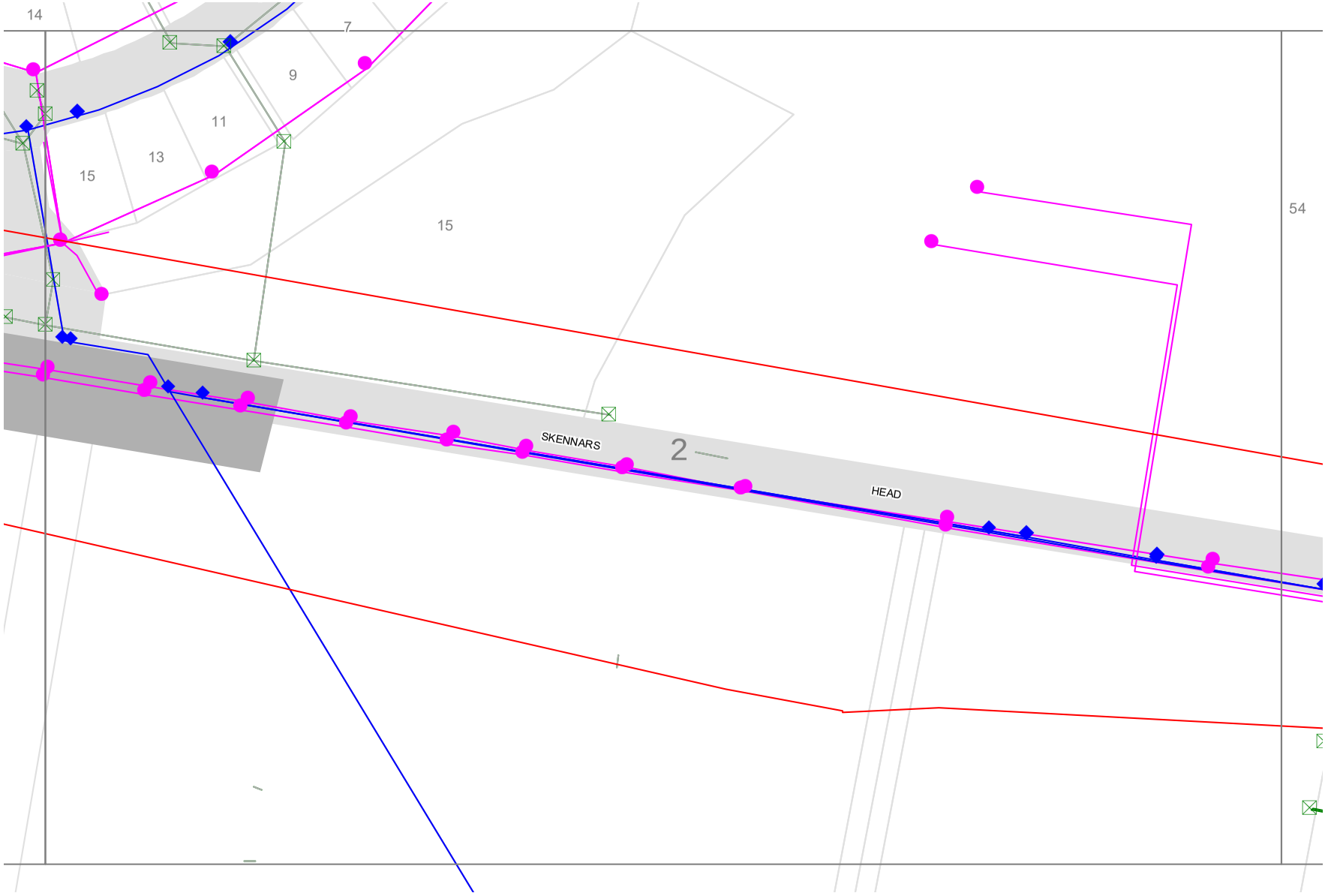

Legend

WATER

- Water
- Recycled Water

SEWER

- Sewer

STORMWATER

- Stormwater

OTHER

- Information not complete
- SCIMS Survey Control Point
- Property Boundary ID: House Number (e.g. 4, 100)
- Road Reserve
- Rivers

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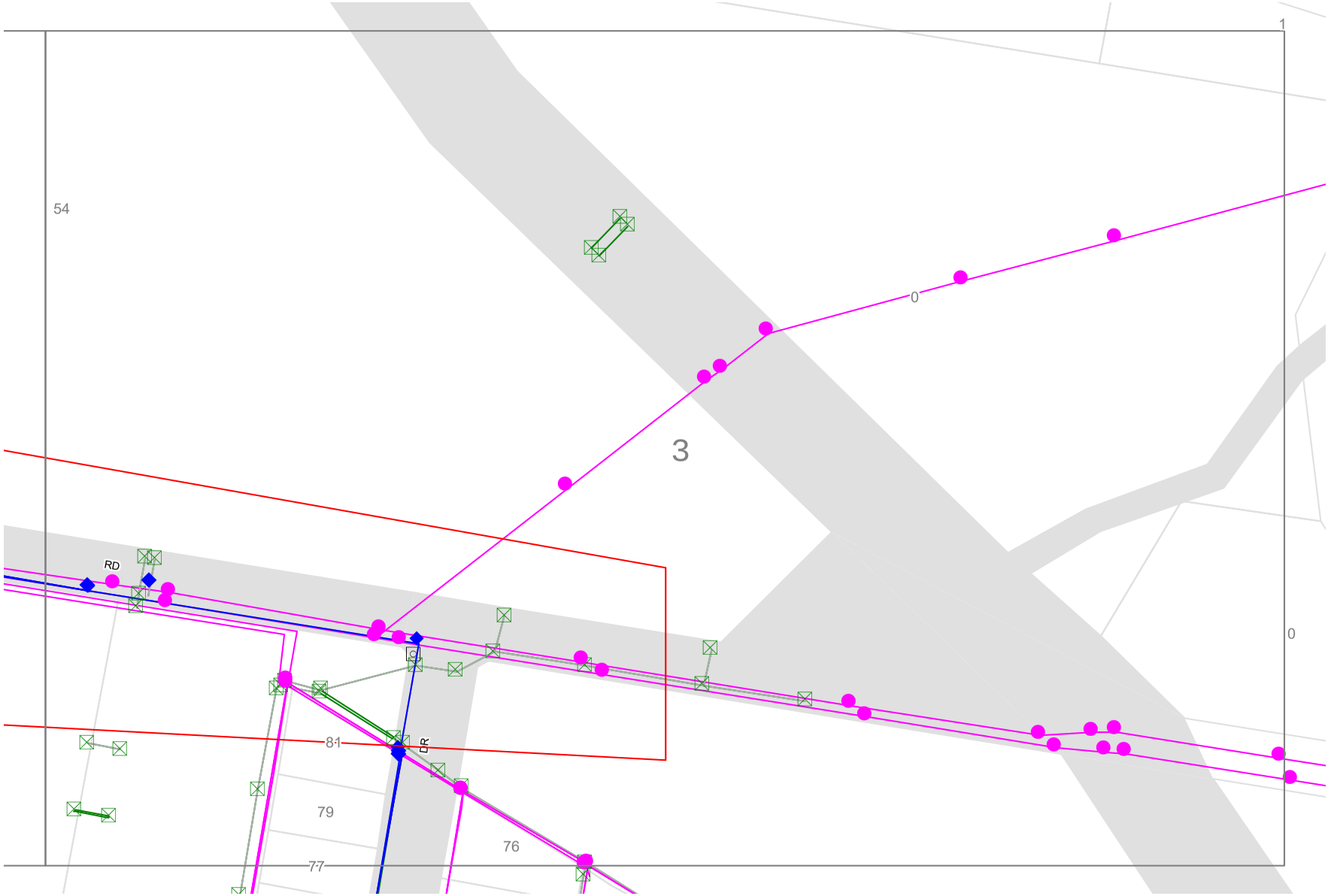

Legend

WATER

- Water
- Recycled Water

SEWER

- Sewer

STORMWATER

- Stormwater

OTHER

- Information not complete
- SCIMS Survey Control Point
- Property Boundary ID: House Number (4, 101)
- Road Reserve
- Rivers

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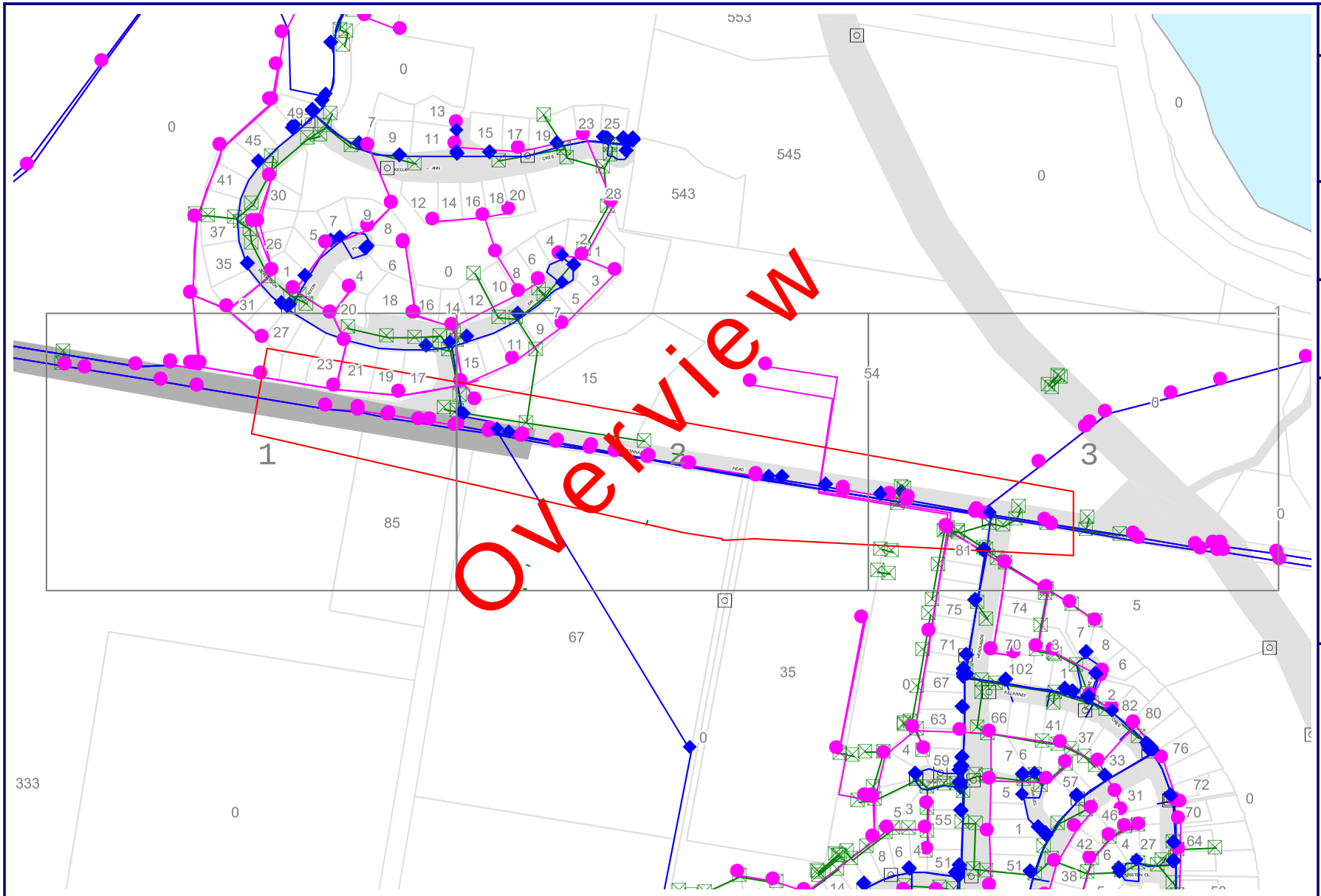

Legend

WATER
- Water
- Recycled Water

SEWER
- Sewer

STORMWATER
- Stormwater

OTHER
- Information not complete
- SCIMS Survey Control Point
- Property Boundary ID: House Number
- Road Reserve
- Rivers

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N W E S
Not to scale

Affected Infrastructure :	Council High Risk Assets
DBYD Sequence Number :	51535283
DBYD Job Number :	10424929
Location of Works :	67 Skennars Head Road, Skennars Head, NSW, 2478

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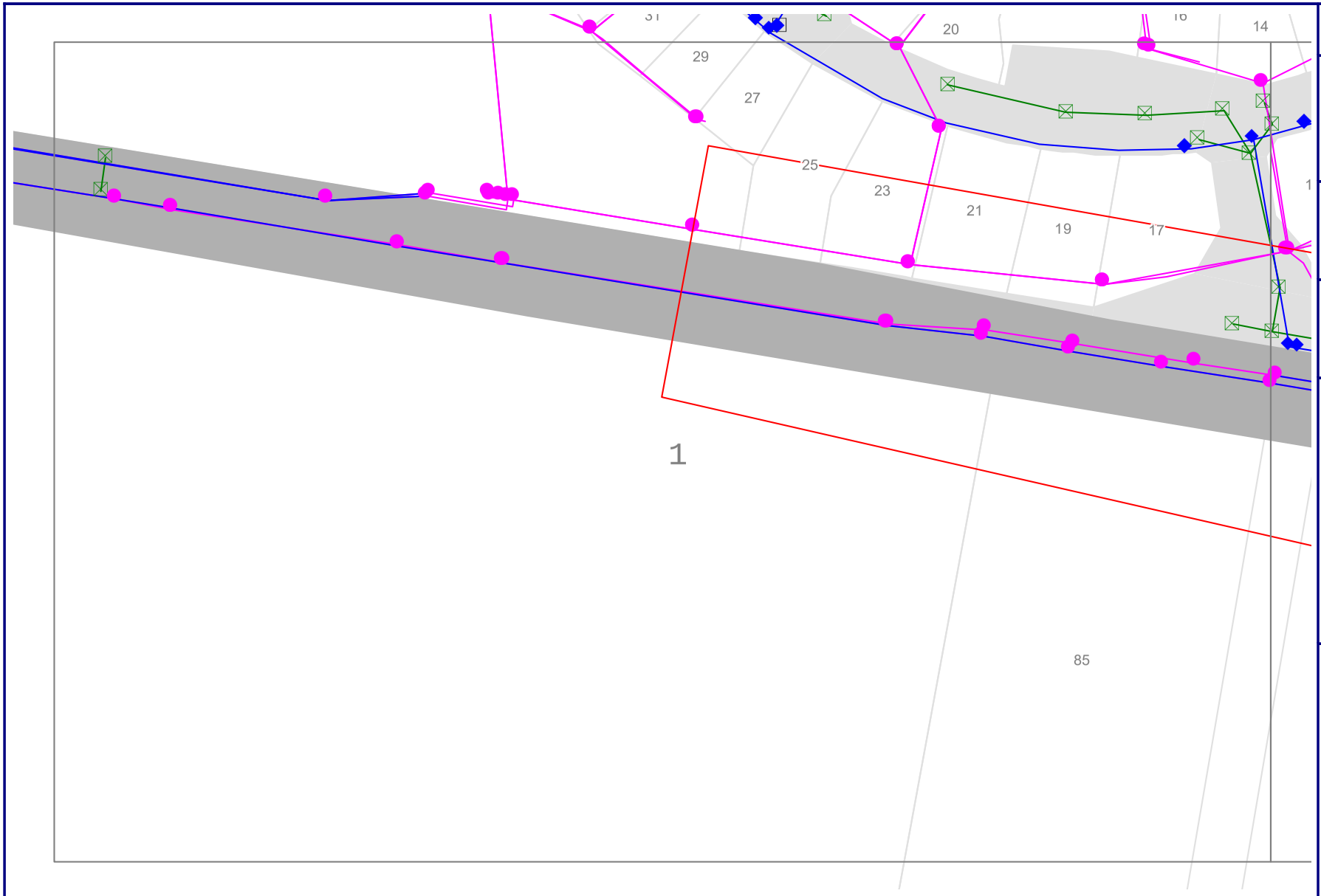

Legend

WATER

- Water
- Recycled Water

SEWER

- Sewer

STORMWATER

- Stormwater

OTHER

- Information not complete
- SCIMS Survey Control Point
- Property Boundary ID: House Number (4, 103)
- Road Reserve
- Rivers

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N W E S
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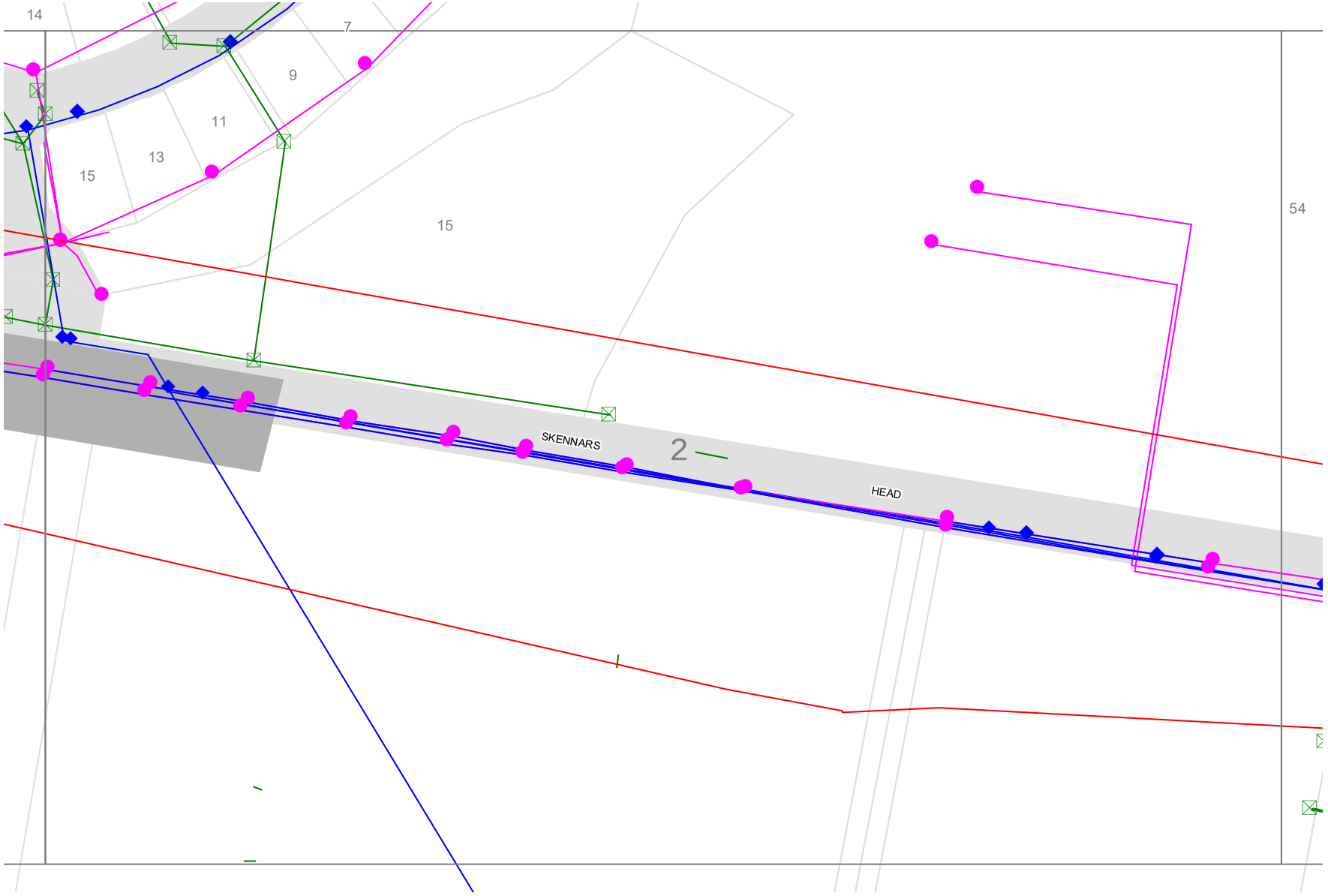

Legend

WATER

- Water
- Recycled Water

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- Sewer

STORMWATER

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OTHER

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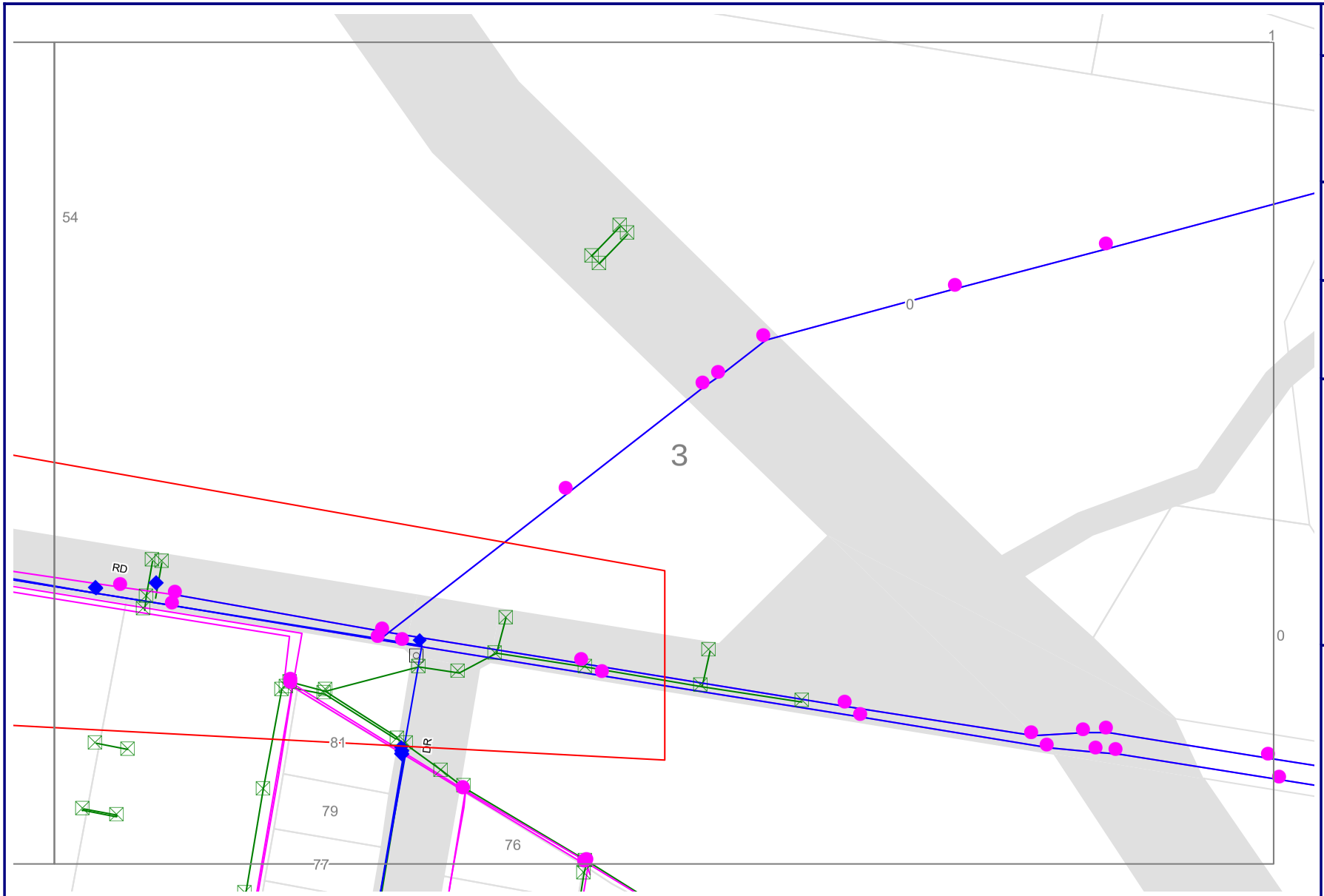

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SEWER

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STORMWATER

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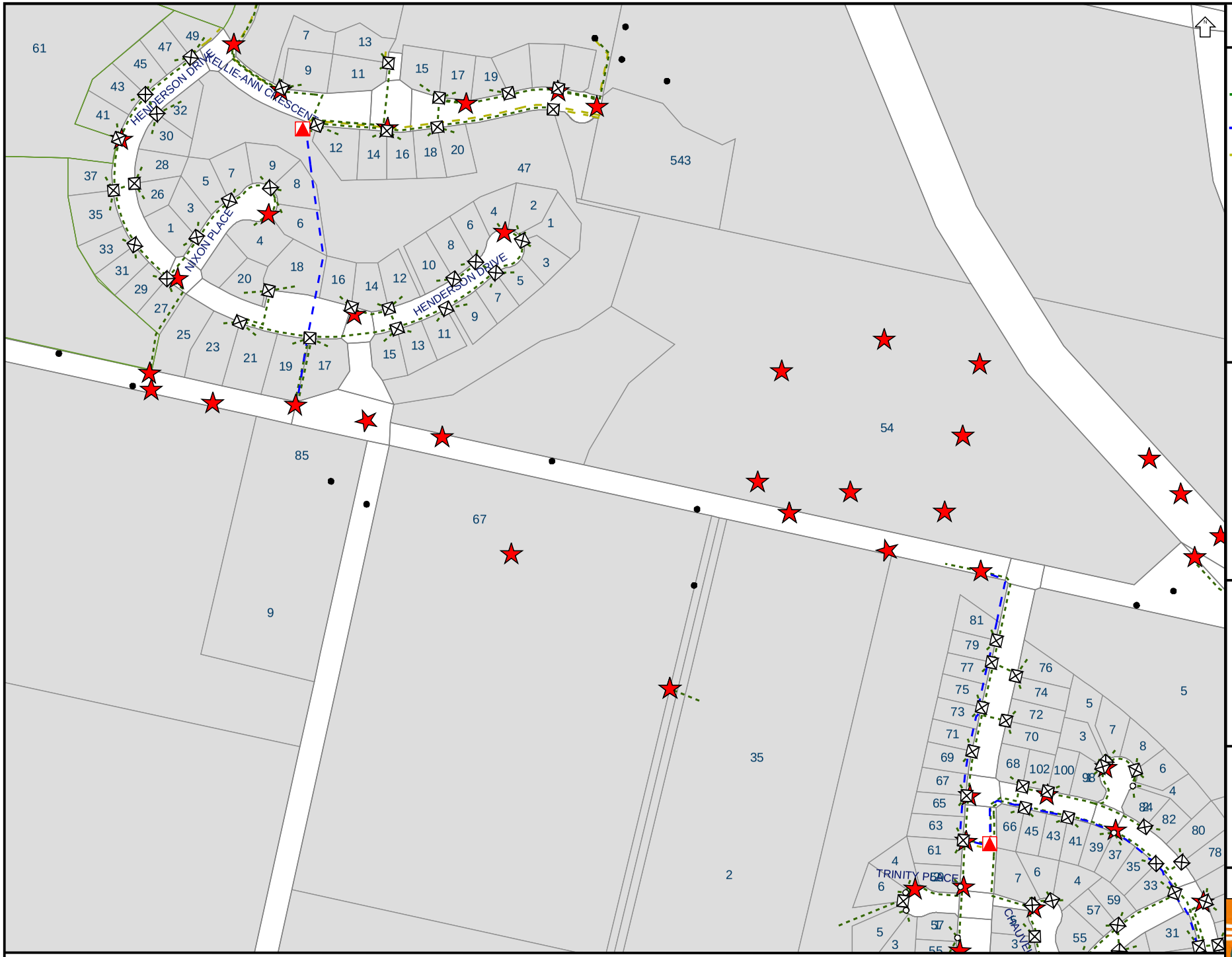


Overhead wires not shown
LOOK UP & LIVE!

LEGEND

- LV Underground Cable
- HV Underground Cable
- Underground Pipe
- Underground Earth or Wires
- Ground Substation
- Pole
- Cubicle
- Pit

Critical Assets
Contact Essential Energy on 13 23 91

- Zone Substation
- Underground Cable
- Underground Fibre

Proposed Works

- Area of proposed works

Proposed assets are shown as orange symbols

THE INFORMATION ON THIS MAP MAY NOT BE ACCURATE.
If details are incorrect, please notify Essential Energy on 13 23 91 (or fax 1800 354 636)

ISSUE DATE: 15/03/2016

You must resubmit your request if you have not started work within 4 weeks of the 'Issue Date' above

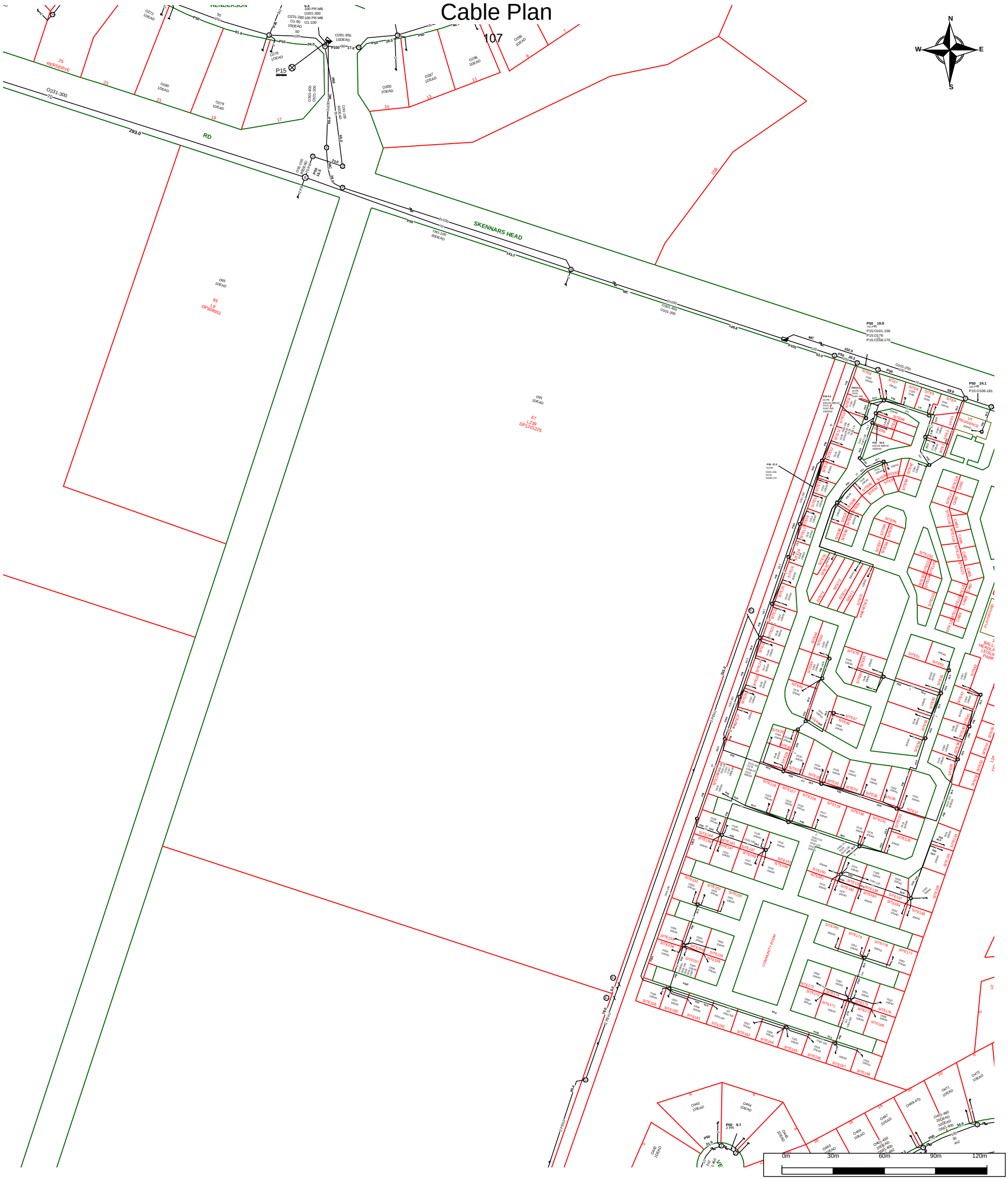
A4 | SCALE: 1:4440

Job Number: 10424929 Sequence number: 51535284 Job location: 67 Skennars Head Road, Skennars Head

Map Centre: 153° 35' 55.4", -28° 49' 24.1"

essential energy

Cable Plan



Telstra

For all Telstra DBYD plan enquiries -
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For urgent onsite contact only - ph 1800 653 935 (bus hrs)

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CAUTION: Fibre optic and/ or major network present in plot area. Please read the Duty of Care and contact Telstra Plan Services should you require any assistance.

The above plan must be viewed in conjunction with the Mains Cable Plan on the following page

Mains Cable Plan

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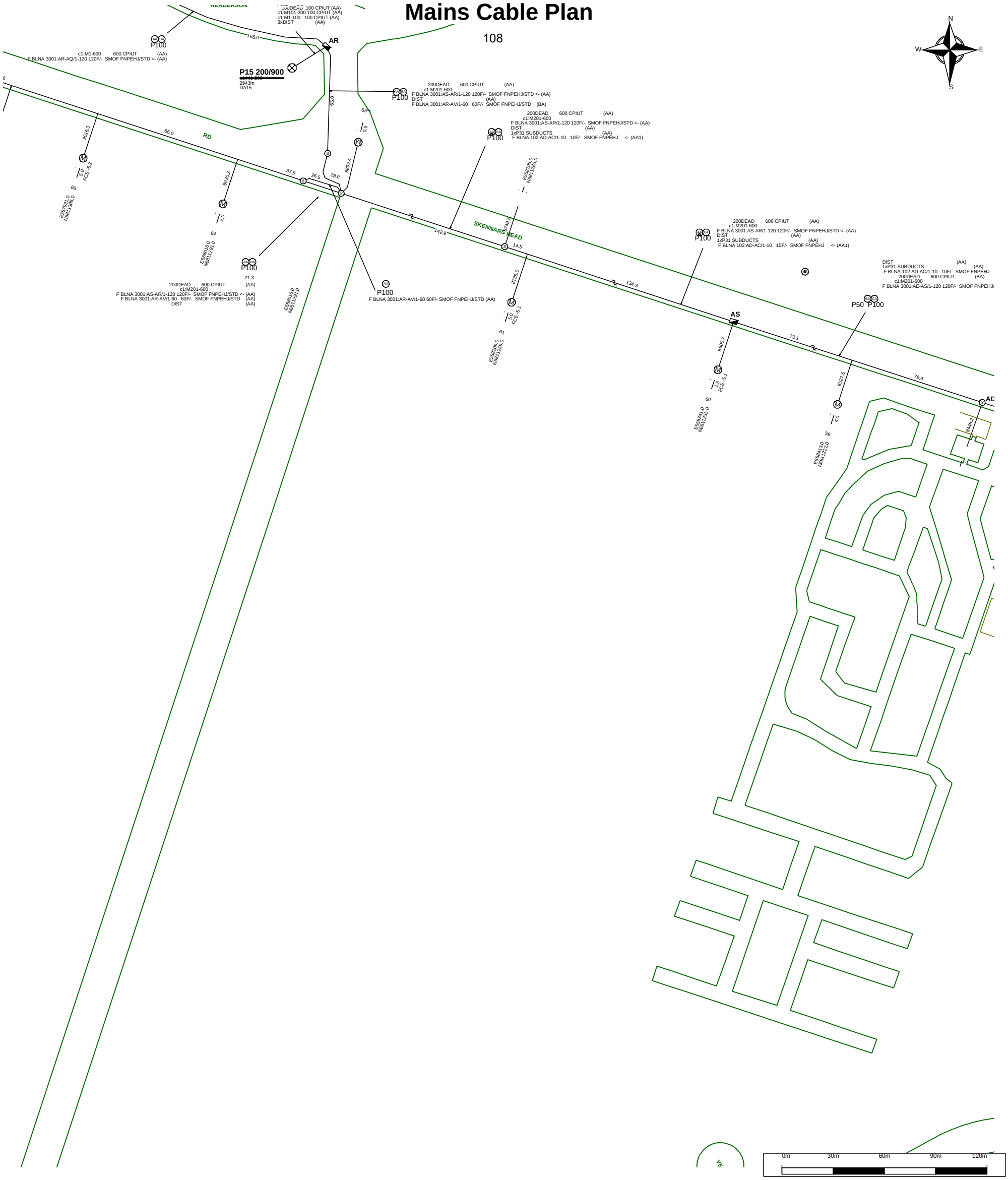
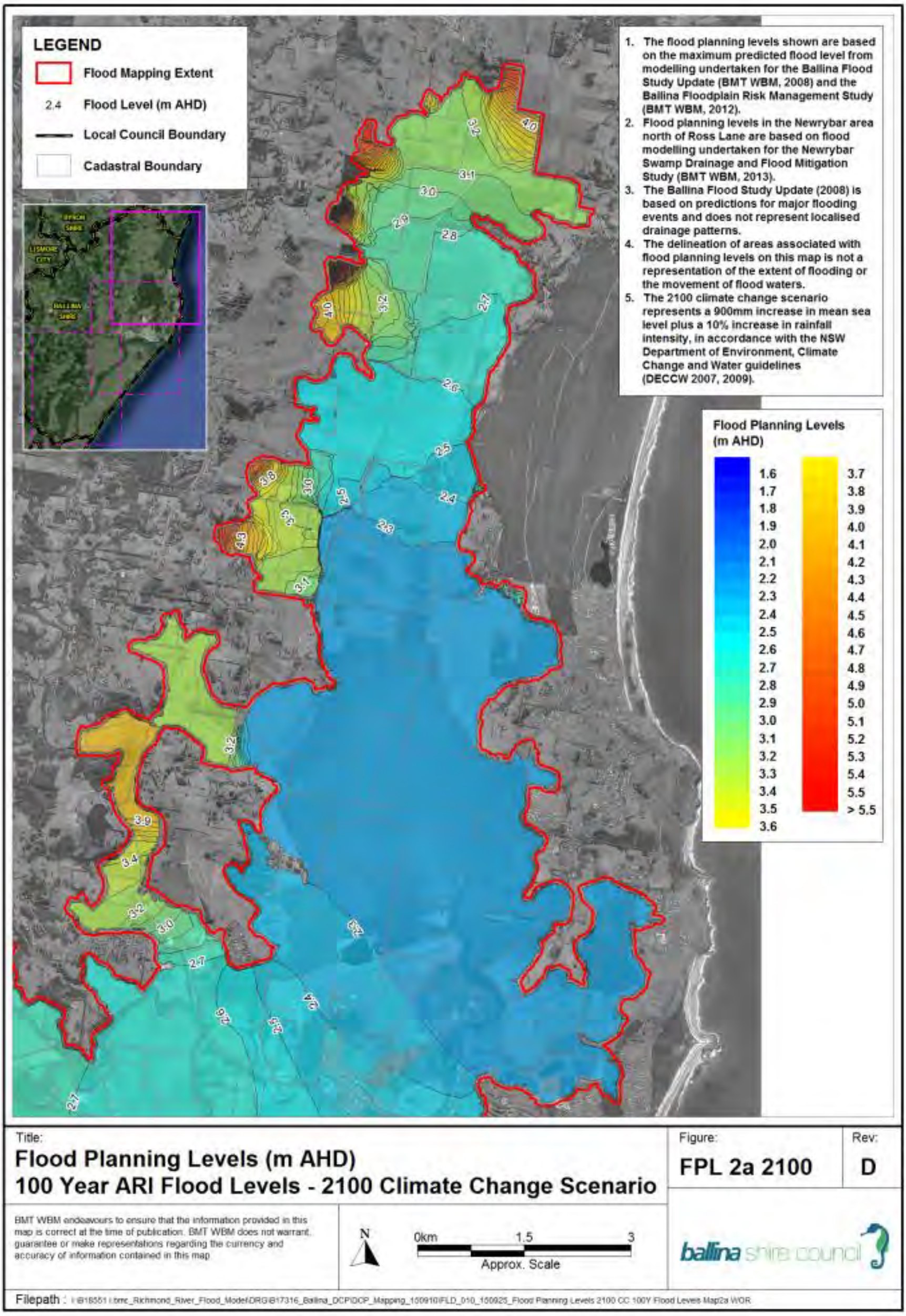


Telstra	For all Telstra DBYD plan enquiries - email - Telstra.Plans@team.telstra.com For urgent onsite contact only - ph 1800 653 935 (bus hrs)
TELSTRA CORPORATION LIMITED A.C.N. 051 775 556	
Generated On 01/08/2016 13:08:24	Sequence Number: 54630002
	CAUTION: Fibre optic and/ or major network present in plot area. Please read the Duty of Care and contact Telstra Plan Services should you require any assistance.

APPENDIX C | FLOOD LEVELS

Schedule F: Map 2a: Ballina LGA (North)
FPLs Based on 100 Year ARI Flood for 2100 Climate Change Conditions



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APPENDIX D | SEWER CALCULATIONS

Planit Engineering
ABN 99 613 049 568
Suite 9a, 80-84 Ballina Street
Lennox Head NSW 2478
(PO Box 161, Lennox Head NSW 2478)

FLOW ESTIMATION FOR DEVELOPED AREAS WSA 02□2002-2.3 APPENDIX B

Project : 67 Skennars Head Road
Job No. : J107

B5.1 Details of the Proposed Residential Developement

A (Gross Plan Area of the Development (Ha))	7.8	Ha
Number of Lots Size	148	
Development Density	50.5	EP/Ha
Equivalent Population	394	EP
$Portion_{Wet}$ (Amount of the development affected by "perennial" groundwater table levels)	50%	
Location	Ballina	
S_{aspect} (Soil aspect - Low Impact = 0.2, Medium = 0.5, High = 0.8)	0.2	
N_{aspect} (Network defects and inflow aspect. Low Impact = 0.2, Medium = 0.5, High = 0.8)	0.4	
ARI containment standard	2	years

B5.2 Peak Dry Weather Flow (PDWF)

Average Dry Weather Flow (ADWF) = 0.00208 * EP	0.81952	l/s
"d" Factor = $0.01(\log A)^4 - 0.19(\log A)^3 + 1.4(\log A)^2 - 4.66(\log A) + 7.57$	4.4	
PDWF = d * ADWF	**3.6**	**l/s**

B5.3 Ground Water Infiltration (GWI)

GWI = 0.025 * A * $Portion_{Wet}$	**0.1**	**l/s**

B5.4 Rainwater Dependent Inflow and Infiltration (IIF)

Leakage Severity Coefficient (C) = $S_{aspect} + N_{aspect}$	0.6	
1 hour, 2 year rainfall intensity ($I_{1,2}$) (Table B2)	47.8	
$Factor_{size} = (40/A)^{0.12}$	**1.2**	
$Factor_{containment}$	1	
Intensity (I) = $I_{1,2}$ * $Factor_{Size}$ * $Factor_{Containment}$	58.316	
Effective Area (A_{Eff}) = A x (Density / 150) 0.5 (Where Density < 150 EP/Ha)	4.52	ha
= A (Where Density >= 150 EP/Ha)		
Rainwater Dependent Inflow and Infiltration (IIF) = 0.028 * A_{Eff} * C * I	**4.4**	**l/s**

B5.5 Design Flow

Design Flow	**PDWF + GWI + IIF = 0.81952 + 0.1 + 4.4 l/s**	**8.1 l/s**

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(PO Box 161, Lennox Head NSW 2478)

FLOW ESTIMATION FOR UNDEVELOPED AREAS WSA 02 2002-2.3 APPENDIX B

Project : 67 Skennars Head Road
Job No. : J107

B5.1 Details of the Proposed Residential Developement

A (Gross Plan Area of the Development (Ha))	7.8	Ha
Number of Lots	1	
Development Density	0.4	EP/Ha
Equivalent Population	3.2	EP
$Portion_{Wet}$ (Amount of the development affected by "perennial" groundwater table levels)	50%	
Location	Ballina	
S_{aspect} (Soil aspect - Low Impact = 0.2, Medium = 0.5, High = 0.8)	0.2	
N_{aspect} (Network defects and inflow aspect. Low Impact = 0.2, Medium = 0.5, High = 0.8)	0.4	
ARI containment standard	2	years

B5.2 Peak Dry Weather Flow (PDWF)

Average Dry Weather Flow (ADWF) = 0.00208 * EP	0.006656	l/s
"d" Factor = $0.01(\log A)^4 - 0.19(\log A)^3 + 1.4(\log A)^2 - 4.66(\log A) + 7.57$	4.4	
PDWF = d * ADWF	**0**	**l/s**

B5.3 Ground Water Infiltration (GWI)

GWI = 0.025 * A * $Portion_{Wet}$	**0.1**	**l/s**

B5.4 Rainwater Dependent Inflow and Infiltration (IIF)

Leakage Severity Coefficient (C) = $S_{aspect} + N_{aspect}$	0.6	
1 hour, 2 year rainfall intensity ($I_{1,2}$) (Table B2)	47.8	
$Factor_{size} = (40/A)^{0.12}$	**1.2**	
$Factor_{containment}$	1	
Intensity (I) = $I_{1,2}$ * $Factor_{Size}$ * $Factor_{Containment}$	58.316	
Effective Area (A_{Eff}) = A x (Density / 150) 0.5 (Where Density < 150 EP/Ha)	0.4	ha
= A (Where Density >= 150 EP/Ha)		
Rainwater Dependent Inflow and Infiltration (IIF) = 0.028 * A_{Eff} * C * I	**0.4**	**l/s**

B5.5 Design Flow

Design Flow	**PDWF + GWI + IIF = 0.006656 + 0.1 + 0.4 l/s**	**0.5 l/s**

APPENDIX E | BMT WBM FLOOD ADVICE

NOTE:
REFER TO TECHNICAL REPORT 10
TO VIEW THIS REPORT

TECHNICAL REPORT 3

Construction Waste Management

PLANNERS NORTH

LIVING GEMS

Waste Management Plan

September 2016

TABLE OF CONTENTS

LIST OF TABLES

GLOSSARY / ABBREVIATIONS

CEMP	Construction Environmental Management Plan
CoA	Conditions of Approval
CT	Contaminant Threshold
CWMP	Construction Waste Management Plan
EEC	Endangered Ecological Community
ENM	Excavated Natural Material, as defined in *The excavated natural material exemption*
EPA	Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPL	Environmental Protection Licence
EWMS	Environmental Work Method Statement
FM Act	*Fisheries Management Act 1994*
GHG	Greenhouse gas emissions
NOW	NSW Office of Water
OEH	Office of Environment and Heritage
PESCP	Progressive Erosion and Sediment Control Plan
RMS	Roads and Maritime Services
SCC	Specific Contaminant Concentrations
TCLP	Toxicity Characteristics Leaching Procedure
The Project	Living Gems
VENM	Virgin Excavated Natural Material, as defined in Schedule 1 of the *Protection of the Environment Operations Act 1997.*
WARR Act	*Waste Avoidance and Resource Recovery Act 2001*

1. INTRODUCTION

1.1 PURPOSE

This Construction Waste Management Plan (CWMP) describes how LIVING GEMS will minimise the amount of waste for disposal and manage waste during construction of the LIVING GEMS, Skennars Head.

This CWMP has been prepared to address the requirements of Council's Development Control Plan 2012.

1.2 CONSULTATION FOR PREPARATION OF THE CWMP

There are no consultation requirements related to this Plan.

2. LEGAL AND OTHER REQUIREMENTS

2.1 LEGISLATION

Legislation relevant to waste and energy management includes:

- *Protection of the Environment Operations Act 1997*
- *Protection of the Environment Operations (General) Regulation 2009*
- *Protection of the Environment Operations (Waste) Regulation 2005*
- *Waste Avoidance and Resource Recovery Act 2001 (WARR Act)*
- *Contaminated Land Management Act 1997*
- *National Greenhouse and Energy Reporting Act 2007*
- *Noxious Weeds Act 1993*
- *Environmentally Hazardous Chemicals Act 1985*
- *Energy Efficiency Opportunities Act 2006 (EEO Act),*
- *Clean Energy Act 2011.*

2.2 GUIDELINES AND STANDARDS

The main guidelines, specifications and policy documents relevant to this CWMP include:

- Waste Classification Guidelines 2009 (DECCW) (EPA Publication),
- Best Practice Waste Reduction Guidelines for the Construction and Demolition Industry (tools for Practice), Natural Heritage Trust, 2000.

3. ENVIRONMENTAL IMPACTS

A risk management approach was used to determine the severity and likelihood of the construction activities' impact on the environment and to prioritise its significance. This process considered potential regulatory and legal risks as well the concerns of the community and other key stakeholders.

The objectives of the risk assessment were to:

- Identify activities, events or outcomes that have the potential to adversely affect the local environment and/or human health/property
- Qualitatively evaluate and categorise each risk item
- Assess whether risk issues can be managed by environmental protection measures
- Qualitatively evaluate residual risk with implementation of measures.

4. WASTE MANAGEMENT

4.1 WASTE MANAGEMENT HIERARCHY

The Waste Avoidance and Resource Recovery Act 2001 ensures that resource management options are considered against a hierarchy of:

- avoidance of unnecessary resource consumption
- resource recovery (including reuse, recycling, reprocessing, and energy recovery), and
- disposal.

Refer to **Figure 4-1** for the most recent waste hierarchy provided by the EPA in the NSW Waste Avoidance and Resource Recovery Strategy 2013-21, 2013.

Figure 4-1 The Waste Hierarchy

The approach to the steps in the waste hierarchy most relevant to the Project is briefly described below.

4.1.1 REDUCE OR AVOID

Reducing or avoiding the generation of waste is of primary importance to the project. The following approach will be adopted:

- Consider construction options that have a higher waste reduction capacity than alternatives.
- Order material/ goods with minimal packaging or request suppliers to remove packaging from site.
- Accurately estimate materials required to minimise wastage of product.

4.1.2 REUSE AND RECYCLING

Waste separation and segregation will be promoted on-site to facilitate reuse and recycling as a priority of the waste management program as follows:

- Segregate waste onsite – waste materials, including spoil and demolition waste, will be separated onsite into dedicated bins / areas for either reuse onsite or collection by a waste contractor and transported to offsite facilities

- Separate waste offsite – wastes will be deposited into one bin where space is not available for placement of multiple bins, and the waste will be sorted offsite by a waste contractor
- Where feasible and reasonable, secondary waste material would be used in construction - refer to **Table 4-1** for details on waste types that may be reused on site, and
- Implement measures for reducing demand on water resources as described in Section 5.5 of the CSWQMP.

4.1.3 WASTE HANDLING AND STORAGE

Where waste is required to be handled and stored onsite prior to onsite reuse or offsite recycling / disposal, the following measures will apply:

- spoil, topsoil and mulch will be stockpiled onsite in allocated areas, where appropriate, and mitigation measures for dust control and surface water management will be implemented in accordance with the CAQMP and the CSWQMP
- liquid wastes will be stored in appropriate containers in bunded areas until transported offsite. Bunded areas will have the capacity to hold 110% of the liquid waste volume for bulk storage or 120% of the volume of the largest container for smaller packaged storage
- hazardous waste will be managed by the appropriately qualified and licensed contractors, in accordance with the requirements of the Environmentally Hazardous Chemicals Act 1985 and the EPA waste disposal guidelines, and
- all other recyclable or non-recyclable wastes will be stored in appropriate covered receptacles (e.g. bins or skips) in appropriate locations onsite and subcontractors commissioned to regularly remove / empty the bins to approved disposal or recycling facilities.

4.1.4 WASTE DISPOSAL

Waste disposal will be in accordance with the Protection of the Environment Operations Act 1997 and the Waste Avoidance and Resource Recovery Act 2001. Wastes that are unable to be reused or recycled will be disposed of offsite to an appropriately licensed waste facility following classification (refer to Section 4.2).

4.2 WASTE CLASSIFICATION

Where waste cannot be avoided, reused or recycled it will be classified and appropriately disposed of. The classification of waste will be undertaken in accordance with the DECCW Waste Classification Guidelines Part 1: Classifying Waste (2009). This document identifies six classes of waste: Special, Liquid, Hazardous, Restricted Solid, General Solid (putrescible) and General Solid (non-putrescible), and describes a six step process to classifying waste.

The general classification principles are as follows:

- If a special waste is mixed with another waste, the waste must be managed to meet the requirements of both the special wastes and the other class of waste.
- If asbestos waste is mixed with any other class of waste, all of the waste must be classified as asbestos waste.
- If liquid waste is mixed with hazardous or solid waste and retains the defined characteristics of liquid waste, it remains liquid waste.
- Two or more classes of waste must not be mixed in order to reduce the concentration of chemical contaminants. Dilution is not an acceptable waste management option.
- Where practicable, it is desirable to separate a mixture of wastes before classifying them.
-

4.3 CLASSIFICATION OF POTENTIAL WASTE STREAMS FROM THE PROJECT

The construction activities and types of wastes that may be generated during construction are outlined in **Table 4-1**. This table also identifies preferred reuse, recycling and disposal methods for each waste stream. Waste classification was determined based on the six step process provided in

the DECCW Waste Classification Guidelines Part 1: Classifying Waste (2009). For additional information on the six steps, refer to Section 4.2 of this CWMP.

TABLE 4-1 CLASSIFICATION OF POTENTIAL WASTE STREAMS

Construction Activity	Waste Type	Waste classification	Proposed Reuse / Recycle / Disposal Methods
Geotechnical investigations and surveys	Drilling mud (that has been dewatered)	Subject to chemical assessment	Reuse off site - apply treated drilling mud to land where there is full compliance with The Treated Drilling Mud Exemption
General demolition	Concrete, bricks, ceramics	General solid waste (non putrescible) (pre classified by the EPA)	Reuse onsite - If suitable, crush and use as backfill/ road base Resource recovery off site - reuse, recycling, reprocessing or energy recovery at an appropriately licensed waste facility in accordance with the DECCW Waste Classification Guidelines (2009) Reuse offsite - apply concrete to land where there is full compliance with The Recovered Aggregate Exemption.
	Asphalt	General solid waste (non-putrescible) (pre classified by the EPA)	Reuse onsite - If suitable, crush and use as backfill/ road base Resource recovery off site - reuse, recycling, reprocessing or energy recovery at an appropriately licensed waste facility in accordance with the DECCW Waste Classification Guidelines (2009) Reuse offsite - apply concrete to land where there is full compliance with The Recovered Aggregate Exemption.
	Scrap metal	General solid waste (non putrescible)	Resource recovery off site - reuse, recycling, reprocessing or energy recovery at an appropriately licensed waste facility in accordance with the DECCW Waste Classification Guidelines (2009)
	Glass	(pre classified by the EPA) General solid waste (non-putrescible)	Resource recovery off site - reuse, recycling, reprocessing or energy recovery at an appropriately licensed waste facility in accordance with the DECCW Waste Classification Guidelines (2009)
	Asbestos	Special waste (Asbestos)	Disposal offsite - disposal at an appropriately licensed waste facility in accordance with the premises' Environment Protection Licence.
Clearing and grubbing	Native vegetation (branches loppings, tree trunks, tree stumps)	General solid waste (non-putrescible) (pre classified by the EPA)	Disposal offsite - disposal at an appropriately licensed waste facility in accordance with the premises' Environment Protection Licence.

Construction Activity	Waste Type	Waste classification	Proposed Reuse / Recycle / Disposal Methods
	Topsoil (containing weeds)	Subject to chemical assessment	Disposal offsite - disposal at an appropriately licensed waste facility in accordance with the premises' Environment Protection Licence
Excavation	Excess spoil (unsuitable material)	General solid waste (non-putrescible) (pre classified by the EPA)	Reuse off site - where there is full compliance with The excavated natural material exemption 2014 Disposal offsite - disposal at an appropriately licensed waste facility in accordance with the premises' Environment Protection Licence
	Contaminated soils	Subject to chemical assessment	Disposal offsite - at an appropriately licensed waste facility in accordance with the premises' Environment Protection Licence and the DECCW Waste Classification Guidelines (2009).
Building / Construction Waste	Steel reinforcing	General solid waste (non-putrescible)	Resource recovery off site - reuse, recycling, reprocessing or energy recovery at an appropriately licensed waste facility in accordance with the DECCW Waste Classification Guidelines (2009)
	Conduits and pipes	General solid waste (non-putrescible)	Resource recovery off site - reuse, recycling, reprocessing or energy recovery at an appropriately licensed waste facility in accordance with the DECCW Waste Classification Guidelines (2009)
	Timber formwork	General solid waste (non-putrescible) (pre classified by the EPA)	Disposal offsite - disposal at an appropriately licensed waste facility in accordance with the premises' Environment Protection Licence and the DECCW Waste Classification Guidelines (2009)
	Packaging materials, including wood, plastics, cardboard and metal	General solid waste (non-putrescible)	Resource recovery off site - reuse, recycling, reprocessing or energy recovery at an appropriately licensed waste facility in accordance with the DECCW Waste Classification Guidelines (2009)
Erosion and sediment control maintenance	Geotextile	General solid waste (non-putrescible)	Disposal offsite - disposal at an appropriately licensed waste facility in accordance with the premises' Environment Protection Licence and the DECCW Waste Classification Guidelines (2009)
	Sediment removed from sediment basins once they reach capacity	General solid waste (non-putrescible)	Incorporate into the earthworks Disposal offsite - disposal at an appropriately licensed waste facility in accordance with the premises' Environment Protection Licence and the DECCW Waste Classification Guidelines (2009)

Construction Activity	Waste Type	Waste classification	Proposed Reuse / Recycle / Disposal Methods
	Sediment fence and sandbags	General solid waste (non-putrescible)	Disposal offsite - disposal at an appropriately licensed waste facility in accordance with the premises' Environment Protection Licence and the DECCW Waste Classification Guidelines (2009)
Site compound and office uses	Drained oil filters, rags and oil absorbent materials that only contain non-volatile petroleum hydrocarbons and do not contain tree liquids	General solid waste (non-putrescible) (pre classified by the EPA)	Disposal offsite - disposal at an appropriately licensed waste facility in accordance with the premises' Environment Protection Licence and the DECCW Waste Classification Guidelines (2009)
	Containers, previously containing dangerous goods, from which residues have been removed by washing or vacuuming	General solid waste (non-putrescible) (pre classified by the EPA)	Disposal offsite - disposal at an appropriately licensed waste facility in accordance with the premises' Environment Protection Licence and the DECCW Waste Classification Guidelines (2009)
	Food waste	General solid waste (non-putrescible) (pre classified by the EPA)	Disposal offsite - disposal at an appropriately licensed waste facility in accordance with the premises' Environment Protection Licence and the DECCW Waste Classification Guidelines (2009)
	Sewage from amenities	General solid waste (non-putrescible) (pre classified by the EPA)	Disposal offsite - disposal at an appropriately licensed waste facility in accordance with the premises' Environment Protection Licence and the DECCW Waste Classification Guidelines (2009)
	Paper, cardboard and plastic glass, aluminium cans	General solid waste (non-putrescible)	Disposal offsite - disposal at an appropriately licensed waste facility in accordance with the premises' Environment Protection Licence and the DECCW Waste Classification Guidelines (2009)
	Unwanted liquid chemicals	Liquid waste	Disposal offsite - disposal at an appropriately licensed waste facility in accordance with the premises' Environment Protection Licence and the DECCW Waste Classification Guidelines (2009)

5. ENVIRONMENTAL MITIGATION MEASURES

Specific mitigation measures to address waste impacts are outlined in **Table 5-1**.

TABLE 5-1 WASTE MITIGATION MEASURES

GENERAL	
Adopt and promote the waste hierarchy (reduce or avoid waste, reuse waste, recycle waste, recover energy, treat waste, dispose of waste).	Environmental Manager
Keep site free of litter and maintain good housekeeping.	Foreman
Do not cause, permit or allow waste generated outside the site to be received at the site for storage, treatment, processing, reprocessing, or disposal on the site, except as expressly permitted by a licence under the Protection of the Environment Operations Act 1997, if such a licence is required in relation to that waste (CoA 810).	Foreman
REDUCE OR AVOID	
Calculate precise estimates prior to placing orders.	Contractor
Implement, where possible, agreements with suppliers to return excess construction materials or packaging for future reuse.	Contractor
RESOURCE RECOVERY (REUSE, RECYCLE)	
Establish a list of preferred suppliers for waste management services (e.g. - waste oil recyclers. metal recyclers, etc.).	Contractor
Include in waste contractor subcontract agreements requirements to comply with statutory requirements, report quantities, types, dates and destination of material removed from site.	Contractor
Classify all wastes generated on the site during construction in accordance with the 2009 Waste Classification Guidelines prior to transporting waste off site.	Contractor
Obtain and provide receipts/dockets for waste removed from site to the EO.	Foreman
Record all waste removed from site in the Waste Register.	Foreman
Provide appropriate facilities to ensure that materials for recycling are separated from materials that are to be disposed of as wastes. Facilities are to be labelled for the various waste streams to ensure easy recognition.	Contractor
Collect and store waste oil in suitable containers and store in a bunded area until collected for recycling. All permanent bunded storage areas must be covered.	Contractor
Reuse excavated spoil generated onsite where possible.	Foreman
Reuse waste material generated onsite where possible, including topsoil and mulch.	Foreman
When transporting waste to the premises other than EPA-licenced waste management facilities, ensure these premises can LAWFULLY ACCEPT THIS WASTE; OBTAIN A COPY OF THE COMPLETED AND SIGNED 'Notice under Section 143' form from the landholder to confirm this prior to transporting material to the premises.	Foreman
Provide paper recycling bins/boxes in all site offices. All paper waste to be sent to recycling facility. Encourage all staff to separate paper waste.	Contractor

Use recycled products in construction to reduce demand on resources, where the use of the material is cost and performance competitive and RMS' specifications allow it.	Contractor
Set printers at the site office to default to double sided and black and white printing. Encourage all staff to minimise paper use through use of electronic media, re-use of paper etc. Refill or return printer cartridges for recycling.	Contractor
DISPOSAL	
Store construction wastes which cannot be recycled in separate skips. The skips will be collected by a licensed waste contractor on a regular basis and transported to a licensed landfill.	Contractor
Empty portable toilets regularly by subcontractors. Dispose wastes in accordance with the 2009 Waste Classification Guidelines. Connect toilets at the site compound to the sewerage network.	Contractor
Establish a list of preferred suppliers for waste management services (e.g. - waste oil recyclers. metal recyclers, etc.).	Contractor
ENERGY CONSUMPTION (FUEL AND POWER)	
Select energy efficient plant, equipment and vehicles where feasible and reasonable to reduce greenhouse gas emissions, through consultation with subcontractors and suppliers.	Contractor
Maintain all vehicles, including trucks entering and leaving the site, and construction equipment in accordance with the manufacturer's specification to comply with all relevant legislation.	Contractor
Procure locally produced goods and services where feasible and cost effective to reduce transport fuel emissions.	Contractor
Consider the procurement of renewable energy technologies (e.g. solar photovoltaic, wind power) for power generation on site.	Contractor

6. COMPLIANCE MANAGEMENT

6.1 ROLES AND RESPONSIBILITIES

The LIVING GEMS project team organisational structure defining relevant roles and responsibilities will be prepared and published prior to the issue of a Construction Certificate for the building work.

6.2 TRAINING

All employees, subcontractors and utility staff working on site will undergo site induction training relating to waste and energy management issues, including:

- existence and requirements of this CWMP
- relevant legislation
- waste reporting requirements
- requirements of the waste hierarchy
- waste I recycle storage requirements
- energy efficient best practices
- waste handling requirements and details of the types of wastes that are intended for on- site reuse
- other specific responsibilities for waste and reuse management, and
- other specific responsibilities for energy management.

6.3 Monitoring and Inspections

Regular monitoring and inspections will be undertaken during construction in accordance with Table 6-1.

Table 6-1 Monitoring & Inspections Tabulation

Monitoring Details	Record	Responsibility	Frequency
Track waster taken offsite	Waste Register	Forman	When waste taken offsite. Waste Register to be updated regularly
	Waste receipts/dockets	Foreman	When waste taken off site to a waste facility
	Transportation dockets	Foreman	When EPA trackable waste taken offsite
Inspections for litter, unauthorised disposal of construction waste, contamination of waste streams and adequacy of capacity of waste receptacles (as part of weekly environmental inspection)	Environmental Inspection Checklist	Foreman	Weekly

6.4 Non-Conformances

Non-conformances will be dealt with and documented in accordance with Section 8.5 of the CEMP.

6.5 Complaints

Complaints will be recorded and addressed in accordance with Section 6.3 of the CEMP and the Community Communication Strategy (CCS).

7. REVIEW AND IMPROVEMENT OF CWMP

The CWMP will be reviewed regularly to ensure compliance with legislative requirements and its suitability and effectiveness for the project.

The review may be in the form of:

- a formal management review
- a second party audit, and/or
- an inclusion as a separate item at a site meeting.

The Environmental Manager can review and update the CWMP more regularly where:

- significant changes in construction activities occur
- where targets are not being achieved, or
- in response to audits and nonconformity reports.

Minor changes to the CWMP will be approved by the Project Engineer in accordance with section 1.8 of the CEMP. All major changes to CHMP will be approved by Ballina Shire Council.

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TECHNICAL REPORT 4

Traffic Assessment

rytenskild
Traffic Engineering

TRAFFIC IMPACT ASSESSMENT

PROPOSED SENIORS LIVING DEVELOPMENT

67 SKENNARS HEAD ROAD, SKENNARS HEAD

LOT 239 DP1201225

(Amended report in response to further issues raised by Council and RMS)

Prepared for

LIVING GEMS

29 MAY 2018

DOCUMENT REGISTER

Document Response to the Request for Further Information (RFI)

RTE Reference 16081

Prepared by Dare Janzekovic, Luke Rytenskild

Document History

Version	Version date	Details	Reviewed and Authorised	
			Name / Position	Signature
1	21 April 2017	RFI Response 1	Luke Rytenskild Director RPEQ 6293	
2	29 May 2018	RFI Response 2	Luke Rytenskild Director RPEQ 6293	

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COMPANY INFORMATION

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TABLE OF CONTENTS

1.0 INTRODUCTION

Rytenskild Traffic Group (RTG) has been engaged by Living Gems to prepare a Traffic Impact Assessment of their proposed seniors living development in Skennars Head.

This report is intended for submission with the Statement of Environmental Effects (SEE). The following issues have been addressed during the study:

- Road network impact assessment;
- On-site traffic circulation;
- Access arrangements.

The traffic report has also been prepared in accordance with the Roads and Maritime Services (RMS) publication, *Guide to Traffic Generating Developments*.

This report has been modified in response to further issues raised by Council and the RMS, and also to suit the latest plan of development. A brief response to the issues raised is provided as follows:

> *3. The traffic report by Rytenskild Traffic Group dated 12 August 2016 states that the internal roads shall have a pavement width of 6 metres. The plan in the Statement of Environmental Effects (SEE) shows a pavement width of 5.5 metres. The traffic report includes swept paths which are assumed to be based on 6 metre wide pavements.*
>
> *Please confirm the proposed pavement widths and if 5.5 metres, please provide a revised traffic report with swept paths to reflect this width.*

Response

As discussed in Section 6, the proposal provides a 6.5 metre circulation roadway with the internal road measuring 5.5 metres. A revised swept path assessment for a 12.5 metre Heavy Rigid Vehicle has been carried out and is presented in Figures 6.2 to 6.4.

> *The traffic report indicates that the sites main intersection/driveway is located approximately 75 metres east of the Henderson Drive intersection. The report suggests that Skennars Head Road will need to be widened to approximately 12 metres wide around the site entry to accommodate vehicles turning right into the site.*
>
> *It is requested that you undertake a warrant assessment on the proposed intersection to determine whether the development requires channelised turn lanes in accordance with the Austroads Road design guidelines.*

Response

Please refer to sections 5 and 7.

The proposed driveway is located in close proximity to the adjoining intersections of Skennars Head Road and Henderson Drive and Skennars Head Road and the sports fields. These intersections shall both need to be upgraded to channelised intersections in the future. The intersection of Skennars Head Road and the sports fields is scheduled to be upgraded to a channelised right turn intersection in the 2016/17 financial year. These works are included in Councils current works program.

In order to confirm that the ultimate scenario for each intersection can be spatially accommodated it is requested that a design be provided showing all three intersections designed as channelized intersections.

Response

As shown in Figure 7.2, the location of the proposed access will allow a channelised right turn lane to be provided at the Henderson Drive intersection.

It is proposed that a Type CHR(S) be provided for the site access. This is provided due to the low volume of traffic expected to arrive to the site from the west. It is estimated that due to the number of dwellings serviced from Henderson Drive the intersection will only warrants a short channelised right turn treatment (CHR(S). Such has been provided with a storage capacity for a single standard vehicle and therefore satisfies the design requirements of Austroads Part 4A for a design speed limit of 70 km / hr.

7. The NSW Roads and Maritime Services (RMS) via letter of 4 November 2016 have also raised a number of traffic matters (copy attached). Please provide responses specifically to the four dot points so they can be considered further and possibly forwarded to the RMS for consideration.

The RMS letter is provided as Appendix A. The analysis in this report has been amended to address concerns raised. In summary:

- Further assessment of the proposed site access intersection with Skennars Head Road is presented in Sections 5 and 7.
- As discussed in Section 5, the proposed roundabout upgrades at the Skennars Head Road / Coast Road intersection functions satisfactorily under the surveyed (year 2016) and future traffic conditions with the proposed development.
- The traffic analysis in Section 5 has been revised in accordance with the traffic distribution suggested by RMS.
- The revised layout provides additional visitor car parking at the entry of and throughout the proposed development.

It is noted that the SIDRA analysis presented in Section 5 is for a higher yield development of 170 units. Therefore, the results of the analysis are conservative based on the updated yield of 147 units and reduction in traffic by 6 trips.

2.0 SUBJECT SITE

The subject site has a total site area of approximately 12 hectares and has a 280 metre (approx.) frontage to Skennars Head Road.

As shown in Figures 2.1 and 2.2, the site is located on the southern side of Skennars Head Road and approximately 600 metres west of The Coast Road / Skennars Head Road intersection.

FIGURE 2.1 – LOCATION OF SUBJECT SITE

3.0 LOCAL ROAD NETWORK

3.1 Existing Local Road Network

Skennars Head Road is a two lane rural road with a 60 Km / Hr posted speed limit. As shown in Figure 3.1, in the vicinity of the site, Skennars Head Road has a pavement width of approximately 9 metres and this widens to approximately 12 metres to the west. A combined foot / cycle path has recently been constructed along the frontage of the site.

As shown in Figure 3.2, The Coast Road / Skennars Head Road intersection to the east has recently (mid 2017) been upgraded to a double lane roundabout. The Rocky Point Road intersection is located just to the south and is restricted to left in / left out movements only.

FIGURE 3.1 – EXISTING LAYOUT OF SKENNARS HEAD ROAD AT PROPOSED ACCESS POINT

FIGURE 3.2 – EXISTING LAYOUT OF THE COAST ROAD / SKENNARS HEAD ROAD ROUNDABOUT

3.2 Surveyed Traffic Volumes

RTG carried out peak period traffic counts at the Skennars Head Road / The Coast Road intersection in June 2016.

The counts indicate that Skennars Head Road carries in the order of 500 vehicles per hour just west of The Coast Road intersection. It is estimated that this volume reduces to approximately 2,500 vehicles per day adjacent to the subject site.

The full traffic survey is provided in Appendix A, with peak period traffic volumes summarised in Figure 3.3. It is noted that traffic survey considered The Coast Road intersections with Skennars Head Road and Rocky Point Road as a single four way intersection, even though they function as separate T intersections.

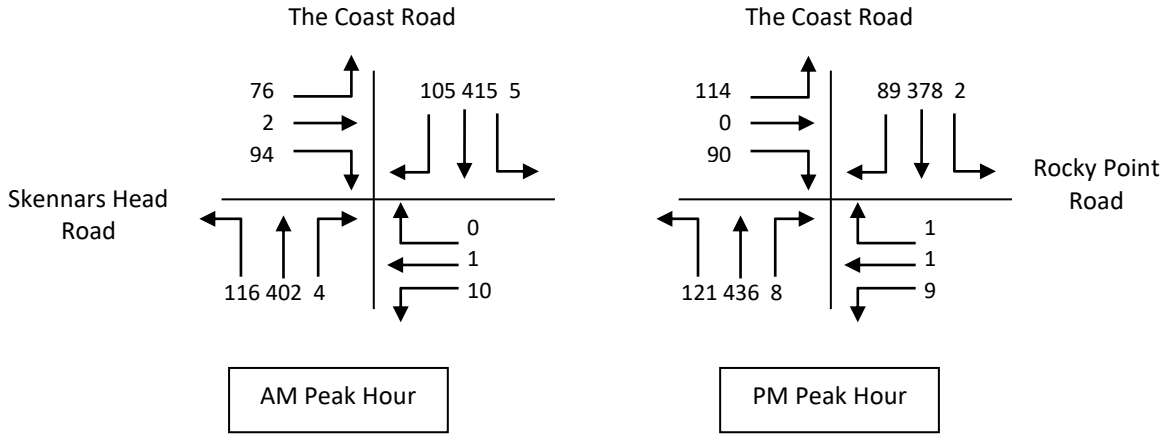


FIGURE 3.3 –SURVEYED PEAK HOUR TRAFFIC VOLUMES AT THE COAST ROAD / SKENNARS HEAD ROAD INTERSECTION

3.3 Road Planning

As shown in Figure 3.4, the Ballina Shire Road Contribution Plan includes the upgrade of North Creek Road and bridge construction, and also an upgrade of Hutley Road. These works will alleviate The Coast Road as it will provide an alternative route to Ballina.

Council is planning to construct a channelised right turn lane at the Henderon Drive / Skennars Head Road intersection. Council has recently upgraded the Skennars Head Road / The Coast Road intersection in to a double lane roundabout.

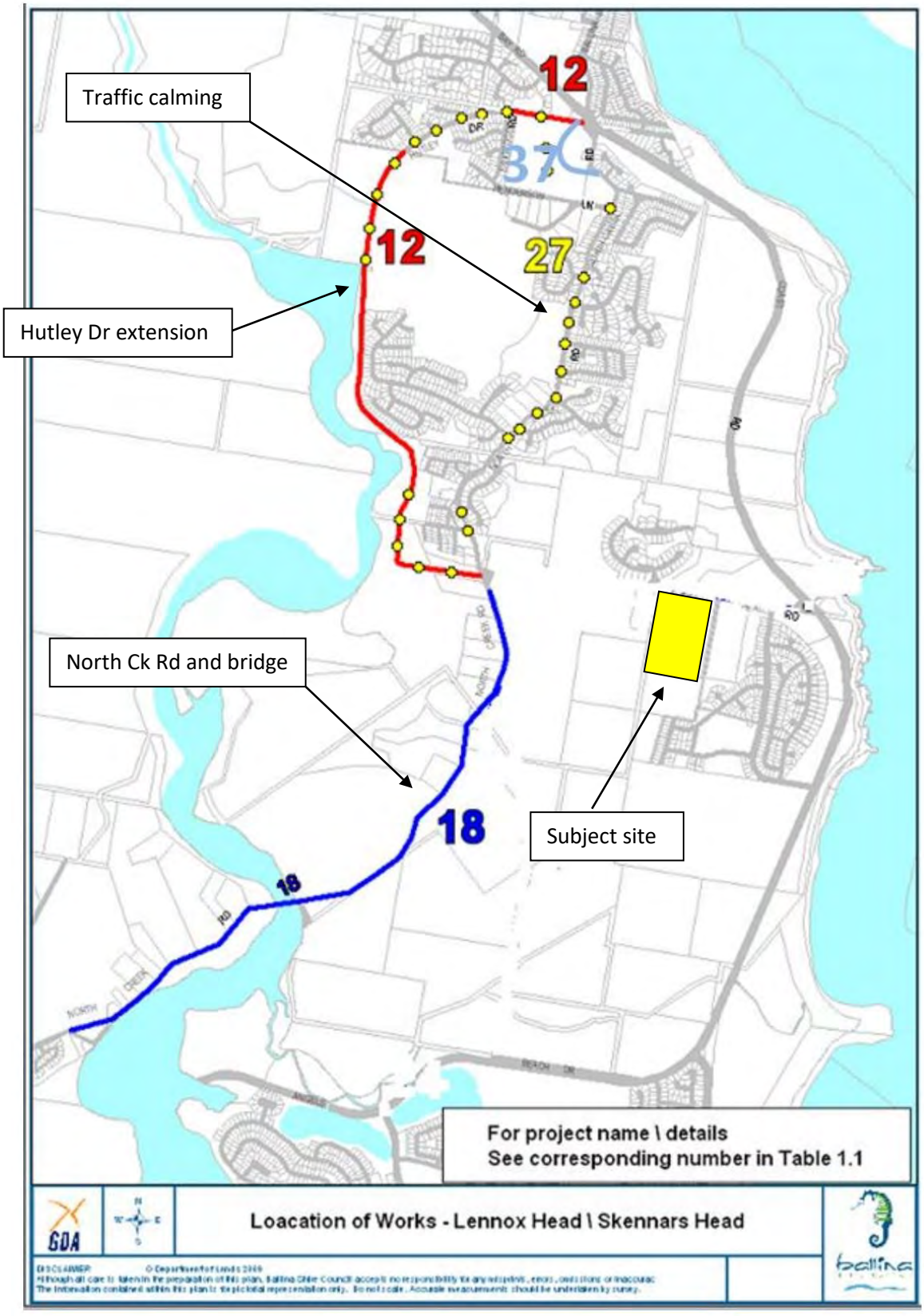


FIGURE 3.4 –PLANNED WORKS UNDER THE BSRCP

4.0 DEVELOPMENT PROPOSAL

The proposed plan of development is for a Seniors Living development which will provide 147 units, including a single unit for an on-site manager. It is proposed that the site will be constructed in three stages as shown in Figure4.1.

Access is proposed to be gained via a single point on Skennars Head Road located approximately 172 metres (centre line to centre line) east of the Henderson Drive intersection. A second crossover is proposed to be provided at the eastern end of the Skennars Head Road frontage, however such will be closed and will only be used for emergencies.

A network of private roads will provide access to each individual lot.

FIGURE 4.1 – PROPOSED SITE PLAN

5.0 DEVELOPMENT TRAFFIC IMPACT

5.1 Trip Generation

In accordance with the Ballina Shire Roads Contribution Plan (and RMS Guide to Traffic Generating Developments), the following trip generation rate is considered to be appropriate for the proposed development:

Self contained dwelling with on-site community facilities
2.5 trips per dwelling / day

Application of the above rate to the proposed development results in a trip generation estimate of 368 vehicle trips per day, and 37 vehicle trips per peak hour assuming a 10% peak hour factor. Peak hour traffic estimates are provided as follows:

Table 5.1: Development Traffic Generation Estimates

Component	Morning Peak Hour			Afternoon Peak Hour		
	In	Out	Total	In	Out	Total
Self contained unit lots (143 lots)	11	26	**37**	22	15	**37**

Peak Hour Distribution: Residential AM – 30/70, PM – 60/40

5.2 Trip Distribution

Based on the surveyed traffic volume data, it is estimated that traffic generated by the development will distribute as follows:

To / from the north via the Coast Road 45%
To / from the south via the Coast Road 55%

Resultant estimates of the development traffic volumes are shown in Figure 5.1

For the purposes of this assessment, it has been assumed that all traffic generated by the proposal will use the Coast Road to travel north and south.

Development traffic will re-distribute when North Creek Road is upgraded and the bridge constructed. At that time the majority of traffic travelling to and from Ballina will use North Creek Road rather than The Coast Road.

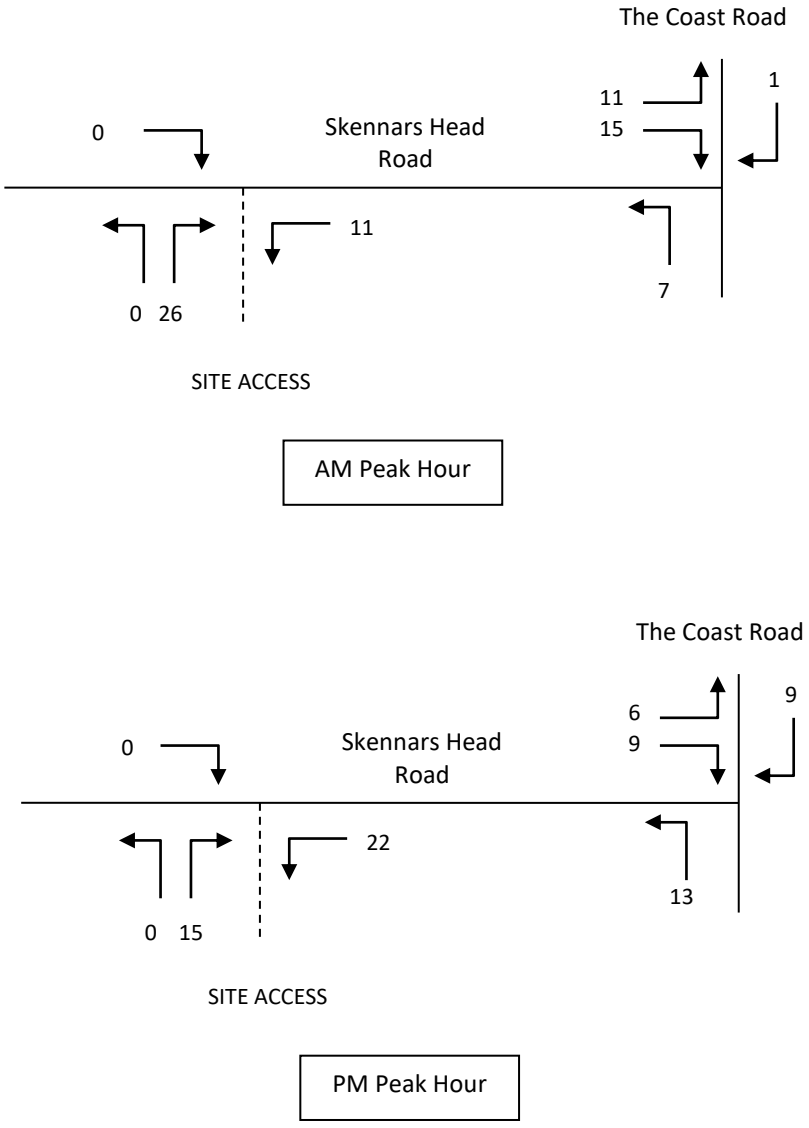


FIGURE 5.1 – DEVELOPMENT TRAFFIC ESTIMATES

5.3 The Coast Road / Skennars Head Road Intersection

SIDRA software has been used to assess the potential impact of the proposed development upon the operation of The Coast Road / Skennars Head Road roundabout under the 2017 and 2027 traffic conditions.

As previously discussed, it is expected that the North Creek Road connection will significantly reduce traffic volumes on The Coast Road. It is considered therefore that a relatively low traffic growth rate of 1% per annum is appropriate and this has been used to estimate future background traffic volumes.

Criteria for interpreting the results of the SIDRA analysis is presented in Appendix B.

SIDRA results are provided in Appendix C and summarised in Table 5.2. As shown, the modelling indicates that the existing roundabout layout will function satisfactorily even with development traffic included. This is consistent with the Ballina Shire Road Contributions Plan which states that the trunk roads in Skennars Head will not require upgrading prior to the year 2036.

Table 5.2: SIDRA Results (The Coast Road / Skennars Head Road Roundabout)

Scenario	Degree Of Saturation	Total Average Delay (seconds)	Queue Length (metres)
2017 AM Peak – with development	0.314	5.4	15.3
2017 PM Peak – with development	0.289	5.4	13.9
2028 AM Peak - with development	0.360	5.6	18.4
2028 PM Peak – with development	0.324	5.5	16.2

*Level of service for critical approach

It is noted that the intersection will provide an improved Level of Service when the North Creek Road connection is constructed.

6.0 INTERNAL ROAD LAYOUT

The geometric design of the internal road layout generally satisfies the requirements specified in the New South Wales – Development Design Specifications D1 (2013). It is proposed that a critical width of 5.5 metres be provided for all access streets, whereas a wider roadway will be provided for the primary spine road aligned between Skennars Head Road and the southern boundary.

It is proposed that a divided roadway be provided between the internal roundabout up to the exclusion zone. Such will restrict right turns to and from the lots directly adjacent to the higher order road. The divided roadway will taper into a standard single carriageway 6.5 metre wide local street which will provide primary connection to the to the lots located further within the site.

A 6 metre wide (sealed pavement) emergency access roadway is provided along the eastern boundary of the site. Such will also provide for some units which are proposed to be constructed as part of Stage 3.

An indicative sketch of the proposed internal road hierarchy is shown in Figure 6.1. As shown in Figures 6.2 – 6.4 a Heavy Rigid Vehicle (HRV) can satisfactorily negotiate the site and exit the development in a forward gear.

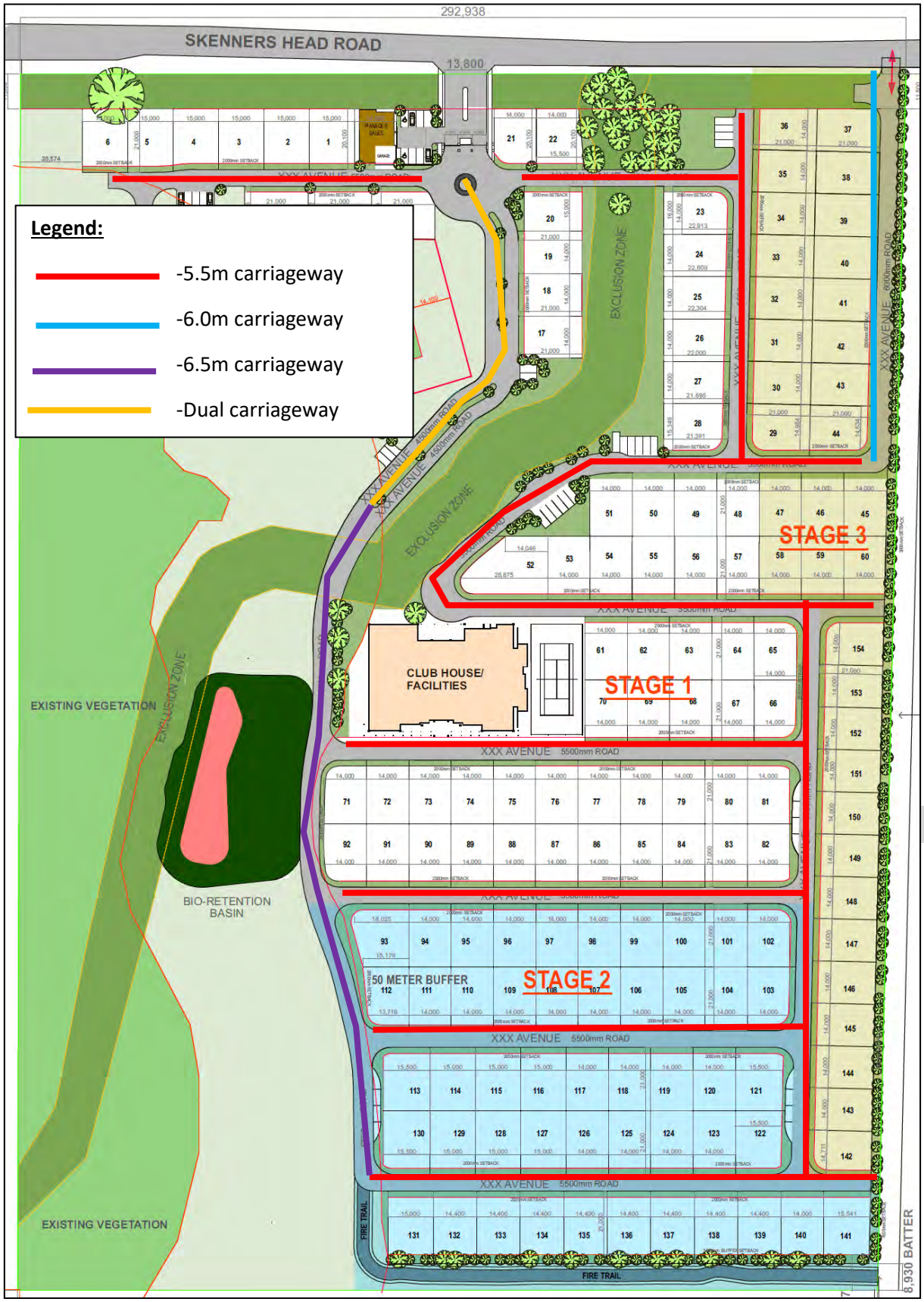


FIGURE 6.1 – INTERNAL ROAD NETWORK (OVERALL)

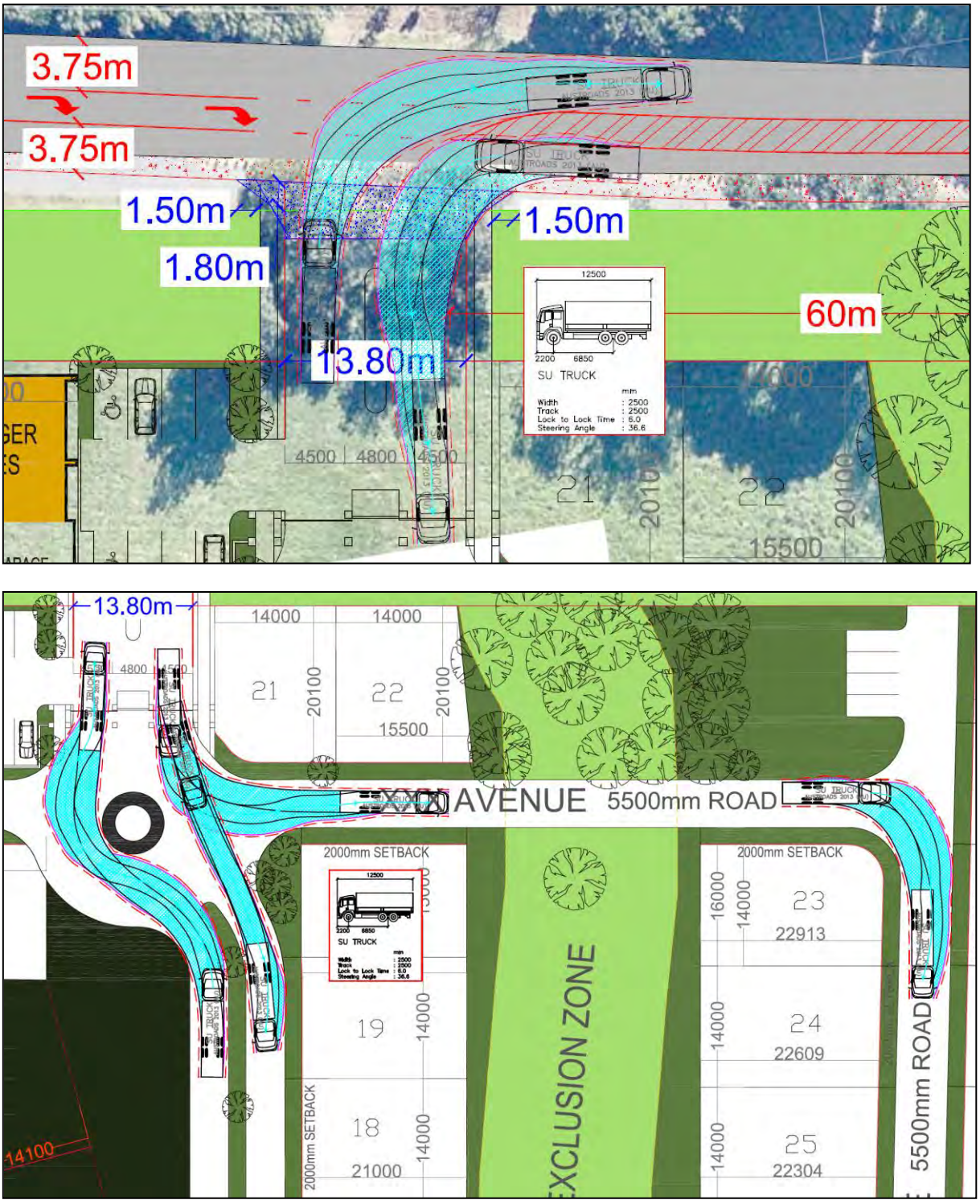


FIGURE 6.2 – HEAVY RIGID VEHICLE (12.5m) CIRCULATION

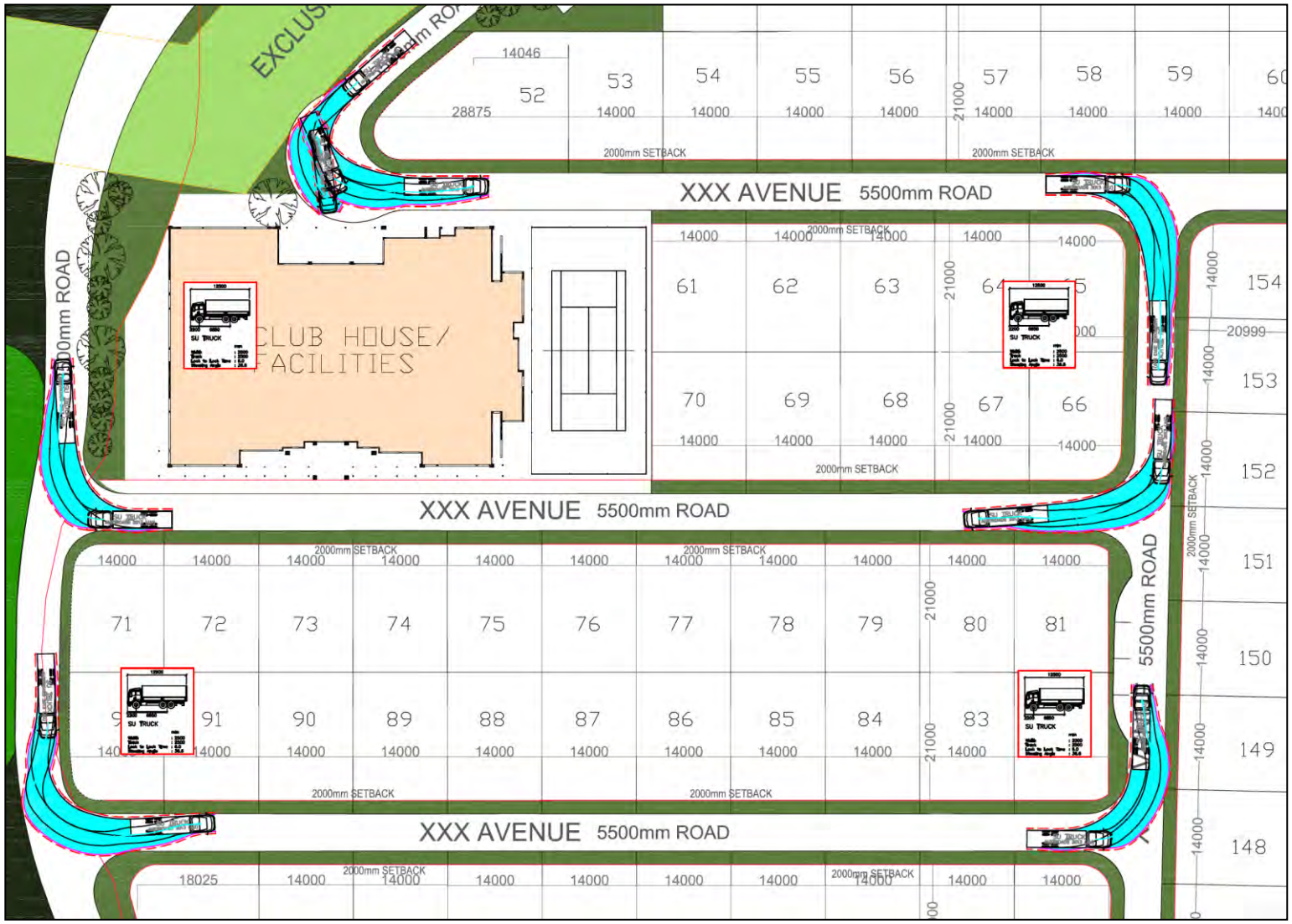


FIGURE 6.3 – HEAVY RIGID VEHICLE (12.5m) CIRCULATION

FIGURE 6.4 – HEAVY RIGID VEHICLE (12.5m) CIRCULATION

7.0 ACCESS INTERSECTION

It is considered that the Skennars Head Road carriageway will need to be widened so that it is consistent with the cross section just to the west at Henderson Drive (refer to section 3). This widened carriageway will allow eastbound vehicles to pass a vehicle propped to turn right into the site. Whilst this may not be critical under current conditions, a additonal volume of vehicles will turn right into the site when the North Creek Road route to Ballina is constructed.

It is considered that the southern side of Skennars Head Road should remain in its current position, with widening only occurring on the northern side, in accordance with the existing kerbline to the west. This is conceptually shown below in Figure 7.1.

There are no constraints at the proposed access intersection with respect to achieving a satisfactory level of sight distance in each direction.

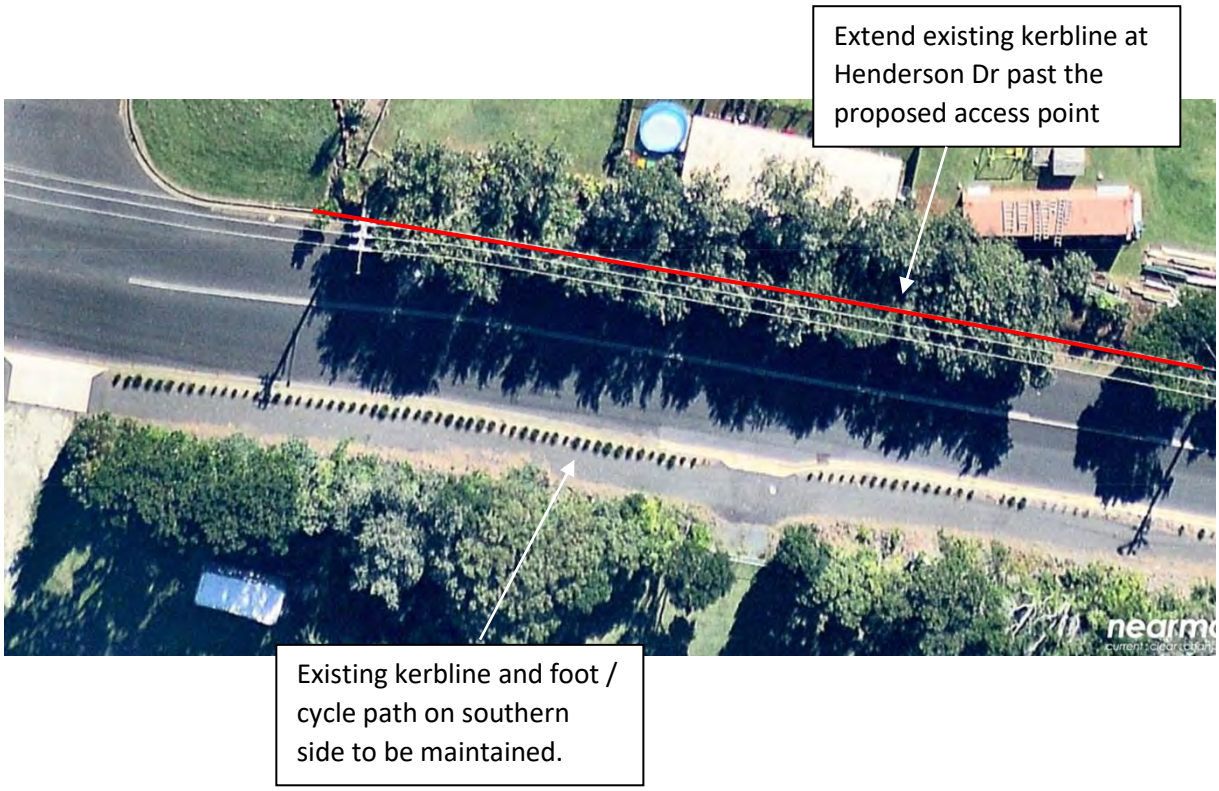


FIGURE 7.1 – RECOMMENDED EXTERNAL ROAD UPGRADE WORKS

A concept layout of the future right turn arrangement along Skennars Head Road has been provided with consideration of the Henderson Drive and the Sports Field access points. As shown in Figure 7.2, the proposed right turn arrangements can satisfactorily be accommodated along the frontage of the site.

As shown, a Type CHR(S) is proposed for the subject site. Whilst a basic right turn facility (Type BAR) is warranted under existing traffic and road network conditions, the proposed Type CHR(S) facility to cater for future conditions when the North Creek Road bridge is constructed.

The proposed short right turn to the proposed site also allows a Short Channelised Right Turn (CHR(S)) to be constructed for the Henderson Drive intersection to the west in accordance with Austroads Part 4A, for a design speed of 70 km . hr.

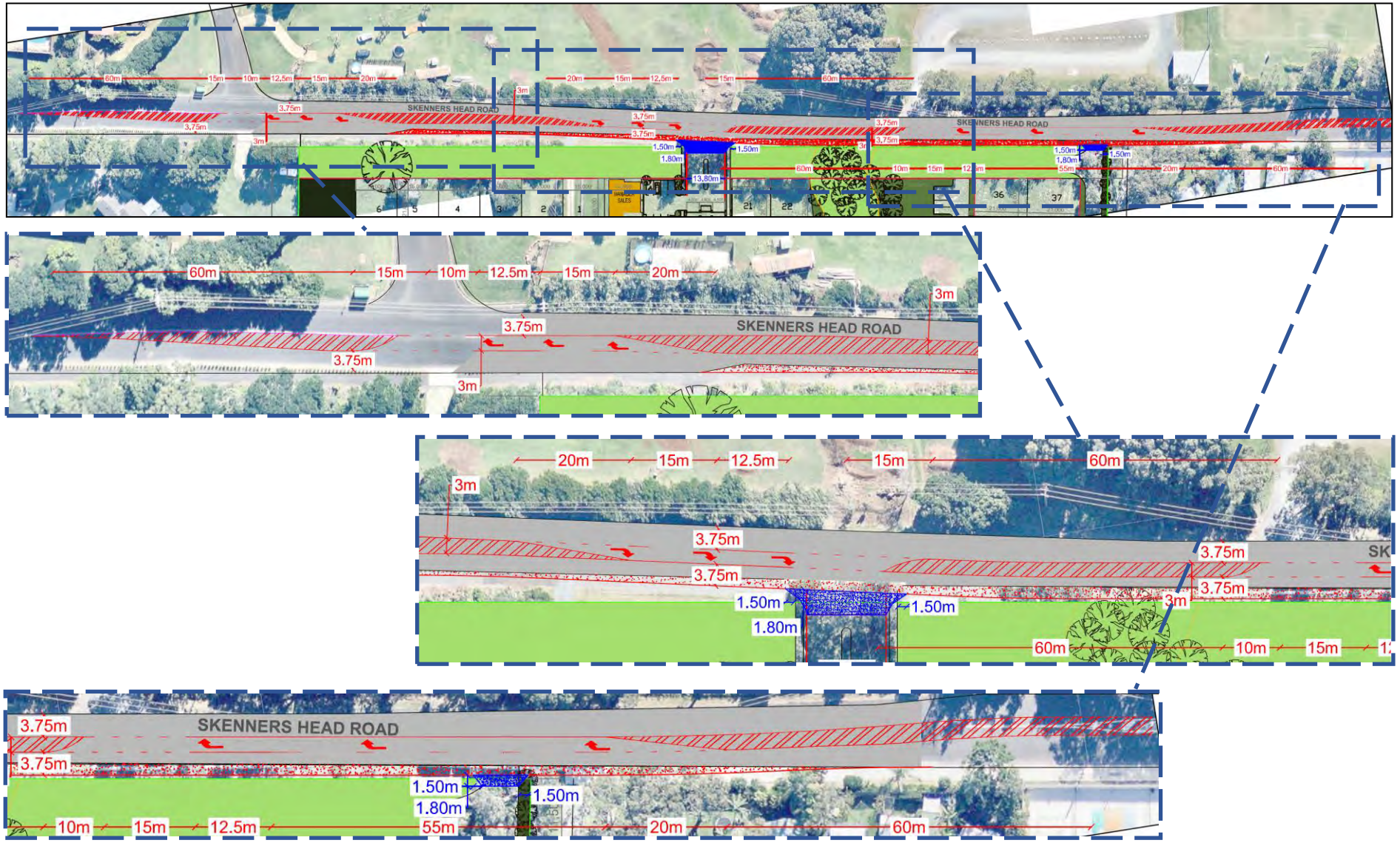


FIGURE 7.2 – SIGHT DISTANCE AVAILABLE AT ACCESS POINT

8.0 SUMMARY OF CONCLUSIONS & RECOMMENDATIONS

- The subject site has a total site area of approximately 12 hectares and has a 280 metre (approx.) frontage to Skennars Head Road. The site is located on the southern side of Skennars Head Road and approximately 600 metres west of The Coast Road / Skennars Head Road intersection.

- Skennars Head Road is a two lane rural road with a 60 Km / Hr posted speed limit. In the vicinity of the site, Skennars Head Road has a pavement width of approximately 9 metres and this widens to approximately 12 metres to the west. A combined foot / cycle path has recently been constructed along the frontage of the site.

- The Coast Road / Skennars Head Road intersection to the east is a priority controlled junction with Type CHL and CHR turn treatments. The Rocky Point Road intersection is located just to the south and also comprises of channelized turn treatments, however right turn movements from Rocky Point Road are not permitted.

- The proposed plan of development is for a Seniors Living development which will provide 147 units, including a single unit for an on-site manager. Access is proposed to be gained via a single point on Skennars Head Road located approximately 75 metres (centre line to centre line) east of the Henderson Road intersection.

- RTG carried out peak period traffic counts at the Skennars Head Road / The Coast Road intersection in June 2016. The counts indicate that Skennars Head Road carries in the order of 500 vehicles per hour just west of the Coast Road intersection.

- The Ballina Shire Road Contribution Plan includes the upgrade of North Creek Road and bridge construction, and also an upgrade of Hutley Road. These works will alleviate The Coast Road as it will provide an alternative route to Ballina. Council is planning to construct a channelised right turn lane at the Henderson Drive / Skennars Head Road intersection in the current financial year. Council has future planning for the construction of a roundabout at the Coast Road / Skennars Head Road intersection.

- It is estimated that the proposed development will generate in the order of 368 vehicle trips per day, and 37 vehicle trips per peak hour assuming a 10% peak hour factor. SIDRA analysis indicates that the existing intersection of The Coast Road and Skennars Head Road has sufficient capacity to accommodate background growth and the proposed development, even without the North Creek Road connection in place.

- The proposed internal road network is considered to be satisfactory and in accordance with relevant standards.

- It is proposed that a Type CHR(S) right turn lane be provided for traffic turning right into the development from Skennars Head Road. This will fit in for plans to construct a channelised right turn lane at the Henderson Drive intersection.

APPENDICES

APPENDIX A – LETTER FROM NSW RMS
APPENDIX B – SURVEYED PEAK PERIOD TRAFFIC COUNTS AT THE COAST RD / SKENNARS HEAD RD
APPENDIX C – CRITERIA FOR INTERPRETING RESULTS OF SIDRA ANALYSIS
APPENDIX D – DETAILED OF SIDRA OUTPUT (THE COAST RD / SKENNARS HEAD RD)

APPENDIX A – LETTER FROM NSW RMS

Transport
Roads & Maritime
Services

File No:NTH 16/00111
Your Ref: DA 2016/524 (JRPP)

General Manager
Ballina Shire Council
PO Box 450
Ballina NSW 2478

Attention: Anthony Peters

Dear Sir

DA 2016/524 Skennars Head Seniors Living Proposal

I refer to your letter of 7 October 2016 regarding the abovementioned development application referred to Roads and Maritime Services for comment.

Roles and Responsibilities

The key interests for Roads and Maritime are the safety and efficiency of the road network, traffic management, the integrity of infrastructure assets and the integration of land use and transport.

In accordance with Clause 104 of *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) Roads and Maritime is given the opportunity to comment on the application as it is considered a traffic generating development listed under Schedule 3.

Roads and Maritime Response

Roads and Maritime offers the following comments for consideration when assessing this proposal:

- The traffic assessment supporting the proposal is silent about the traffic impacts of access to Skennars Head Road. An assessment of capacity, sight distance and offset from adjacent intersections should be provided for consideration.
- Roads and Maritime understands there are currently plans to upgrade the intersection of Skennars Head Road and the Coast Road. The traffic impact assessment has not examined the traffic impact of the proposal in the context of these planned works.
- It is noted that traffic distributions are based on existing traffic movements and assign approximately 55 percent of development traffic to the north and 45 percent to the south. This distribution is true only for the pm movement out of Skennars Head Road. The major commercial and business activity likely to attract trips to and from the development are located at Ballina to the south. It is anticipated that development traffic assignment is likely to be higher towards the south than the north. The traffic assignment used in the current assessment has the effect of underestimating right turn delay for development traffic from Skennars Head Road.

Roads and Maritime Services

76 Victoria Street, Grafton NSW 2460 |
PO Box 576, Grafton NSW 2460 |

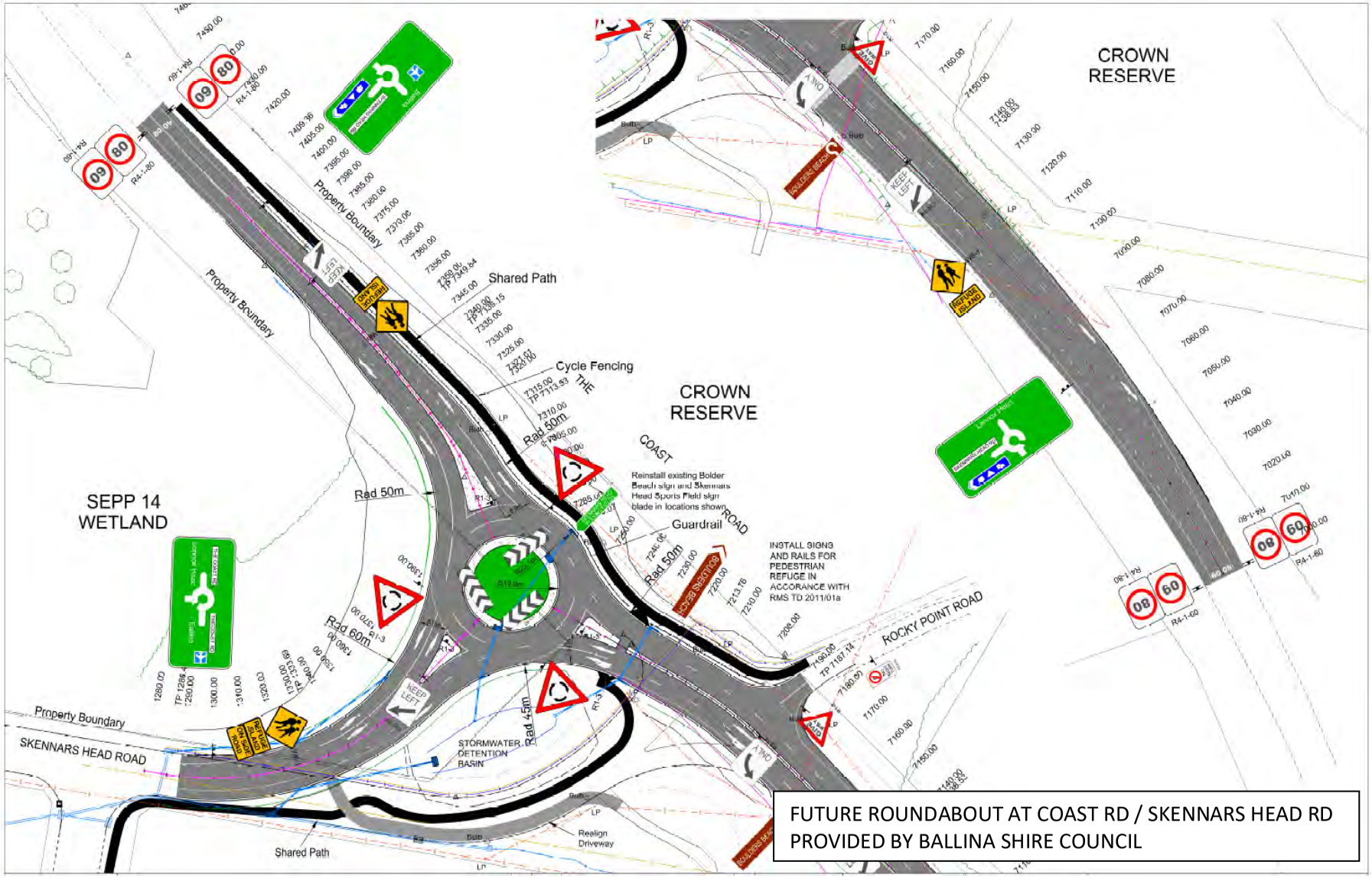
www.rms.nsw.gov.au | 13 22 13

- In 2009 Roads and Maritime commissioned trip generation and parking generation surveys for housing for seniors. On-site parking at the five non-metropolitan sites surveyed varied from 0.12 to 0.38 per residence. From the drawings it is estimated the rate of visitor parking proposed for the Skennars Head seniors living is 0.14. This rate is at the lower end when compared to sites surveyed in 2009.

Upon determination of the application it would be appreciated if Council could forward a copy of the Consent Conditions to Roads and Maritime for our records. If you require further information please contact Land Use Manager Liz Smith on 66401362 or email Development.Northern@rms.nsw.gov.au.

Yours faithfully

4 November 2016
for Monica Sirol
Network and Safety Manager, Northern Region



FUTURE ROUNDABOUT AT COAST RD / SKENNARS HEAD RD
PROVIDED BY BALLINA SHIRE COUNCIL

APPENDIX B – SURVEYED PEAK PERIOD TRAFFIC COUNTS

MANUAL TRAFFIC COUNT

Location: Skennars Head Road / The Coast Road / Rocky Point Roa
Start Date: Monday 27th June, 2016

MORNING PEAK PERIOD

Time	SB Left	SB Thru	SB Right	NB Left	NB Thru	NB Right	WB Left	WB Thru	WB Right	EB Left	EB Thru	EB Right	Total	Cumul Total
06/27/16 7:00	2	75	12	17	75	1	2	0	0	7	0	15	206	
06/27/16 7:15	1	71	11	14	77	0	2	0	0	12	0	12	200	
06/27/16 7:30	4	83	10	18	82	1	1	0	0	10	1	14	224	
06/27/16 7:45	2	87	21	21	91	1	3	0	0	11	1	21	259	889
06/27/16 8:00	2	95	25	24	107	0	3	0	0	17	1	23	297	980
06/27/16 8:15	2	107	22	20	98	1	2	1	0	21	0	22	296	1076
06/27/16 8:30	1	112	27	31	102	2	2	0	0	20	1	26	324	1176
06/27/16 8:45	0	101	31	41	95	1	3	0	0	18	0	23	313	1230
06/27/16 9:00	1	91	30	32	91	2	2	0	0	19	0	19	287	1220
06/27/16 9:15	0	87	26	36	87	1	1	1	0	21	0	18	278	1202
06/27/16 9:30	1	92	22	32	79	2	2	0	0	19	1	15	265	1143
06/27/16 9:45	1	95	24	42	72	1	2	0	0	13	0	16	266	1096
06/27/16 10:00	2	88	18	33	75	0	0	0	0	14	0	13	243	1052
06/27/16 10:15	1	86	21	41	69	1	1	0	0	11	0	14	245	1019
AM Peak Hour	5	415	105	116	402	4	10	1	0	76	2	94		

AFTERNOON PEAK PERIOD

Time	SB Left	SB Thru	SB Right	NB Left	NB Thru	NB Right	WB Left	WB Thru	WB Right	EB Left	EB Thru	EB Right	Total	Cuml Total
06/27/16 14:00	2	67	7	25	92	0	1	0	0	5	1	17	217	
06/27/16 14:15	2	74	3	25	74	2	6	0	0	3	1	10	200	
06/27/16 14:30	6	82	6	26	85	2	3	1	0	11	1	27	250	
06/27/16 14:45	0	83	33	22	102	1	4	0	4	10	0	17	276	943
06/27/16 15:00	1	89	19	20	109	2	3	0	0	33	0	18	294	1020
06/27/16 15:15	0	85	21	19	96	2	2	0	1	44	0	28	298	1118
06/27/16 15:30	1	99	21	40	114	1	3	1	0	24	0	25	329	1197
06/27/16 15:45	0	105	28	42	117	3	1	0	0	13	0	19	328	1249
06/27/16 16:00	0	107	13	30	97	2	1	0	1	16	1	19	287	1242
06/27/16 16:15	0	92	31	39	95	2	1	2	1	24	0	17	304	1248
06/27/16 16:30	2	61	14	30	100	2	3	0	0	18	0	9	239	1158
06/27/16 16:45	0	71	14	53	125	0	5	0	0	10	0	12	290	1120
06/27/16 17:00	0	47	10	36	101	1	1	0	0	10	0	15	221	1054
06/27/16 17:15	1	80	24	54	90	0	1	0	0	10	0	14	274	1024
PM Peak Hour	2	378	89	121	436	8	9	1	1	114	0	90		

APPENDIX C – CRITERIA FOR INTERPRETING RESULTS OF SIDRA ANALYSIS

1. Level of Service (LOS)

LOS	Traffic Signals and Roundabouts	Give Way and Stop Signs
'A'	Good operation.	Good operation.
'B'	Good with acceptable delays and spare capacity.	Acceptable delays and spare capacity.
'C'	Satisfactory.	Satisfactory but accident study required.
'D'	Operating near capacity.	Near capacity and accident study required.
'E'	At capacity; at signals incidents will cause excessive delays. Roundabouts require other control mode.	At capacity and requires other control mode.
'F'	Unsatisfactory and requires additional capacity.	Unsatisfactory and requires other control mode.

2. Average Vehicle Delay (AVD)

The AVD provides a measure of the operational performance of an intersection as indicated on the table below which relates AVD to LOS. The AVD's listed in the table should be taken as a guide only as longer delays could be tolerated in some locations (i.e. inner city conditions) and on some roads (i.e. minor side street intersecting with a major arterial route).

Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way and Stop Signs
A	less than 14	Good operation.	Good operation.
B	15 to 28	Good with acceptable delays and spare capacity.	Acceptable delays and spare capacity.
C	29 to 42	Satisfactory.	Satisfactory but accident study required.
D	43 to 56	Operating near capacity.	Near capacity and accident study required.
E	57 to 70	At capacity; at signals incidents will cause excessive delays. Roundabouts require other control mode.	At capacity and requires other control mode.

3. Degree of Saturation (DS)

The DS is another measure of the operational performance of individual intersections.

For intersections controlled by **traffic signals**[1] both queue length and delay increase rapidly as DS approaches 1, and it is usual to attempt to keep DS to less than 0.9. Values of DS in the order of 0.7 generally represent satisfactory intersection operation. When DS exceeds 0.9 queues can be anticipated.

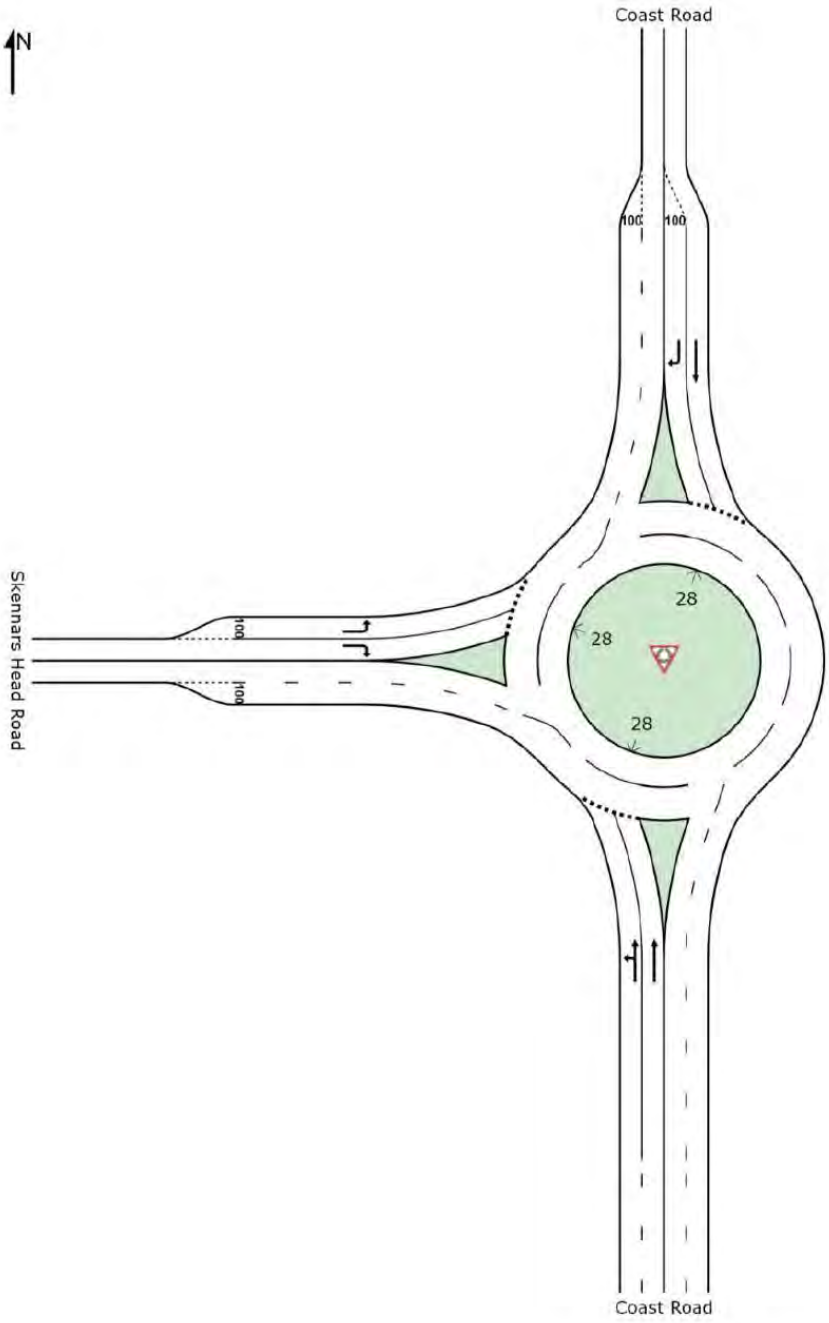
For intersections controlled by a **roundabout or GIVE WAY or STOP signs**, satisfactory intersection operation is indicated by a DS of 0.8 or less.

[1] *The values of DS for intersections under traffic signal control are only valid for cycle length of 120 secs.*

APPENDIX D – SIDRA RESULTS

The Coast Road / Skennars Head Road roundabout

- 2017 AM peak hour, with proposed development
- 2017 PM peak hour, with proposed development
- 2028 AM peak hour, with proposed development
- 2028 PM peak hour, with proposed development



2017 with proposed development

MOVEMENT SUMMARY

Site: 2017 AM Peak - with dev (Coast Rd - Skennars Head Rd) - Roundabout

2016 AM peak hour without development
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Coast Road											
1	L2	132	5.0	0.180	4.4	LOS A	1.0	7.1	0.31	0.45	54.9
2	T1	427	5.0	0.256	4.3	LOS A	1.5	11.2	0.31	0.42	56.5
Approach		559	5.0	0.256	4.3	LOS A	1.5	11.2	0.31	0.42	56.1
North: Coast Road											
8	T1	441	5.0	0.314	4.2	LOS A	2.1	15.3	0.33	0.41	56.3
9	R2	117	5.0	0.133	10.1	LOS B	0.7	5.1	0.33	0.62	52.8
Approach		558	5.0	0.314	5.5	LOS A	2.1	15.3	0.33	0.45	55.5
West: Skennars Head Road											
10	L2	96	5.0	0.100	5.6	LOS A	0.5	3.5	0.50	0.60	54.3
12	R2	106	5.0	0.098	10.8	LOS B	0.5	3.5	0.49	0.69	52.2
Approach		202	5.0	0.100	8.3	LOS A	0.5	3.5	0.50	0.64	53.2
All Vehicles		1319	5.0	0.314	5.4	LOS A	2.1	15.3	0.35	0.47	55.4

MOVEMENT SUMMARY

Site: 2017 PM Peak - with dev (Coast Rd - Skennars Head Rd) - Roundabout

2016 PM peak hour without development
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Coast Road											
1	L2	144	5.0	0.195	4.3	LOS A	1.1	7.9	0.30	0.44	54.9
2	T1	472	5.0	0.278	4.2	LOS A	1.7	12.5	0.30	0.41	56.5
Approach		616	5.0	0.278	4.2	LOS A	1.7	12.5	0.30	0.42	56.1
North: Coast Road											
8	T1	404	5.0	0.289	4.2	LOS A	1.9	13.9	0.32	0.40	56.4
9	R2	106	5.0	0.121	10.1	LOS B	0.6	4.6	0.33	0.61	52.8
Approach		511	5.0	0.289	5.4	LOS A	1.9	13.9	0.32	0.45	55.6
West: Skennars Head Road											
10	L2	129	5.0	0.123	5.5	LOS A	0.6	4.4	0.52	0.61	54.3
12	R2	105	5.0	0.116	11.3	LOS B	0.6	4.0	0.53	0.72	52.1
Approach		235	5.0	0.123	8.1	LOS A	0.6	4.4	0.52	0.66	53.2
All Vehicles		1361	5.0	0.289	5.4	LOS A	1.9	13.9	0.35	0.47	55.4

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

2028 with proposed development

MOVEMENT SUMMARY

Site: 2028 AM Peak - with dev (Coast Rd - Skennars Head Rd) - Roundabout

2016 AM peak hour without development
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Coast Road											
1	L2	146	5.0	0.203	4.5	LOS A	1.1	8.3	0.34	0.46	54.8
2	T1	477	5.0	0.289	4.4	LOS A	1.8	13.2	0.34	0.43	56.3
Approach		623	5.0	0.289	4.4	LOS A	1.8	13.2	0.34	0.44	55.9
North: Coast Road											
8	T1	493	5.0	0.360	4.4	LOS A	2.5	18.4	0.38	0.43	56.0
9	R2	129	5.0	0.152	10.3	LOS B	0.8	5.9	0.37	0.63	52.6
Approach		622	5.0	0.360	5.6	LOS A	2.5	18.4	0.38	0.47	55.3
West: Skennars Head Road											
10	L2	105	5.0	0.117	5.9	LOS A	0.6	4.1	0.54	0.63	54.2
12	R2	128	5.0	0.123	11.0	LOS B	0.6	4.5	0.52	0.71	52.1
Approach		234	5.0	0.123	8.7	LOS A	0.6	4.5	0.53	0.67	53.0
All Vehicles		1479	5.0	0.360	5.6	LOS A	2.5	18.4	0.39	0.49	55.2

MOVEMENT SUMMARY

Site: 2028 PM Peak - with dev (Coast Rd - Skennars Head Rd) - Roundabout

2016 PM peak hour without development
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Coast Road											
1	L2	159	5.0	0.216	4.4	LOS A	1.2	8.9	0.33	0.45	54.8
2	T1	517	5.0	0.308	4.3	LOS A	2.0	14.3	0.33	0.42	56.4
Approach		676	5.0	0.308	4.3	LOS A	2.0	14.3	0.33	0.43	56.0
North: Coast Road											
8	T1	448	5.0	0.324	4.3	LOS A	2.2	16.2	0.35	0.42	56.2
9	R2	117	5.0	0.136	10.2	LOS B	0.7	5.2	0.35	0.62	52.7
Approach		565	5.0	0.324	5.5	LOS A	2.2	16.2	0.35	0.46	55.4
West: Skennars Head Road											
10	L2	143	5.0	0.140	5.7	LOS A	0.7	5.1	0.54	0.63	54.2
12	R2	116	5.0	0.132	11.6	LOS B	0.6	4.7	0.56	0.74	52.0
Approach		259	5.0	0.140	8.3	LOS A	0.7	5.1	0.55	0.68	53.1
All Vehicles		1500	5.0	0.324	5.5	LOS A	2.2	16.2	0.38	0.48	55.3

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

TECHNICAL REPORT 5

Geotechnical Assessment

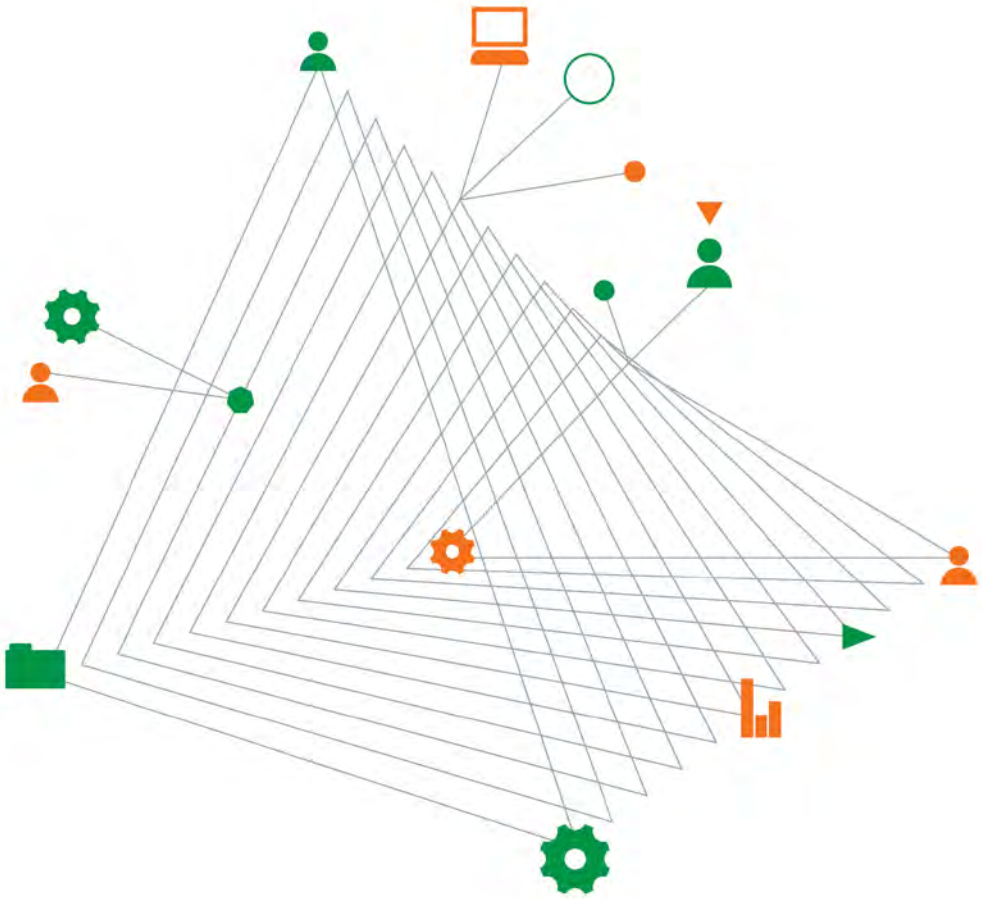
coffey
A TETRA TECH COMPANY

Living Gems Pty Ltd

Geotechnical, Acid Sulfate Soil and Phase 1 Environmental Site Assessments

Seniors Living Development, Skennars Head

11 August 2016



Experience comes to life when it is powered by expertise

Geotechnical, Acid Sulfate Soil and Phase 1 Environmental Site Assessments

Seniors Living Development, Skennars Head

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11 August 2016

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For and on behalf of Coffey

Rian Vleggaar
Senior Geotechnical Engineer

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Appendices

1. Introduction

Coffey Geotechnics Pty Ltd (Coffey) has conducted a Geotechnical, Acid Sulfate Soil and Phase 1 Environmental Site Assessment at Lot 239 DP1201225, located at 67 Skennars Head Road, Skennars Head.

The investigations were commissioned by Planners North on behalf of Living Gems Pty Ltd on 6 June 2016, and the work was undertaken in general accordance with our proposal GEOTALST03696AA-AA dated 5 May 2016. The work was carried out under Coffey's standard consultancy agreement per the proposal.

This report is provided to document the investigations and the outcomes of the assessments. The required assessments were:

- Whether the proposed fill of about 1m to raise the site level for increased flood protection will be adversely affected by the subsurface materials.
- Whether there is the potential for site contamination (a Phase 1 Environmental Site Assessment (ESA)).
- Whether actual or potential acid sulfate soils are present.

2. Site Description and Proposed Development

An annotated aerial image of the site is shown in Figure 1, along with borehole locations and the property boundary. The site area is about 11.6 hectares.

The site had been used for primary production (grazing purposes) with records of this use since the early 19th century being available. The site is zoned part RU1 Primary Production under the Ballina Local Environmental Plan (2012).

A residential dwelling is present at the north-west of the property on elevated terrain.

The remainder of the property is primarily pasture on low-lying land, however the ground along the western margin and south-western area was particularly wet and waterlogged. To the west of the property and along the western boundary, an Environmental Protection zone (SEPP 14) coastal wetland is present.

Multiple natural and man-made drainage lines are visible on Figure 1. Flow is generally towards the south at the north of the property and west otherwise, towards the wetlands to the west.

The proposed development includes roads and other civil infrastructure, and multiple aged care free-standing dwellings constructed on small (<250m^2) allotments. The footprint of development is understood to be approximately in the eastern two-thirds of the property. The approximate boundary of the development footprint is shown on Figure 1.

We understand that about 1m of site filling is proposed in the low lying areas to raise the site to above flood levels.

3. Geotechnical Investigation

The geotechnical investigation and sampling for the Acid Sulfate Soil (ASS) assessment was carried out using eight borehole locations designated BH1 to BH8 as shown on Figure 1. BH1 and BH2 were carried out as deep (10m) boreholes and the remainder of the boreholes were carried out to a depth of 2.5m.

The locations were selected based on the site observations, topography, proposed development area, and constraints including difficult access over waterlogged soils, the presence of the water main across the site, and potential populations of hairy joint grass that were not to be disturbed.

The investigations were carried out on the 27th to 29th of June 2016. A geotechnical professional from Coffey was present during the investigations to direct the investigation crews, equipment and sampling, and to carry out site observations.

Engineering logs were prepared during the drilling of the boreholes and are included in Appendix A. Geotechnical sampling included:

- Standard Penetration Test (SPT) samples were collected at 0.5m intervals in all of the boreholes to a depth of 2.5m, and Acid Sulfate Soil samples were sub-sampled from these SPT samples.
- SPT samples were collected at 1.5m intervals below 2.5m depth in BH1 and BH2.

4. Geotechnical Assessment

4.1. Geological Model

The 1:25,000 inset map for Ballina, within the Coastal Quaternary Geology Map of NSW 1:100,000 sheet for Lismore indicates that the surface geology of the site comprises:

- Residual soil from the Lismore Basalt formation at the elevated terrain at the north-west of the site.
- Pleistocene back-barrier flat deposits of marine sand, indurated sand, clay, silt gravel, organic mud and peat, across the low-lying area of the site.
- Holocene saline swamp deposits of organic mud, peat, clay, silt, marine sand, fluvial sand are expressed at the surface along the western margin of the site.

A geotechnical model has been prepared on the basis of the borehole investigations. The geotechnical model is summarised in Table 4-1.

The site is underlain by deep (more than 10m) sedimentary material of Quaternary age. Various layers have been identified using the borehole data. These layers have been assigned to Units in Table 4-1 on the basis of behaviour types and material classifications. Further details for each borehole are provided on the borehole logs in Appendix A.

Figure 2 has been prepared to show an interpretation of the section from the south of the site to the north of the site across the lower lying terrain, underlying the proposed development. The location of the section line is shown in Figure 1. The section line was taken wholly within the area where sedimentary material is exposed at ground level, and does not include the rise in topography underlain by residual soils at the north-west of the site. The inferred boundaries may change if more deep investigations are carried out to provide infill information between BH1 and BH2.

Groundwater levels were observed to be between about 1m and 2m below ground level.

The presence of soft soils (Unit 5) are considered rare for Pleistocene age deposits. We therefore infer that the sand deposits (Units 2, 3 and 4) overlying the soft soils may therefore be a relatively recent (rather than Pleistocene) incursion of alluvial or windblown sand, with a low level of induration, covering the soft soil associated with estuarine conditions present during the early Holocene sea level rise.

Table 4-1: Geological Model – Depth to Base of Unit, metres below ground level

Unit	BH1	BH2	BH3	BH4	BH5	BH6	BH7	BH8
Unit 1 – Organic Silt	0.2	0.5	0.5	0.2	0.5	0.2	1.0	--
Unit 2 – Loose to dense sand	1.0	1.0	--	1.0	1.0	1.0	1.5	1.5
Unit 3 – Very dense indurated sand	3.0	2.0	--	2.0	2.0	> 2.5	> 2.5	> 2.5
Unit 4 – Loose to medium dense sand	-	4.5	--	> 2.5	> 2.5	--	--	--
Unit 5a – Very soft estuarine clay, with large fraction sand at BH1	4.5	7.5	--	--	--	--	--	--
Unit 5b – Firm to stiff estuarine clay	--	9.0	--	--	--	--	--	--
Unit 5c – Loose gravelly marine sand	--	> 10.0	--	--	--	--	--	--
Unit 6 – Stiff alluvial clay	7.5	--	--	--	--	--	--	--
Unit 7 – Medium dense sand	9.0	--	--	--	--	--	--	--
Unit 8 – Stiff alluvial clay	> 10.0	--	--	--	--	--	--	--
Unit 9 – Stiff to very stiff residual clay	--	--	> 2.5	--	--	--	--	--

Note to Table: '—' indicates that the unit was not encountered in that borehole.

4.2. Geotechnical Laboratory Test Results

A summary of the laboratory test results is provided in Table 4-2. The test results are included in Appendix B.

Table 4-2: Summary of Laboratory Test Results

Sample	Unit	FMC[1]	PI[2]	LS%[3]	% Clay[4] and Silt	% Sand	% Gravel
BH1 3.5 – 3.95m	5a	45%	15%	7.5%	23%	76%	1%
BH2 5 – 5.45m	5a	76%	39%	13%	-	-	-
BH2 6.5 – 6.95m	5a	82%	41%	17%	-	-	-
BH2 8 – 8.45m	5b	30%	16%	8%	29%	67%	4%

A '-' symbol indicates the relevant measurement was not considered for that sample.

5. Filling Assessment

5.1. Potential for Settlement at Low-lying Areas

5.1.1. Potential magnitude of settlements

The application of 1m of controlled fill is expected to apply a long-term load of about 22 kPa. Light residential construction is expected to apply a further maximum of 5 kPa across the development footprint.

The observed profiles at BH1 and BH2 for the low-lying terrain are considered to be susceptible to primary consolidation settlement due to the presence of soft soils. The elevated terrain as shown on Figure 1, with the profile per BH3 is not considered susceptible to primary consolidation settlement.

The potential primary consolidation settlement at BH1 and BH2 has been estimated to be in the order of 60mm and 110mm respectively for an applied surcharge of 27 kPa. This primary consolidation settlement may occur over a timeframe of about 2 years at BH1 and 4 years at BH2.

Secondary 'creep' settlements are also likely to occur, in the order of 25mm for BH1 and 35mm for BH2 estimated at 50 years following completion of the filling.

Monitoring of the ground settlement during filling is considered essential to verify the actual ground behaviour and confirm settlement has ceased. More detailed investigation, testing and analysis would

[1] Field Moisture Content
[2] Plasticity Index
[3] Linear Shrinkage
[4] Proportions are by mass

be required to refine these preliminary estimates and these estimates are to be considered approximate only.

Potential measures to decrease the magnitude and the time of settlement experienced by the permanent structures on the site could include the use of a drainage blanket and bridging layer combination, with deep wick drains to drain expelled moisture from the soft clay, combined with temporary surcharge earthworks. Installation of wick drains through the dense sands may however be difficult, and this aspect will require more detailed consideration.

Depositional environments may be complex. Deeper palaeochannels, now infilled with soft soil, may be present between investigation locations. Variation in the soft soil deposit thickness may also be possible away from the investigation locations. Variability in the subsurface material distributions could be managed by undertaking more specialised infill testing using piezocone equipment at closer spacing than the initial two deep boreholes undertaken for this project. Such investigations are recommended to aid in the assessment of settlements with more detail and to assess feasibility of potential ground treatments to manage settlement.

'Topping up' of fill in areas with different settlements as a result of variation within the ground profile may be required following the completion of the primary consolidation settlement.

Services connections between the perimeter of the works and those areas of the development where the above settlements are likely will need to be designed to tolerate these settlements if installed prior to the completion of settlement.

Differential settlements within the extent of filling will depend on the variability of the soft soil deposits and load layout. Again, infill testing would be required to assess this variability further.

It is possible that the presence of the very dense sand in the upper layers of the site may moderate the amount of settlement experienced. The very dense sand may act firstly to bridge any loadings from the surface which may alter the load distribution experienced by the soft soil layers favourably. The degree of moderation of the settlement will require further investigations, testing and detailed analysis to be estimated.

5.1.2. Effect of Settlements on the Existing Water Main

The expected settlements due to consolidation are likely to be of concern for the council water main that is located across the property (Refer Section 7.2.1).

It is not expected that the main could tolerate the induced settlements (however Council engineers may be able to provide more information in this regard) and therefore measures to limit settlement along the water main should be considered. Such measures could include not filling within 5m of the main across the low lying area, or providing a bridging layer or structure over the pipeline to avoid settlement affecting the pipeline. The latter would require further geotechnical assessment, assessment and design, including deeper investigations than undertaken for this project along the length of the pipeline.

Relocation of the main to outside of the footprint of the proposed infilling on the low-lying terrain may also be a viable option however an economic analysis would be required to assess the feasibility of the realignment compared to the protection of the existing pipeline.

5.2. Site preparation

Prior to filling, vegetation should be stripped from the ground surface. Typically unsuitable soil (e.g. Unit 1 soft organic soil or otherwise identified on site) would be recommended to be stripped to provide a good foundation to fill and control settlements. However, as the expected settlements are relatively large and the deeper soft soil is the primary source of the large settlement, such stripping to

control settlements will have a lesser effect on the reduction of settlement at this site. If the material is left in place, a further 20mm should be added to the settlement estimates of the site. Furthermore treatment of the soils may be required to improve acid soil. Leaving these soils in place will therefore have the benefit of reducing the treatment and disposal costs however increased settlement and trafficability issues should be expected.

Trafficking of the site by construction equipment will be difficult. Access tracks using gravel are expected to be required to allow access onto the site. It may be necessary to conduct large scale stripping of vegetation and filling from a 'beach head' from the perimeter of the site, working inwards to the middle of the site to provide a platform for equipment to work from.

The use of geofabric is recommended as site improvement beneath the fill. The geofabric will have the benefit of providing some measure of basal reinforcement and prevention of mixing of fine soil with overlying gravel material. Non-woven geofabric (e.g. Bidim A34 or similar) is recommended if sand fill is used. Heavier grades may be appropriate if cobble or rockfill is used and Coffey should be consulted if this will be the case. Geofabric should be placed between layers of dissimilar properties as a separation and filtration mechanism.

It is envisaged that the existing drainage channels to be covered in fill would require a culvert drainage system to be provided. The foundation of such pipelines should be prepared by removing soft, compressible or other deleterious materials to achieve a sound base on the Unit 2 sand materials. We caution that the deleterious soft material may be thicker in the existing drainage channels than encountered at the boreholes, and groundwater may be intersected when preparing the foundations. Bridging layers using angular rock cobble, wrapped in suitable geofabric may be required to prepare foundations to headwalls and/or pipelines.

The site would likely be filled using relatively permeable materials. The prepared surface would include low permeability soils. In order to reduce the potential for pooling of infiltrated water under the imported fill, and subsequent softening of the low permeability surface soils and settlement, the prepared surface prior to filling should be shaped to be water-shedding.

5.3. Fill Materials, Work Methods and Specification

The use of granular fill such as sand or gravel is recommended to achieve a platform that will be less sensitive seasonal moisture changes. Clean sand (Unified Soil Classification System (USCS) type SP) or gravel (GC, GW, GM, GP) may be used. The proportion of fines (clay and silt) should be limited to less than 25% for these materials. If materials with a greater proportion of fines are used, for example clay fill or gravelly clay, the site reactivity will be increased (Refer Section 5.4).

The fill should be placed as controlled fill according to the guidelines of AS3798-2007 – *Guidelines for Earthworks for Commercial and Residential Developments*. Fill beneath structures (e.g. footings, dwellings, substations, tanks, culverts, etc) should be placed as Level 1 controlled fill, while fill beneath roads and/or away from structures may be placed as Level 2 controlled fill.

Fill should be placed to a placement density of 95% Standard Maximum Dry Density (SMDD) and within 2% of the Optimum Moisture Content (OMC), or 70% Density Index for granular materials. If there are zones within the development that are earmarked for commercial purposes (e.g. shops), or the development may in future include commercial facilities, then the compaction ratios should be increased to 98% SMDD or 75% DI at those locations.

AS3798-2007 provides guidance on density tests frequencies.

If more than 20% of the fill material is larger than 39.5mm, then a method specification will need to be developed as a quality control measure in lieu of density ratio tests.

Compaction equipment must be selected appropriate for the layer thickness adopted. The compacted lift thickness should be greater than 1.5 times the largest particle size in the layer being compacted.

5.4. Effect of Fill on Site Reactivity

5.4.1. Current Low-Lying Areas

If non-reactive fill is used (e.g. SP, GP, GW) for the 1m of controlled filling, with less than 12% fines, then the filled site's reactivity is expected to be relatively low in response to seasonal ground moisture changes. Using controlled fill, the site reactivity may then be considered to be that of a Class A site based on the guidelines of AS2870-2011: *Residential Slabs and Footings* and provided that successful Level 1 certification can be achieved.

If material containing more than 12% fines was used, then the reactivity of the site will increase. Table 5-1 has been prepared showing the potential impact on the site reactivity if using controlled fill containing fines.

Table 5-1: Effect on Site Reactivity using Material containing High Plasticity Fines

Reactivity of Fill Material expressed as the Shrink-Swell Index (I_{ss})	Calculated Reactivity due to Seasonal Moisture Changes (1m thick fill)	
	Initial 5 years	After 5 years
I_{ss} = 1%	20mm	15mm
I_{ss} = 3%	65mm	35mm
I_{ss} = 5%	110mm	65mm

5.4.2. Current Elevated Terrain

The current elevated terrain is underlain by high plasticity residual clay soil and we understand filling would not be used in this area. Based on our experience in similar soils in the region, for preliminary planning purposes the reactivity of the ground profile on the elevated terrain would be in the order of Class M or H1 based on AS2870-2011. The more adverse classification is recommended to be used until more detailed studies are carried out.

5.4.3. Foundations in Controlled Fill

Per Section 5.2, if organic soil is left in-situ prior to controlled filling, the presence of this material will affect allowable bearing capacities for footings within the relatively thin controlled fill planned to be about 1m. Footings should not be placed more than 400mm below the finished surface level of the controlled fill where the fill is at least 1m thick, and should then be designed on the basis of 50 kPa allowable bearing pressure. If a clear distance of 2 footing widths for square pad footings or 4 footing widths for strip footings is provided between the underside of the footing and the base of the controlled fill, then the footings may be designed for 100 kPa allowable bearing pressure.

6. Acid Sulfate Soil Assessment

6.1. Definition of Coastal Acid Sulfate Soils

Coastal Acid Sulfate Soils (ASS) are soils containing significant concentrations of pyrite, which when exposed to oxygen in the presence of sufficient moisture, oxidises, resulting in the generation of sulfuric acid. Unoxidised pyritic soils are referred to as **Potential** ASS (PASS). When the soils are exposed, the oxidation of pyrite occurs and sulfuric acids are generated, at which stage the soils are said to be **Actual** ASS (AASS).

Pyritic soils typically form as waterlogged, saline sediments rich in iron and sulfate. Typical coastal environments leading to the formation of these soils include tidal flats, salt marshes and mangrove swamps below about RL5m AHD. They can also form as bottom sediments in coastal rivers and creeks.

Pyritic soils of concern on low lying NSW and coastal lands have mostly formed in the Holocene Period (ie: 10,000 years ago to present day), predominantly in the 7,000 years since the last rise in sea level. It is generally considered that pyritic soils which formed prior to the Holocene (ie: >10,000 years ago) would have already oxidised and leached during periods of low sea level which occurred during ice ages, exposing pyritic coastal sediments to oxygen. This may not have occurred in every case, however, and some older ASS is known to contain unoxidised pyrite.

6.2. Significance of ASS

Disturbance or poorly managed development and use of ASS can generate significant amounts of sulfuric acid, which can lower soil and water pH to extreme levels (generally pH <4) and produce acid soils, resulting in high salinity.

The low pH, high salinity soils can reduce or altogether preclude vegetation growth and can produce aggressive conditions which may be detrimental to concrete and steel components of structures, foundations, pipelines and other engineering works.

Generation of acid conditions often releases aluminium, iron and other naturally occurring elements from the otherwise stable soil matrices. High concentrations of such elements, coupled with low pH and alterations to salinity, can be detrimental to aquatic life. In severe cases, affected waters flowing off site into nearby waterways can have a detrimental effect on those aquatic ecosystems.

6.3. Review of Acid Sulfate Soil Risk Maps

A review of the Department of Land and Water Conservation (DLWC) Edition 2 (1997) Lismore-Ballina Acid Sulfate Soil Risk Map indicates that there are three zones of ASS risk mapped across the site.

- The elevated terrain at the north-west of the site is not susceptible to the presence of ASS, given the residual nature of the subsurface soils being derived from Lismore Basalts. These soils could however be naturally slightly acidic.
- Across the lower-lying terrain, the following mapping of ASS risk is present:
    - Typically across the eastern half of the site towards the coast, the land is mapped as Wa2 – indicating wind-blown deposits, with a low probability of ASS soil at depths of around 1m to 3m. A low risk is therefore shown, although localised occurrences of ASS may be present.

- Typically across the western half of the site towards the wetland landform, the land is mapped as Es1 – indicating estuarine swamp deposits, with a high probability of ASS soil within 1m of the ground surface. There is a severe environmental risk if ASS material is disturbed, for instance through shallow drainage, excavation or clearing.

The boundaries of the risk mapping and description of the location of the risk mapping should be considered approximate only.

The geology of the site is noted in Section 4.1 for reference.

6.4. Regulatory Background and Applicable Guidelines

The action criteria for acid sulfate soils assessments are provided in Acid Sulfate Soils Manual (ASSMAC 1998).

The action criteria presented in Table 6-1 trigger the need for development activities to prepare a management plan and obtain development consent. The action criteria are based on the percentage of oxidisable sulfur (or equivalent) for different soil types. It is understood that planned earthworks within the site are likely to disturb over 1,000 tonnes of soil. For projects that disturb over 1,000 tonnes the action criteria for oxidisable sulfur (SPOS) is 0.03%S (net acidity).

Table 6-1 includes criteria for smaller disturbances of three broad soil texture categories.

Table 6-1: ASS Action Criteria

Type of Material		**Action Criteria 1-1,000 tonnes disturbed**		**Action Criteria if more than 1,000 tonnes disturbed**	
Texture range. McDonald *et al.* (1990)	**Approx. Clay content** (%<0.002mm)	**Net Acidity Sulfur trail** % S oxidisable (oven-dry basis) eg S_{TOS} or S_{POS}	**Net Acidity Acid Trail** mol H+/ Tonne (oven-dry basis) eg. TPA or TSA	**Net Acidity Sulfur trail** % S oxidisable (oven-dry basis) eg S_{TOS} or S_{POS}	**Net Acidity Acid Trail** mol H+/ Tonne (oven-dry basis) eg. TPA or TSA
Coarse Texture **Sands to loamy Sands**	≤ 5	0.03	18	0.03	18
Medium Texture **Sandy loams to light clays**	5 – 40	0.06	36	0.03	18
Fine Texture **Medium to heavy clays and silty clays**	≥ 40	0.1	62	0.03	18

Source: ASSMAC (1998) Acid Sulfate Soils Manual

6.5. Laboratory Test Results

The results of ASS peroxide field screen tests are shown in Table 6-2.

Values in bold indicate that the relevant samples were submitted for additional Chromium Suite tests to assess the proportion of inorganic reducible sulfur within the soil. The results of Chromium Suites of tests are shown in Table 6-3. The laboratory certificates of analysis are included in Appendix C.

Table 6-2: Peroxide Screen Test Results Summary

Location and Depth	pH_{field}	$pH_{field,oxidised}$	Reaction Rating
BH1 0 – 0.5m	5.5	3.3	None to slight
BH1 0.5 – 1.0m	5.5	3.9	None to slight
BH1 1.0 – 1.5m	4.5	3.3	None to slight
BH1 1.5 – 2.0m	4.6	2.3	Strong with froth
BH1 2.0 – 2.5m	**5.3**	**1.3**	**Extreme**
BH2 0 – 0.5m	5.9	4.1	Moderate
BH2 0.5 – 1.0m	6.3	4.6	None to slight
BH2 1.0 – 1.5m	**6.1**	**4.4**	**Strong with froth**
BH2 1.5 – 2.0m	6.2	4.4	Strong with froth
BH2 2.0 – 2.5m	**6.0**	**3.1**	**Extreme**
BH3 0 – 0.5m	5.8	4.1	Moderate
BH3 0.5 – 1.0m	4.9	3.9	None to slight
BH3 1.0 – 1.5m	4.9	3.7	None to slight
BH3 1.5 – 2.0m	4.8	3.5	None to slight
BH3 2.0 – 2.5m	4.6	3.5	None to slight
BH4 0 – 0.5m	4.8	1.8	Strong with froth
BH4 0.5 – 1.0m	4.8	2.7	Strong with froth
BH4 1.0 – 1.5m	**4.9**	**2.4**	**Strong with froth**
BH4 1.5 – 2.0m	5.0	2.5	Strong with froth
BH4 2.0 – 2.5m	5.8	2.2	Moderate
BH5 0 – 0.5m	5.6	3.3	Strong with froth
BH5 0.5 – 1.0m	5.5	3.7	None to slight
BH5 1.0 – 1.5m	5.6	3.5	Strong with froth
BH5 1.5 – 2.0m	**5.9**	**3.5**	**Extreme**
BH5 2.0 – 2.5m	6	3.6	Extreme
BH6 0 – 0.5m	4.4	3.1	Strong with froth
BH6 0.5 – 1.0m	**4.9**	**2.6**	**Strong with froth**
BH6 1.0 – 1.5m	4.4	2.9	None to slight
BH6 1.5 – 2.0m	5.0	2.4	Strong with froth

Location and Depth	pH_{field}	$pH_{field,oxidised}$	Reaction Rating
BH6 2.0 – 2.5m	5.6	3.3	Strong with froth
BH7 0 – 0.5m	6.2	3.8	Strong with froth
BH7 0.5 – 1.0m	6.0	4.1	Strong with froth
BH7 1.0 – 1.5m	6.5	4.3	Strong with froth
BH7 1.5 – 2.0m	6.6	4.0	Strong with froth
BH7 2.0 – 2.5m	**6.1**	**2.1**	**Strong with froth**
BH8 0 – 0.5m	**5.1**	**2.0**	**Strong with froth**
BH8 0.5 – 1.0m	5.5	3.5	Moderate
BH8 1.0 – 1.5m	6.0	3.6	Strong with froth
BH8 1.5 – 2.0m	6.1	3.7	Strong with froth
BH8 2.0 – 2.5m	6.1	3.1	Strong with froth

Table 6-3: Chromium Suites Test Results Summary

Location and Depth	Titratable Actual Acidity mol H^+ per tonne	Chromium Reducible Sulfur (CRS) % S	Acid Neutralising Capacity % S	Liming Rate kg CaCO3 per tonne dry weight
BH1 2 – 2.5m	**76**	< 0.005	0	5.7
BH2 1.0 – 1.5m	17	0.01	0	1.7
BH2 2.0 – 2.5m	14	**0.16**	0	8.6
BH4 1.0 – 1.5m	**250**	0.024	0	20
BH5 1.5 – 2.0m	**30**	**0.05**	0	5.3
BH6 0.5 – 1.0m	4	< 0.02	0	< 1
BH7 2.0 – 2.5m	**19**	0.03	0	7.0
BH8 0 – 0.5m	**83**	**0.13**	0	6.3

Note to Table 6-2: Values highlighted in bold exceed the adopted Action Criteria for ASS.

6.6. Interpretation of Acid Sulfate Soil Results

The level of disturbance of the existing soil for the proposed filling of the site is expected to be limited to less than 1m by depth. The disturbance may involve clearing soft and compressible surface materials in preparation for receiving controlled fill for the development platform. For the purposes of the assessment we have adopted the criteria of 0.03% CRS (18 mole TAA) for granular materials notwithstanding the quantum of disturbance to the existing ground.

The test results are interpreted as follows:

- The site soils are considered to be Potential Acid Sulfate Soils (PASS) on the basis of a number of samples returning a proportion of inorganic and reducible sulfur in excess of the 0.03% CRS criteria at the levels tested, including within 0 – 0.5m of the ground surface.

- BH4 1 – 1.5m is considered to be an Actual Acid Sulfate Soil (AASS) evidenced by the high current acidity and some remaining presence of CRS, indicating that the oxidation of the sulfur may have already occurred due to natural process (i.e. groundwater level movements).

- A liming rate of up to 20 kg per dry tonne of material disturbed has been calculated by the laboratory.

Based on the test results and the interpretation we recommend that an Acid Sulfate Management Plan (ASSMP) be developed for the proposed works once site preparation and filling strategies have been considered further by the civil designers, in order to manage any material removed for site preparation or lowering of the groundwater where required.

7. Phase 1 Environmental Site Assessment (ESA)

7.1. Phase 1 ESA Objective and Scope of Works

The Phase 1 ESA was prepared to assess for potential soil contamination present within the proposed development area and the suitability with respect to potential contamination of the site for the intended residential subdivision.

While the EPA administers the *Contaminated Land Management Act 1997,* it does not provide certification services for properties. The EPA has published contaminated land guidelines which are the primary references for the investigation and management of contaminated sites within NSW. Coffey has carried out the work described in this Phase 1 ESA with reference to the following EPA approved guidelines:

- DUAP EPA Managing Land Contamination Planning Guidelines, SEPP 55 – Remediation of Land, 1998.
- NEPC 2013 Amendment of the Assessment of Site Contamination NEPM 1999. NEPC, 2013.
- NEPC National Environmental Protection (Assessment of Site Contamination) Measure. NEPC, 1999.
- NSW DEC Guidelines for the NSW Site Auditor Scheme (2nd ed), 2006.
- NEPM Guideline on Investigation levels for Soil & Groundwater, 1999.
- NSW EPA Guidelines for Consultants Reporting on Contaminated Sites, 2011.
- NSW EPA Sampling Design Guidelines, 1995.

The scope of work carried out for the Phase 1 ESA is summarised below.

- A review of the sites development history was undertaken, including:
    - A services search.
    - A title search.
    - Review of historical aerial images.
    - Review of council records.
    - A Search for NSW EPA (EPA) Notices.
    - A groundwater bore search.
    - A SafeWork NSW Dangerous Goods search.
    - An interview questionnaire completed by the current owner.
- A site walkover was undertaken by Coffey to observe the site and document any Areas of Environmental Concern (AEC).
- The data collected was assessed and we have provided an assessment of the likelihood for soil contamination to be present on this site, potential control measures for AECs and comment on the suitability of the proposed residential development with respect to the potential for contamination.

7.2. Site History Searches

Supporting documentation for the site history searches are provided in Appendix D. The proponent of the development and owner of the property, Greenlife Properties Pty Ltd, provided authority for Coffey to undertake the relevant searches.

7.2.1. Services Search

A services search was conducted on 20 June 2016 in preparation for the field work for the project. The following asset owners were identified:

- Ballina Shire Council.
    - A pressure water main is located diagonally across the site from the eastern boundary to the northern boundary. Council considers this asset to be a “high risk” asset.
    - A sewer main is located along the northern boundary of the site.
    - Stormwater lines are present to the north of Skennars Head Road and a culvert crossing, which discharges onto the site, is present on Skennars Head road.
- Telstra.
    - Telstra’s Cable Plan shows multiple pits and two 100 pair cables along the northern boundary of the site, but located off-site. The existing dwelling is serviced by a two pair cable from this line. A two pair cable with elevated junctions is present along the eastern boundary but off-site.
    - Telstra’s Mains Cable plan shows fibre optic lines along the northern boundary of the site but off-site.
- Essential Energy.
    - Essential Energy’s provided plans show predominantly overhead power lines.
    - Two underground earth or wire connections are shown for the site, one at the house site and one on the eastern boundary, but off site. Underground power cables are possible at these poles.

The plans provided in Appendix D are valid for a limited time as noted on the plans. Updated plans will be required to be sought for design or construction purposes.

7.2.2. Title Search

A title search of the site was undertaken by Advance Legal Searches Pty Ltd. The report with detailed Title Tree and plans is provided in Appendix D. Note that the Report Note (a) is relevant to the subject site and Note (b) is relevant to the lot to the south of the subject site.

The current Folio Identifier for the site is Lot 239 DP1201225. The site has previously been identified as Lot 3 DP251003. A summary of ownership for the site is provided in Table 7-1.

- The land use at the site was ostensibly that of farming between 1907 and the early 1970’s either by the then owner of the property or through a lease arrangement.

- It appears that a subdivision of the land occurred around 1975. Larger parcels of property in Portions 16 and 64 in Parish of Ballina were subdivided and Lot 3 of DP251003 was created approximately describing the current site between 1976 and 2014.
- It is considered likely that, in combination with the aerial imagery review, that low intensity farming activities have continued between the 1976 subdivision and 2013.
- We understand that at the time of writing (2016) the dwelling on the property was being leased and that the farming activities had ceased.

Table 7-1: Title Search Summary

Year	Ownership
Lot 239 DP 1201225	
2015 – to date	Greenlife Properties Pty Ltd
2014 – 2015	Patrick James Kearney Anthony Thomas Kearney
2014 – 2014	Patrick James Kearney Anthony Thomas Kearney The Trustees for the Roman Catholic Church for the diocese of Lismore *(The southern boundary of the subject site was subject to a boundary adjustment with the lot to the south owned by the Catholic Church around 2011-2012. The current folio identifier arose as a result of this adjustment).*
Lot 3 DP 251003	
2011 – 2014	Patrick James Kearney Anthony Thomas Kearney
1990 – 2011	Barry Phillip Crowley, retired builder
1987 – 1990	John Lachlan Macaulay, manager Elaine Regina Macaulay, wife
Lot 3 DP 251003 – CTVol 13010 Fol 230	
1976 – 1987	John Lachlan Macaulay, manager Elaine Regina Macaulay, wife
1976 – 1976	Joburn Pty. Ltd.
Portions 16 & 64, Parish Ballina – Area 138 Acres – CTVol 7429 Fol 5	
1974 – 1976	Joburn Pty. Ltd.
1971 – 1974	John Spence Blackburn, chartered accountant
1958 – 1971	Mary Ethel Cook, wife of Baden John Cook, farmer
Portions 16 & 64, Parish Ballina – Area 138 Acres – CTVol 5647 Fol's 185 - 188	
1957 – 1958	Mary Ethel Cook, wife of Baden John Cook, farmer
1957 – 1957	Norman Douglas Sharpe, store keeper Kenneth William Sharpe, store keeper Marjorie Elizabeth Sharpe, clerk
(1947 – 1958)	*(lease to Albert Henry Knight, farmer shown on CTVol 5647 Fol's 185-188)*
1947 – 1957	Henry Edwin Sharpe, storekeeper Norman Douglas Sharpe, grocery manager Kenneth William Sharpe, grocer Marjorie Elizabeth Sharpe, clerk

Portion 16 and 64 Parish Ballina – Area 138 Acres – CTVol 5530 Fol 143	
1946 – 1947	Norman Douglas Sharpe, grocery manager Kenneth William Sharpe, grocer Henry Edwin Sharp, storekeeper Marjorie Elizabeth Sharpe, clerk
1945 – 1946	Arthur Robert Taylor, farmer
(1946 – 1947)	*(lease to Albert Henry Knight, farmer shown on CTVol 5530 Fol 143)*
Portion 16, Parish Ballina – Area 100 Acres – CTVol 1840 Fol 85	
1945 – 1945	Arthur Robert Taylor, farmer
1921 – 1945	Samuel Hill Miller, farmer
(1916 – 1921)	*(lease to John Clifford, farmer shown on CTVol 1840 Fol 85)*
1911 – 1921	Charlotte Lucie Crawford, widow
(1907 – 1916)	*(lease to Thomas Stewart, farmer shown on CTVol 1840 Fol 85)*
1907 – 1911	William Crawford, farmer

7.2.3. Aerial Photographs

Historical aerial photographs were reviewed for the years of 1958, 1967, 1972, 1987, 1991 and 2004. The review of these photographs show no change in the land use from cleared grazing land had occurred other than the construction of the dwelling and yards at the northwest of the site.

- All photos show the land is used for low intensity farming.
- The existing dwelling and sheds are visible in the 1987 image, which is consistent with the council records obtained dated the dwelling to around 1976.

Between 2004 and 2016 we referenced publicly available satellite imagery for 2009, 2011, 2012, 2013, 2014 and 2016.

- The 2009 image shows indications of slashing tracks in cleared grazing areas.
- The 2012 and 2013 images show livestock present.

The aerial images indicate that prior to 1976 the land was used for low intensity farming, and likely for cattle grazing. Around 1976 the existing dwelling was constructed, and the sheds to the west of the dwelling were constructed in the early to mid-1980s. Low intensity farming activities continued after the construction of the dwelling until recently.

The background imagery in Figure 1 is based on a 2012 satellite image.

7.2.4. Council Records

Coffey conducted a search of the available records through Ballina Shire Council's online search facility. The results are summarised in Table 7-2 and the records attached in Appendix D.

Table 7-2: Summary of Council records search

Year	Description of Record and notes
1976	BA 89 1976 Residential dwelling with septic tank and trenches. Note – trench field not identifiable during walkover or from aerial imagery, likely south of the dwelling. The dwelling is understood to be currently connected to the council sewerage system.
1982	BA 85 1982 Machinery Shed with concrete floor approximately 45.6m^2. The shed is located to the west of the house.
1986	BA 17 1986 Machinery Shed Workshop addition to 1982 shed with gravel floor through doubling floor space to 91m^2.
1986	BA295 1986 Small Tractor Shed approximately 17.5m^2. To the south-west of the 1982 shed. It is considered likely that this shed size was doubled without a Council record based on our site walkover.
2011-2012	DA2011/272 Boundary adjustment with adjacent Lot 240 DP1201225 and changes to the right of ways across the site.

7.2.5. NSW EPA Notices

Coffey conducted a search of the NSW EPA online facility for notices.

No notices were evident for the subject site.

Nearby notices returned for other properties in the Ballina Shire Council area are:

- 13 Fig Tree Hill Drive, Lennox Head (former dip site).
- McLeans Ridges Road, McLeans Ridges (former dip site).
- Pacific Highway, West Ballina (former service station).

All of the above notices are more than 5km from the subject site and therefore not considered relevant to the assessment.

7.2.6. Groundwater Bore Search

A search for nearby groundwater bores or works was conducted using the NSW Department of Industries (Office of Water) online search application.

Of significance to the subject site, a commercial use water bore is located at the property to the east (Ballina Headland Leisure Park). The well is designated as GW304959, and the record shows the well to be 5m deep. High iron content and slightly acidic pH is noted on the record.

Stock and farming bores are located in the vicinity but greater than 0.5 km from the subject site. An inactive stock bore is located to the south-east of the site by about 200m.

A map of bore locations with records of the bore details are included in Appendix D.

7.2.7. SafeWork NSW Dangerous Goods Search

A search for information on Storage of Hazardous Chemicals was undertaken with SafeWork NSW. No records were returned for the search at the subject site.

Correspondence from the search is included in Appendix D.

7.2.8. Interviews

A questionnaire regarding the site history was provided to the current owner of the site, Greenlife Properties Pty Ltd. The response received is included in Appendix D. The information provided is consistent with our understanding of the site history.

The previous owners of the land were not available for interview.

7.3. Site Walkover

A geotechnical professional from Coffey undertook a site walkover on 21 July 2016. The walkover was carried out to observe the existing features of the site as they relate to the Phase 1 ESA and the identification of any Areas of Environmental Concern (AEC).

The walkover is discussed in the series of Photographs below. Three AECs were identified, being:

- The complex of sheds (1982, 1986 and additional undated shed) located to the south-west of the dwelling. There is the potential for limited hydrocarbon soil contamination in the earthen floor of these sheds due to their historic use to store and service farm equipment. Furthermore items of inert waste was encountered, which could be removed off site along with demolition debris.

- The existing dwelling. Given the age of the dwelling (1976) it is likely that building elements may contain asbestos.

- The small garden shed located east of the dwelling. The wall cladding contains fibre cement sheeting and an assessment of whether this shed includes asbestos elements should be undertaken.

Some localised herbicide use has occurred recently to control weeds on a small stockpile of inert waste, see Photograph 4.

Photograph 1: View south of currently tenanted dwelling.

Photograph 2: View east of elevated terrain from the driveway.

Photograph 3: View south-west of 1982 shed plus 1986 extension at the rear. The cladding is metallic. The floor of the rear part of the shed comprised exposed soil. The closed section of the shed was not accessed but is likely covered with 100mm concrete based on the 1982 building application.

Photograph 4: View of inert waste (concrete, timber posts, steel etc) in stockpile to the north west of the 1982/1986 shed. Note weeds have likely recently been treated with herbicide.

Photograph 5: View south of rear of 1986 tractor shed. The cladding is metallic. The right hand side appears to be an extension beyond the 1986 building application. The floor is exposed soil.

Photograph 6: Typical view of hard rubbish between 1982 and 1986 sheds. Includes vehicle parts, other areas include timber pallets, tractor tyres, metal framing and cladding.

Photograph 7: View inside 1986 tractor shed. Note empty cans of engine starting fluid, small oil stain on dirt floor, used automotive batteries, and bag of swollen material (likely agricultural product or similar). Two empty 4L and aged containers of Glyphosate herbicide were located in this shed.

Photograph 8: View of Small (<10m^2) shed south of 1986 tractor shed. Contents included a used automotive battery, shelving (timber) and concrete floor. Cladding is metallic.

Photograph 9: View south from the House Yard to the low-lying area. Note the wetland vegetation to the right of the photo (westwards).

Photograph 10: Typical panoramic view of low lying area. This panorama was taken looking south-eastwards from the east of the house yards. Note the gently sloping elevated terrain. The tree lines in the far distance approximately outline the property on the eastern and southern boundaries.

Photograph 11: View north-west of small shed located to the east of the dwelling. The roof is metallic however the wall cladding is likely fibre cement sheeting, although positive identification of whether the cladding contained asbestos fibres was not possible. Note the concrete pipe and collars stacked against the shed.

Photograph 12: View north-east from elevated terrain to the drainage line which receives runoff from the road reserve through a culvert. The low lying area was heavily waterlogged.

Photograph 13: Panoramic view looking south-west, form the north-eastern corner of the property. Note the gently sloping elevated terrain behind the trees. Skennars Head Road is to the right of the photograph.

7.4. Discussion of Findings

On the basis of the Site History Search and Site Walkover observations it is assessed that there is a low potential for systemic soil contamination to be present on this site.

The three areas identified as localised AECs are recommended to be managed as follows:

- The shed complex south-west of the dwelling:
    - The sheds may be demolished according to appropriate building demolition procedures and safeguards.
    - Hard wastes (e.g. steel, concrete, tyres) may be disposed of at licenced landfills as general waste.
    - Used automotive batteries may be disposed of at licensed resource recovery centres.
    - The upper 150mm of soil within the footprint of the sheds plus a 1.5m wide perimeter strip, is recommended to be removed and pending its waste classification may then be disposed to a landfill licenced to accept this waste.
    - Validation testing should be undertaken at the time of site preparation to confirm that the exposed soils below the 150mm of removed soil in each of the shed footprints and perimeter is not contaminated.
- The existing dwelling should be surveyed for the presence of asbestos containing materials by a SafeWork NSW licensed asbestos assessor, and the demolition of the dwelling must consider the findings of such a survey. If asbestos is found, it is recommended that a SafeWork NSW licensed asbestos removalist is engaged to remove and appropriately dispose of the asbestos material within the dwelling to a licensed landfill facility.
- The small garden shed to the east of the dwelling should be surveyed for the presence of asbestos elements, and the demolition of the shed must consider the findings of such a survey. If asbestos is found, it is recommended that a SafeWork NSW licensed asbestos removalist is engaged to remove and appropriately dispose of the asbestos material within the shed to a licensed landfill facility.

The past use of this site has been limited to low intensity grazing since 1907, with a residential dwelling constructed around 1976.

The proposed use of the land for residential purposes is not considered to be affected by the past land use given the assessed low potential for contamination to be present. Prior to the development, we have assessed that further more detailed Phase 2 contamination studies are not required. During the early works phase of future development of this site the management actions for the above three AECs should be addressed.

8. Closing Comment

We draw your attention to the enclosed sheets entitled “Important Information about your Coffey Report” and “Import Important information about your Coffey Environmental Report”, which outlines limitations and uses of this report.

9. References

Ahern, C.R., Blunden B. and Stone Y. (Eds) (1998) *Acid Sulfate Soils Laboratory Methods. In Acid Sulfate Soil Manual.* Ahern, C.R., Blunden B., and Stone Y. (Eds), Acid Sulfate Soils Management Advisory Committee, Wollongbar.

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Department of Land & Water Conservation (1997). *Lismore-Ballina Acid Sulfate Soil Risk Map* (1:25,000) – Edition Two.

Hashimoto T.R. & Troedson A.L. 2008. *Lismore 1:100 000 and 1:25 000, Coastal Quaternary geology map series*. Geological Survey

BSC. (2012), *Management of Contaminated Land, Policy Ref: C12.* Ballina Shire Council, Ballina.

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NSW EPA. (1995). *Sampling Design Guidelines*. Environmental Protection Authority NSW, Sydney.

NSW EPA. (1994). *Contaminated Sites: Guidelines for Assessing Service Station Sites*. Environmental Protection Authority NSW, Sydney.

Important information about your Coffey Report

As a client of Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

Your report is based on project specific criteria

Your report has been developed on the basis of your unique project specific requirements as understood by Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project.

Interpretation of factual data

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions.

For this reason, owners should retain the services of Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other project design professionals who are affected by the report. Have Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they incorporate the report findings.

Data should not be separated from the report*

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way.

Logs, figures, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples.

These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Geoenvironmental concerns are not at issue

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Coffey for information relating to geoenvironmental issues.

Rely on Coffey for additional assistance

Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design towards construction, speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Responsibility

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

* For further information on this aspect reference should be made to "Guidelines for the Provision of Geotechnical information in Construction Contracts" published by the Institution of Engineers Australia, National headquarters, Canberra, 1987.

Important information about your Coffey Environmental Report

1. Introduction

This report has been prepared by Coffey for you, as Coffey's client, in accordance with our agreed purpose, scope, schedule and budget.

The report has been prepared using accepted procedures and practices of the consulting profession at the time it was prepared, and the opinions, recommendations and conclusions set out in the report are made in accordance with generally accepted principles and practices of that profession.

The report is based on information gained from environmental conditions (including assessment of some or all of soil, groundwater, vapour and surface water) and supplemented by reported data of the local area and professional experience. Assessment has been scoped with consideration to industry standards, regulations, guidelines and your specific requirements, including budget and timing. The characterisation of site conditions is an interpretation of information collected during assessment, in accordance with industry practice,

This interpretation is not a complete description of all material on or in the vicinity of the site, due to the inherent variation in spatial and temporal patterns of contaminant presence and impact in the natural environment. Coffey may have also relied on data and other information provided by you and other qualified individuals in preparing this report. Coffey has not verified the accuracy or completeness of such data or information except as otherwise stated in the report. For these reasons the report must be regarded as interpretative, in accordance with industry standards and practice, rather than being a definitive record.

2. Your report has been written for a specific purpose

Your report has been developed for a specific purpose as agreed by us and applies only to the site or area investigated. Unless otherwise stated in the report, this report cannot be applied to an adjacent site or area, nor can it be used when the nature of the specific purpose changes from that which we agreed.

For each purpose, a tailored approach to the assessment of potential soil and groundwater contamination is required. In most cases, a key objective is to identify, and if possible quantify, risks that both recognised and potential contamination posed in the context of the agreed purpose. Such risks may be financial (for example, clean up costs or constraints on site use) and/or physical (for example, potential health risks to users of the site or the general public).

3. Limitations of the Report

The work was conducted, and the report has been prepared, in response to an agreed purpose and scope, within time and budgetary constraints, and in reliance on certain data and information made available to Coffey. The analyses, evaluations, opinions and conclusions presented in this report are based on that purpose and scope, requirements, data or information, and they could change if such requirements or data are inaccurate or incomplete.

This report is valid as of the date of preparation. The condition of the site (including subsurface conditions) and extent or nature of contamination or other environmental hazards can change over time, as a result of either natural processes or human influence. Coffey should be kept appraised of any such events and should be consulted for further investigations if any changes are noted, particularly during construction activities where excavations often reveal subsurface conditions.

In addition, advancements in professional practice regarding contaminated land and changes in applicable statues and/or guidelines may affect the validity of this report. Consequently, the currency of conclusions and recommendations in this report should be verified if you propose to use this report more than 6 months after its date of issue.

The report does not include the evaluation or assessment of potential geotechnical engineering constraints of the site.

4. Interpretation of factual data

Environmental site assessments identify actual conditions only at those points where samples are taken and on the date collected. Data derived from indirect field measurements, and sometimes other reports on the site, are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions.

Variations in soil and groundwater conditions may occur between test or sample locations and actual conditions may differ from those inferred to exist. No environmental assessment program, no matter how comprehensive, can reveal all subsurface details and anomalies. Similarly, no professional, no matter how well qualified, can reveal what is hidden by earth, rock or changed through time.

The actual interface between different materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions.

For this reason, parties involved with land acquisition, management and/or redevelopment should retain the services of a suitably qualified and experienced environmental consultant through the development and

use of the site to identify variances, conduct additional tests if required, and recommend solutions to unexpected conditions or other unrecognised features encountered on site. Coffey would be pleased to assist with any investigation or advice in such circumstances.

5. Recommendations in this report

This report assumes, in accordance with industry practice, that the site conditions recognised through discrete sampling are representative of actual conditions throughout the investigation area. Recommendations are based on the resulting interpretation.

Should further data be obtained that differs from the data on which the report recommendations are based (such as through excavation or other additional assessment), then the recommendations would need to be reviewed and may need to be revised.

6. Report for benefit of client

Unless otherwise agreed between us, the report has been prepared for your benefit and no other party. Other parties should not rely upon the report or the accuracy or completeness of any recommendation and should make their own enquiries and obtain independent advice in relation to such matters.

Coffey assumes no responsibility and will not be liable to any other person or organisation for, or in relation to, any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report.

To avoid misuse of the information presented in your report, we recommend that Coffey be consulted before the report is provided to another party who may not be familiar with the background and the purpose of the report. In particular, an environmental disclosure report for a property vendor may not be suitable for satisfying the needs of that property's purchaser. This report should not be applied for any purpose other than that stated in the report.

7. Interpretation by other professionals

Costly problems can occur when other professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, a suitably qualified and experienced environmental consultant should be retained to explain the implications of the report to other professionals referring to the report and then review plans and specifications produced to see how other professionals have incorporated the report findings.

Given Coffey prepared the report and has familiarity with the site, Coffey is well placed to provide such assistance. If another party is engaged to interpret the recommendations of the report, there is a risk that the contents of the report may be misinterpreted and Coffey disowns any responsibility for such misinterpretation.

8. Data should not be separated from the report

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, laboratory data, drawings, etc. are customarily included in our reports and are developed by scientists or engineers based on their interpretation of field logs, field testing and laboratory evaluation of samples. This information should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way. This report should be reproduced in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties.

9. Responsibility

Environmental reporting relies on interpretation of factual information using professional judgement and opinion and has a level of uncertainty attached to it, which is much less exact than other design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. As noted earlier, the recommendations and findings set out in this report should only be regarded as interpretive and should not be taken as accurate and complete information about all environmental media at all depths and locations across the site.

Figures

revision	description	drawn	approved	date

Aerial Image Source - Image © NSW Dept. Finance, Services and Innovation / Google Earth Pro. Image dated August 2012. Boundary Data NSW LPI Six Maps.

Approx. 100m

North

drawn	**RV**
approved	
date	**27/07/2016**
scale	**-**
original size	**A3**

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client: **LIVING GEMS PTY LTD**

project: **GEOTECHNICAL, ACID SULFATE SOIL AND PHASE 1 ENVIRONMENTAL SITE ASSESSMENTS - SENIORS LIVING DEVELOPMENT, SKENNARS HEAD**

title: **SITE PLAN WITH INVESTIGATION LOCATIONS**

project no: **GEOTALST03696AA-AB** figure no: **1**

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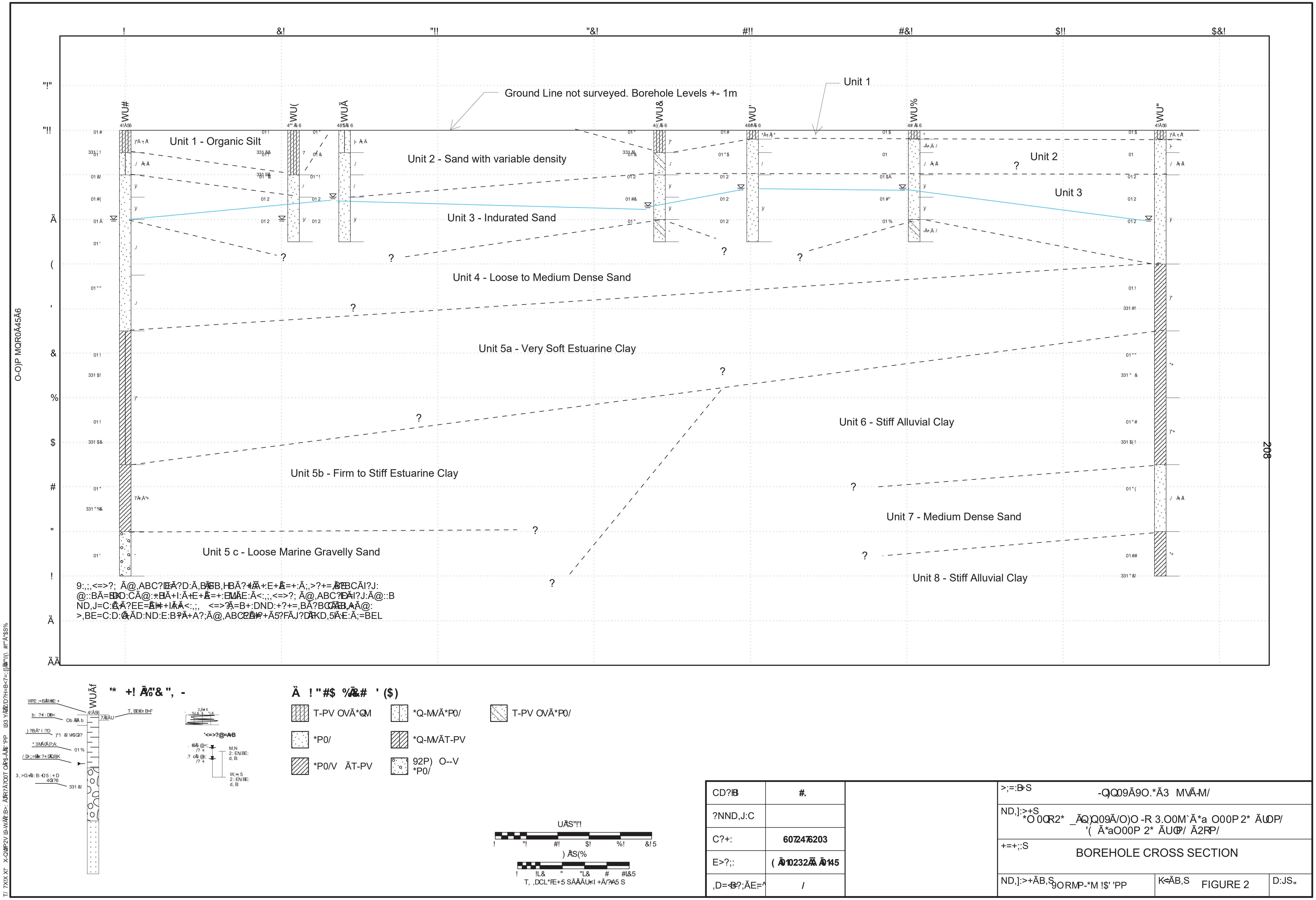

Ground Line not surveyed. Borehole Levels +- 1m
Unit 1
Unit 1 - Organic Silt
Unit 2 - Sand with variable density
Unit 2
Unit 3 - Indurated Sand
Unit 3
Unit 4 - Loose to Medium Dense Sand
Unit 5a - Very Soft Estuarine Clay
Unit 5b - Firm to Stiff Estuarine Clay
Unit 5 c - Loose Marine Gravelly Sand
Unit 6 - Stiff Alluvial Clay
Unit 7 - Medium Dense Sand
Unit 8 - Stiff Alluvial Clay
BOREHOLE CROSS SECTION
FIGURE 2

Appendix A - Engineering Logs with Explanation Sheets

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Engineering Log - Borehole

Borehole ID.	**BH1**
sheet:	1 of 2
project no.	**GEOTALST03696AA**
client:	**LIVING GEMS PTY LTD**
date started:	**27 Jun 2016**
principal:	
date completed:	**27 Jun 2016**
project:	**SENIORS' LIVING DEVELOPMENT, SKENNARS HEAD**
logged by:	**ZC**
location:	**67 SKENNARS HEAD ROAD**
checked by:	**RV**

position: E: 558,436; N: 6,811,359 (Datum Not Specified) surface elevation: 100 m (Datum Not Specified) angle from horizontal: 90°

drill model: GOT 2008, Track mounted drilling fluid: hole diameter : 100 mm

drilling information | **material substance**

method & support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
AD/V, W	1, 2, 3		SPT 1, 1, 2 N*=3	100			ML	**Clayey SILT**: low liquid limit, dark brown, with some organics.	M	VS to S		**ALLUVIUM**
							SP	**SAND**: fine grained, grey.		VL		
			SPT 1, 3, 6 N*=9							MD to D		
			SPT 4, 1, 30/100mm N*=R	99	1.0			Colour change to dark brown.		VD		**INDURATED SAND**
			SPT 31/100mm HB N*=R									
		27/06/16	SPT 30/100mm HB N*=R	98	2.0				W			
				97	3.0		CL	**Sandy CLAY**: low to medium plasticity, grey, sand is fine grained.	<Wp	VS		**ESTUARINE SOIL**
			SPT 0, 0, 0 N*=0									
M				96	4.0							HP 20 kPa
							CH	**Sandy CLAY**: high plasticity, brown and mottled grey, sand is fine to course grained, with some fine gravel.	>Wp	St		**ALLUVIUM**
			SPT 3, 5, 6 N*=11	95	5.0							HP 195 kPa

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method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore
- * bit shown by suffix
- e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration
1 2 3 — no resistance ranging to refusal

water
10-Oct-12 water level on date shown
water inflow
water outflow

samples & field tests
- B bulk disturbed sample
- D disturbed sample
- E environmental sample
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remouded (kPa)
- R refusal
- HB hammer bouncing

classification symbol & soil description based on Unified Classification System

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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Engineering Log - Borehole

Borehole ID.	**BH1**
sheet:	2 of 2
project no.	**GEOTALST03696AA**
date started:	**27 Jun 2016**
date completed:	**27 Jun 2016**
logged by:	**ZC**
checked by:	**RV**

client: ***LIVING GEMS PTY LTD***

principal:

project: ***SENIORS' LIVING DEVELOPMENT, SKENNARS HEAD***

location: ***67 SKENNARS HEAD ROAD***

position: E: 558,436; N: 6,811,359 (Datum Not Specified) surface elevation: 100 m (Datum Not Specified) angle from horizontal: 90°

drill model: GOT 2008, Track mounted drilling fluid: hole diameter : 100 mm

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	hand penetrometer (kPa) 100 200 300 400	structure and additional observations
W, M				94			CH	**Sandy CLAY**: high plasticity, brown and mottled grey, sand is fine to course grained, with some fine gravel. *(continued)*	>Wp	VSt		**ALLUVIUM**
			SPT 4, 5, 7 N*=12									
				93	7.0						×	HP 370 kPa
							SW	**SAND**: fine to coarse grained, grey and brown, trace of clay and a trace of fine gravel.	W	MD to D		
			SPT 5, 9, 8 N*=17	92	8.0							
				91	9.0		CH	**Sandy CLAY**: high plasticity, brown and grey, sand is fine to course grained, trace of fine gravel.	>Wp	St		
			SPT 6, 9, 13 N*=22									
				90	10.0			Borehole BH1 terminated at 10.0 m			×	HP 150 kPa
				89	11.0							

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method
AD auger drilling*
AS auger screwing*
HA hand auger
W washbore

* bit shown by suffix
e.g. AD/T
B blank bit
T TC bit
V V bit

support
M mud
C casing
N nil

penetration
1 2 3 no resistance ranging to refusal

water
10-Oct-12 water level on date shown
water inflow
water outflow

samples & field tests
B bulk disturbed sample
D disturbed sample
E environmental sample
SS split spoon sample
U## undisturbed sample ##mm diameter
HP hand penetrometer (kPa)
N standard penetration test (SPT)
N* SPT - sample recovered
Nc SPT with solid cone
VS vane shear; peak/remouded (kPa)
R refusal
HB hammer bouncing

classification symbol & soil description
based on Unified Classification System

moisture
D dry
M moist
W wet
Wp plastic limit
Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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Engineering Log - Borehole

Borehole ID.	**BH2**
sheet:	1 of 2
project no.	**GEOTALST03696AA**
client:	**LIVING GEMS PTY LTD**
date started:	**27 Jun 2016**
principal:	
date completed:	**27 Jun 2016**
project:	**SENIORS' LIVING DEVELOPMENT, SKENNARS HEAD**
logged by:	**ZC**
location:	**67 SKENNARS HEAD ROAD**
checked by:	**RV**

position: E: 558,368; N: 6,811,035 (Datum Not Specified) surface elevation: 100 m (Datum Not Specified) angle from horizontal: 90°

drill model: GOT 2008, Truck mounted drilling fluid: hole diameter : 100 mm

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	hand penetrometer (kPa) 100 200 300 400	structure and additional observations
AD/V			SPT 0, 1, 1 N*=2	100			ML	**Clayey SILT**: low liquid limit, brown and mottled grey, with some organics, trace of fine grained sand..	M	VS to S		**ALLUVIUM**
			SPT 1, 7, 2 N*=9				SP	**Silty SAND**: fine grained, dark brown.		MD to D	HP 60 kPa	**INDURATED SAND**
			SPT 11, 25, 25 N*=50	99	1.0		SP	**SAND**: fine grained, dark brown.		VD		
			SPT 8, 13, 14 N*=27							VD		
N		27/06/16	SPT 4, 4, 4 N*=8	98	2.0		SP	**SAND**: fine grained, brown.	W	MD		**ALLUVIUM**
			SPT 2, 3, 3 N*=6					Colour change to grey.				
				97	3.0					MD		
W			SPT 4, 5, 6 N*=11									
M				96	4.0							
			SPT 0, 0, 0 N*=0	95	5.0		CL	**Silty CLAY**: low plasticity, grey, with some shell fragments..	<Wp	VS	HP 30 kPa	**ESTUARINE SOIL**

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method
AD auger drilling*
AS auger screwing*
HA hand auger
W washbore

* bit shown by suffix
e.g. AD/T
B blank bit
T TC bit
V V bit

support
M mud N nil
C casing

penetration
1 2 3 no resistance ranging to refusal

water
10-Oct-12 water level on date shown
water inflow
water outflow

samples & field tests
B bulk disturbed sample
D disturbed sample
E environmental sample
SS split spoon sample
U## undisturbed sample ##mm diameter
HP hand penetrometer (kPa)
N standard penetration test (SPT)
N* SPT - sample recovered
Nc SPT with solid cone
VS vane shear; peak/remouded (kPa)
R refusal
HB hammer bouncing

classification symbol & soil description
based on Unified Classification System

moisture
D dry
M moist
W wet
Wp plastic limit
Wl liquid limit

consistency / relative density
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense

Engineering Log - Borehole

Borehole ID.	**BH2**
sheet:	2 of 2
project no.	**GEOTALST03696AA**
client:	**LIVING GEMS PTY LTD**
date started:	**27 Jun 2016**
principal:	
date completed:	**27 Jun 2016**
project:	**SENIORS' LIVING DEVELOPMENT, SKENNARS HEAD**
logged by:	**ZC**
location:	**67 SKENNARS HEAD ROAD**
checked by:	**RV**

position: E: 558,368; N: 6,811,035 (Datum Not Specified) surface elevation: 100 m (Datum Not Specified) angle from horizontal: 90°

drill model: GOT 2008, Truck mounted drilling fluid: hole diameter : 100 mm

drilling information | **material substance**

method & support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
W, M				94			CL	**Silty CLAY**: low plasticity, grey, with some shell fragments.. *(continued)*	<Wp	VS		**ESTUARINE SOIL**
			SPT 0, 0, 0 N*=0	93	7.0		CH	**Sandy CLAY**: fine grained, high plasticity, grey, sand is fine grained, with some shell fragments.	>Wp	F to St	HP 35 kPa	
			SPT 0, 0, 1 N*=1	92	8.0						HP 145 kPa	
				91	9.0		SW	**Gravelly SAND**: fine to coarse grained, brown, gravel is fine, with some clay.	W	L		**MARINE**
			SPT 7, 3, 3 N*=6	90	10.0			Borehole BH2 terminated at 10.0 m				
				89	11.0							

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method
AD auger drilling*
AS auger screwing*
HA hand auger
W washbore

* bit shown by suffix
e.g. AD/T
B blank bit
T TC bit
V V bit

support
M mud
C casing
N nil

penetration
1 2 3 — no resistance ranging to refusal

water
10-Oct-12 water level on date shown
water inflow
water outflow

samples & field tests
B bulk disturbed sample
D disturbed sample
E environmental sample
SS split spoon sample
U## undisturbed sample ##mm diameter
HP hand penetrometer (kPa)
N standard penetration test (SPT)
N* SPT - sample recovered
Nc SPT with solid cone
VS vane shear; peak/remouded (kPa)
R refusal
HB hammer bouncing

classification symbol & soil description
based on Unified Classification System

moisture
D dry
M moist
W wet
Wp plastic limit
Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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Engineering Log - Borehole

Borehole ID.	***BH3***
sheet:	1 of 1
project no.	***GEOTALST03696AA***
client:	***LIVING GEMS PTY LTD***
date started:	***29 Jun 2016***
principal:	
date completed:	***29 Jun 2016***
project:	***SENIORS' LIVING DEVELOPMENT, SKENNARS HEAD***
logged by:	***ZC***
location:	***67 SKENNARS HEAD ROAD***
checked by:	***RV***

position: E: 558,355; N: 6,811,365 (Datum Not Specified) surface elevation: 100 m (Datum Not Specified) angle from horizontal: 90°

drill model: GOT 2008, Truck mounted drilling fluid: hole diameter : 100 mm

drilling information | **material substance**

method & support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
AD/V — N	1 2 3		SPT 1, 2, 5 N*=7	100			ML	**Clayey SILT**: low liquid limit, brown, with some organics.	M	F		**ORGANIC SOIL**
			SPT 5, 6, 7 N*=13				CH	**Silty CLAY**: high plasticity, brown to red.		St	HP 150 kPa	**RESIDUAL SOIL**
			SPT 4, 6, 9 N*=15	99	1.0					VSt	HP 335 kPa	
			SPT 4, 7, 9 N*=16								HP 385 kPa	
			SPT 4, 7, 7 N*=14	98	2.0						HP 365 kPa	
											HP 280 kPa	
								Borehole BH3 terminated at 2.5 m				
				97	3.0							
				96	4.0							
				95	5.0							

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method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore

* bit shown by suffix
e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration
1 2 3 — no resistance ranging to refusal

water
- 10-Oct-12 water level on date shown
- water inflow
- water outflow

samples & field tests
- B bulk disturbed sample
- D disturbed sample
- E environmental sample
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remouded (kPa)
- R refusal
- HB hammer bouncing

classification symbol & soil description based on Unified Classification System

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Engineering Log - Borehole

Borehole ID.	**BH4**
sheet:	1 of 1
project no.	**GEOTALST03696AA**
date started:	**28 Jun 2016**
date completed:	**28 Jun 2016**
logged by:	**ZC**
checked by:	**RV**

client: ***LIVING GEMS PTY LTD***

principal:

project: ***SENIORS' LIVING DEVELOPMENT, SKENNARS HEAD***

location: ***67 SKENNARS HEAD ROAD***

position: E: 558,391; N: 6,811,288 (Datum Not Specified) surface elevation: 100 m (Datum Not Specified) angle from horizontal: 90°

drill model: GOT 2008, Truck mounted drilling fluid: hole diameter : 100 mm

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	hand penetrometer (kPa) 100 200 300 400	structure and additional observations
AD/V — N		28/06/16 ▽	SPT 0, 1, 2 N*=3	100			ML	**Clayey SILT**: low liquid limit, dark brown, with some organics.	M	S		**ALLUVIUM**
							SP	**SAND**: fine grained, dark brown to black.		L to MD		
			SPT 3, 4, 5 N*=9					Colour change to grey.		MD to D		
			SPT 6, 7, 31 N*=38	99	1.0			Colour change to dark brown.	W	VD		**INDURATED SAND**
			SPT 21, 12, 9 N*=21							VD		
			SPT 2, 2, 2 N*=4	98	2.0		SC	**CLAYEY SAND**: fine grained, grey.		L to MD		**ESTUARINE SOIL**
								Borehole BH4 terminated at 2.5 m				
				97	3.0							
				96	4.0							
				95	5.0							

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method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore

* bit shown by suffix
e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration
1 2 3 — no resistance ranging to refusal

water
10-Oct-12 water level on date shown
water inflow
water outflow

samples & field tests
- B bulk disturbed sample
- D disturbed sample
- E environmental sample
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remouded (kPa)
- R refusal
- HB hammer bouncing

classification symbol & soil description based on Unified Classification System

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Engineering Log - Borehole

Borehole ID.	**BH5**
sheet:	1 of 1
project no.	**GEOTALST03696AA**
client:	**LIVING GEMS PTY LTD**
date started:	**29 Jun 2016**
principal:	
date completed:	**28 Jun 2016**
project:	**SENIORS' LIVING DEVELOPMENT, SKENNARS HEAD**
logged by:	**ZC**
location:	**67 SKENNARS HEAD ROAD**
checked by:	**RV**

position: E: 558,328; N: 6,811,218 (Datum Not Specified) surface elevation: 100 m (Datum Not Specified) angle from horizontal: 90°

drill model: GOT 2008, Truck mounted drilling fluid: hole diameter : 100 mm

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	hand penetrometer (kPa) 100 200 300 400	structure and additional observations
AD/V — N			SPT 1, 0, 1 N*=1	100			ML	**Clayey SILT**: low liquid limit, dark brown, with some organics and a trace of fine grained sand.	M	VS		**ALLUVIUM**
			SPT 1, 1, 4 N*=5				SC	**CLAYEY SAND**: fine grained, grey and brown.		MD	HP 50 kPa	
			SPT 12, 25/100mm, /0mm N*=R	99	1.0		SP	**SAND**: fine grained, dark brown.		VD		**INDURATED SAND**
		28/06/16 ▽	SPT 20, 17, 8 N*=25						W	VD		
			SPT 0, 0, 1 N*=1	98	2.0		SC	**CLAYEY SAND**: fine grained, grey.		L		**ALLUVIUM**
								Borehole BH5 terminated at 2.5 m				
				97	3.0							
				96	4.0							
				95	5.0							

method
AD auger drilling*
AS auger screwing*
HA hand auger
W washbore
* bit shown by suffix
e.g. AD/T
B blank bit
T TC bit
V V bit

support
M mud N nil
C casing

penetration
1 2 3 no resistance ranging to refusal

water
10-Oct-12 water level on date shown
water inflow
water outflow

samples & field tests
B bulk disturbed sample
D disturbed sample
E environmental sample
SS split spoon sample
U## undisturbed sample ##mm diameter
HP hand penetrometer (kPa)
N standard penetration test (SPT)
N* SPT - sample recovered
Nc SPT with solid cone
VS vane shear; peak/remouded (kPa)
R refusal
HB hammer bouncing

classification symbol & soil description
based on Unified Classification System

moisture
D dry
M moist
W wet
Wp plastic limit
Wl liquid limit

consistency / relative density
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense

Engineering Log - Borehole

Borehole ID.	**BH6**
sheet:	1 of 1
project no.	**GEOTALST03696AA**
client:	**LIVING GEMS PTY LTD**
date started:	**28 Jun 2016**
principal:	
date completed:	**28 Jun 2016**
project:	**SENIORS' LIVING DEVELOPMENT, SKENNARS HEAD**
logged by:	**ZC**
location:	**67 SKENNARS HEAD ROAD**
checked by:	**RV**

position: E: 558,430; N: 6,811,227 (Datum Not Specified) surface elevation: 100 m (Datum Not Specified) angle from horizontal: 90°

drill model: GOT 2008, Truck mounted drilling fluid: hole diameter : 100 mm

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	hand penetrometer (kPa) 100 200 300 400	structure and additional observations
AD/V — N		28/06/16 ▽	SPT 1, 1, 1 N*=2	100			ML	**Clayey SILT**: low liquid limit, dark brown, with some organics.	M	S to VS		**ALLUVIUM**
							SP	**SAND**: fine grained, dark brown.		L		
			SPT 3, 7, 6 N*=13					Colour change to grey.		D		
			SPT 22, 25/50mm, /0mm N*=R	99	1.0			Colour change to dark brown.	W	VD		**INDURATED SAND**
			SPT 25/100mm, /0mm, /0mm HB N*=R									
			SPT 23, 25/70mm, /0mm N*=R	98	2.0							
				97	3.0			Borehole BH6 terminated at 2.5 m				
				96	4.0							
				95	5.0							

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method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore

* bit shown by suffix
e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration
1 2 3 — no resistance ranging to refusal

water
- 10-Oct-12 water level on date shown
- water inflow
- water outflow

samples & field tests
- B bulk disturbed sample
- D disturbed sample
- E environmental sample
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remouded (kPa)
- R refusal
- HB hammer bouncing

classification symbol & soil description based on Unified Classification System

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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Engineering Log - Borehole

Borehole ID.	**BH7**
sheet:	1 of 1
project no.	**GEOTALST03696AA**
client:	**LIVING GEMS PTY LTD**
date started:	**29 Jun 2016**
principal:	
date completed:	**29 Jun 2016**
project:	**SENIORS' LIVING DEVELOPMENT, SKENNARS HEAD**
logged by:	**ZC**
location:	**67 SKENNARS HEAD ROAD**
checked by:	**RV**

position: E: 558,368; N: 6,811,090 (Datum Not Specified) surface elevation: 100 m (Datum Not Specified) angle from horizontal: 90°

drill model: GOT 2008, Truck mounted drilling fluid: hole diameter : 100 mm

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	hand penetrometer (kPa) 100 200 300 400	structure and additional observations
AD/V — N			SPT 1, 0, 0 N*=0	100			ML	**Clayey SILT**: low liquid limit, black, with some fine grained sand and with some organics.	M	F		**ALLUVIUM**
			SPT 0, 0, 0 N*=0					Colour change to dark brown.			HP 55 kPa	
			SPT 5, 7, 8 N*=15	99	1.0		SP	**SAND**: fine grained, dark brown.		D	HP 45 kPa	
			SPT 15, 25, 25/100mm N*=R							VD		**INDURATED SAND**
		29/06/16	SPT 25/90mm, /0mm, /0mm N*=R	98	2.0				W			
								Borehole BH7 terminated at 2.5 m				
				97	3.0							
				96	4.0							
				95	5.0							

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method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore
- * bit shown by suffix
- e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration
1 2 3 — no resistance ranging to refusal

water
- 10-Oct-12 water level on date shown
- water inflow
- water outflow

samples & field tests
- B bulk disturbed sample
- D disturbed sample
- E environmental sample
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remouded (kPa)
- R refusal
- HB hammer bouncing

classification symbol & soil description based on Unified Classification System

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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Engineering Log - Borehole

Borehole ID.	**BH8**
sheet:	1 of 1
project no.	**GEOTALST03696AA**
date started:	**28 Jun 2016**
date completed:	**28 Jun 2016**
logged by:	**ZC**
checked by:	**RV**

client: ***LIVING GEMS PTY LTD***

principal:

project: ***SENIORS' LIVING DEVELOPMENT, SKENNARS HEAD***

location: ***67 SKENNARS HEAD ROAD***

position: E: 558,395; N: 6,811,101 (Datum Not Specified) surface elevation: 100 m (Datum Not Specified) angle from horizontal: 90°

drill model: GOT 2008, Truck mounted drilling fluid: hole diameter : 100 mm

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	hand penetrometer (kPa) 100 200 300 400	structure and additional observations
AD/V — N			SPT 0, 1, 0 N*=1	100			SP	**SILTY SAND**: fine grained, Black, with some organics.	M	VL to L		**ALLUVIUM**
			SPT 1, 2, 3 N*=5				SP	**SAND**: fine grained, Brown.		MD		
			SPT 2, 3, 7 N*=10	99	1.0			Colour change to dark brown		D		
		28/06/16 ▽	SPT 12, 25/100mm, /0mm N*=R						W	VD		**INDURATED SAND**
			SPT 25/90mm, /0mm, /0mm N*=R	98	2.0							
								Borehole BH8 terminated at 2.5 m				
				97	3.0							
				96	4.0							
				95	5.0							

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method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore
- * bit shown by suffix
- e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration
1 2 3 — no resistance ranging to refusal

water
- 10-Oct-12 water level on date shown
- water inflow
- water outflow

samples & field tests
- B bulk disturbed sample
- D disturbed sample
- E environmental sample
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remouded (kPa)
- R refusal
- HB hammer bouncing

classification symbol & soil description based on Unified Classification System

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Soil Description Explanation Sheet (1 of 2)

DEFINITION:
In engineering terms soil includes every type of uncemented or partially cemented inorganic or organic material found in the ground. In practice, if the material can be remoulded or disintegrated by hand in its field condition or in water it is described as a soil. Other materials are described using rock description terms.

CLASSIFICATION SYMBOL & SOIL NAME

Soils are described in accordance with the Unified Soil Classification (UCS) as shown in the table on Sheet 2.

PARTICLE SIZE DESCRIPTIVE TERMS

NAME	SUBDIVISION	SIZE
Boulders		>200 mm
Cobbles		63 mm to 200 mm
Gravel	coarse	20 mm to 63 mm
	medium	6 mm to 20 mm
	fine	2.36 mm to 6 mm
Sand	coarse	600 µm to 2.36 mm
	medium	200 µm to 600 µm
	fine	75 µm to 200 µm

MOISTURE CONDITION

Dry	Looks and feels dry. Cohesive and cemented soils are hard, friable or powdery. Uncemented granular soils run freely through hands.
Moist	Soil feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.
Wet	As for moist but with free water forming on hands when handled.

CONSISTENCY OF COHESIVE SOILS

TERM	UNDRAINED STRENGTH s_u (kPa)	FIELD GUIDE
Very Soft	<12	A finger can be pushed well into the soil with little effort.
Soft	12 – 25	A finger can be pushed into the soil to about 25mm depth.
Firm	25 – 50	The soil can be indented about 5mm with the thumb, but not penetrated.
Stiff	50 – 100	The surface of the soil can be indented with the thumb, but not penetrated.
Very Stiff	100 – 200	The surface of the soil can be marked, but not indented with thumb pressure.
Hard	>200	The surface of the soil can be marked only with the thumbnail.
Friable	–	Crumbles or powders when scraped by thumbnail.

DENSITY OF GRANULAR SOILS

TERM	DENSITY INDEX (%)
Very loose	Less than 15
Loose	15 – 35
Medium Dense	35 – 65
Dense	65 – 85
Very Dense	Greater than 85

MINOR COMPONENTS

TERM	ASSESSMENT GUIDE	PROPORTION OF MINOR COMPONENT IN:
Trace of	Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary component.	Coarse grained soils: <5% Fine grained soils: <15%
With some	Presence easily detected by feel or eye, soil properties little different to general properties of primary component.	Coarse grained soils: 5 - 12% Fine grained soils: 15 - 30%

SOIL STRUCTURE

ZONING		CEMENTING	
Layers	Continuous across exposure or sample.	Weakly cemented	Easily broken up by hand in air or water.
Lenses	Discontinuous shape.	Moderately cemented	Effort is required to break up the soil by hand in air or water.
Pockets	Irregular inclusions of different material.		

GEOLOGICAL ORIGIN WEATHERED IN PLACE SOILS

Extremely weathered material	Structure and fabric of parent rock visible.
Residual soil	Structure and fabric of parent rock not visible.

TRANSPORTED SOILS

Aeolian soil	Deposited by wind.
Alluvial soil	Deposited by streams and rivers.
Colluvial soil	Deposited on slopes (transported downslope by gravity).
Fill	Man made deposit. Fill may be significantly more variable between tested locations than naturally occurring soils.
Lacustrine soil	Deposited by lakes.
Marine soil	Deposited in ocean basins, bays, beaches and estuaries.

Soil Description Explanation Sheet (2 of 2)

SOIL CLASSIFICATION INCLUDING IDENTIFICATION AND DESCRIPTION

FIELD IDENTIFICATION PROCEDURES USC (Excluding particles larger than 60 mm and basing fractions on estimated mass)							USC	PRIMARY NAME
COARSE GRAIINED SOILS More than 50% of materials less than 63 mm is larger than 0.075 mm	(A 0.075 mm particle is about the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than 2.36 mm	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes			GW	GRAVEL
				Predominantly one size or a range of sizes with more intermediate sizes missing.			GP	GRAVEL
			GRAVELS WITH FINES Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)			GM	SILTY GRAVEL
				Plastic fines (for identification procedures see CL below)			GC	CLAYEY GRAVEL
		SANDS More than half of coarse fraction is smaller than 2.36 mm	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate sizes			SW	SAND
				Predominantly one size or a range of sizes with some intermediate sizes missing.			SP	SAND
			SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).			SM	SILTY SAND
				Plastic fines (for identification procedures see CL below).			SC	CLAYEY SAND
FINE GRAINED SOILS More than 50% of material less than 63 mm is smaller than 0.075 mm			IDENTIFICATION PROCEDURES ON FRACTIONS <0.2 mm					
		SILTS & CLAYS Liquid limit less than 50	**DRY STRENGTH**	**DILATANCY**	**TOUGHNESS**			
			None to Low	Quick to slow	None		ML	SILT
			Medium to High	None	Medium		CL	CLAY
			Low to medium	Slow to very slow	Low		CL	ORGANIC SILT
		SILTS & CLAYS Liquid limit greater than 50	Low to medium	Slow to very slow	Low to medium		MH	SILT
			High	None	High		CH	CLAY
			Medium to High	None	Low to medium		OH	ORGANIC CLAY
HIGHLY ORGANIC SOILS			Readily identified by colour, odour, spongy feel andfrequently by fibrous texture.				PT	PEAT

● Low plasticity – Liquid Limit w_L less than 35%. ● Medium plasticity – w_L between 35% and 50%. ● High plasticity – w_L greater than 50%.

COMMON DEFECTS IN SOIL

TERM	DEFINITION	DIAGRAM
PARTING	A surface or crack across which the soil has little or no tensile strength. Parallel or sub parallel to layering (eg bedding). May be open or closed.	
JOINT	A surface or crack across which the soil has little or no tensile strength. Parallel or sub parallel to layering (eg bedding). May be open or closed.	
SHEARED ZONE	A surface or crack across which the soil has little or no tensile strength but which is not parallel or sub parallel to layering. May be open or closed. The term 'fissure' may be used for irregular joints <0.2 m in length	
SHEARED SURFACE	Zone in clayey soil with roughly parallel near planar, curved or undulating boundaries containing closely spaced, smooth or slickensided, curved intersecting joints which divide the mass into lenticular or wedge shaped blocks.	

TERM	DEFINITION	DIAGRAM
SOFTENED ZONE	A near planar curved or undulating, smooth, polished or slickensided surface in clayey soil. The polished or slickensided surface indicates that movement (in many cases very little) has occurred along the defect.	
TUBE	A zone in clayey soil, usually adjacent to a defect in which the soil has a higher moisture content than elsewhere.	
TUBE CAST	Roughly cylindrical elongated body of soil different from the soil mass in which it occurs. In some cases the soil which makes up the tube cast is cemented.	
INFILLED SEAM	Sheet or wall like body of soil substance or mass with roughly planar to irregular near parallel boundaries which cuts through a soil mass. Formed by infilling of open joints.	

Rock Description Explanation Sheet (1 of 2)

The descriptive terms used by Coffey are given below. They are broadly consistent with Australian Standard AS1726-1993.

DEFINITIONS: Rock substance, defect and mass are defined as follows:

Rock Substance In engineering terms rock substance is any naturally occurring aggregate of minerals and organic material which cannot be disintegrated or remoulded by hand in air or water. Other material is described using soil descriptive terms. Effectively homogenous material, may be isotropic or anisotropic.

Defect Discontinuity or break in the continuity of a substance or substances.

Mass Any body of material which is not effectively homogeneous. It can consist of two or more substances without defects, or one or more substances with one or more defects.

SUBSTANCE DESCRIPTIVE TERMS:

ROCK NAME	Simple rock names are used rather than precise geological classification.
PARTICLE SIZE	Grain size terms for sandstone are:
Coarse grained	Mainly 0.6mm to 2mm
Medium grained	Mainly 0.2mm to 0.6mm
Fine grained	Mainly 0.06mm (just visible) to 0.2mm
FABRIC	Terms for layering of penetrative fabric (eg. bedding, cleavage etc.) are:
Massive	No layering or penetrative fabric.
Indistinct	Layering or fabric just visible. Little effect on properties.
Distinct	Layering or fabric is easily visible. Rock breaks more easily parallel to layering of fabric.

CLASSIFICATION OF WEATHERING PRODUCTS

Term	Abbreviation	Definition
Residual Soil	**RS**	Soil derived from the weathering of rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.
Extremely Weathered Material	**XW**	Material is weathered to such an extent that it has soil properties, ie, it either disintegrates or can be remoulded in water. Original rock fabric still visible.
Highly Weathered Rock	**HW**	Rock strength is changed by weathering. The whole of the rock substance is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Some minerals are decomposed to clay minerals. Porosity may be increased by leaching or may be decreased due to the deposition of minerals in pores.
Moderately Weathered Rock	**MW**	The whole of the rock substance is discoloured, usually by iron staining or bleaching , to the extent that the colour of the fresh rock is no longer recognisable.
Slightly Weathered Rock	**SW**	Rock substance affected by weathering to the extent that partial staining or partial discolouration of the rock substance (usually by limonite) has taken place. The colour and texture of the fresh rock is recognisable; strength properties are essentially those of the fresh rock substance.
Fresh Rock	**FR**	Rock substance unaffected by weathering.

Notes on Weathering:
AS1726 suggests the term "Distinctly Weathered" (DW) to cover the range of substance weathering conditions between XW and SW. For projects where it is not practical to delineate between HW and MW or it is judged that there is no advantage in making such a distinction. DW may be used with the definition given in AS1726. Where physical and chemical changes were caused by hot gasses and liquids associated with igneous rocks, the term "altered" may be substituted for "weathering" to give the abbreviations XA, HA, MA, SA and DA.

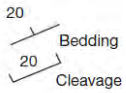
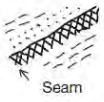
ROCK SUBSTANCE STRENGTH TERMS

Term	Abbre-viation	Point Load Index, $I_{s(50)}$ (MPa)	Field Guide
Very Low	**VL**	Less than 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with a knife; pieces up to 30mm thick can be broken by finger pressure.
Low	**L**	0.1 to 0.3	Easily scored with a knife; indentations 1mm to 3mm show with firm bows of a pick point; has a dull sound under hammer. Pieces of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium	**M**	0.3 to 1.0	Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.
High	**H**	1 to 3	A piece of core 150mm long by 50mm can not be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High	**VH**	3 to 10	Hand specimen breaks after more than one blow of a pick; rock rings under hammer.
Extremely High	**EH**	More than 10	Specimen requires many blows with geological pick to break; rock rings under hammer.

Notes on Rock Substance Strength:
In anisotropic rocks the field guide to strength applies to the strength perpendicular to the anisotropy. High strength anisotropic rocks may break readily parallel to the planar anisotropy.
The term "extremely low" is not used as a rock substance strength term. While the term is used in AS1726-1993, the field guide therein makes it clear that materials in that strength range are soils in engineering terms.
The unconfined compressive strength for isotropic rocks (and anisotropic rocks which fall across the planar anisotropy) is typically 10 to 25 times the point load index Is(50). The ratio may vary for different rock types. Lower strength rocks often have lower ratios than higher strength rocks.

Rock Description Explanation Sheet (2 of 2)

COMMON DEFECTS IN ROCK MASSES

Term	Definition	Diagram	Map Symbol	Graphic Log (Note 1)
Parting	A surface or crack across which the rock has little or no tensile strength. but which is not parallel or sub parallel to layering or planar anisotropy in the rock substance. May be open or closed.			 (Note 2)
Joint	A surface or crack across which the rock has little or no tensile strength. but which is not parallel or sub parallel to layering or planar anisotropy in the rock substance. May be open or closed.			 (Note 2)
Sheared Zone (Note 3)	Zone of rock substance with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge shaped blocks.			
Sheared Surface (Note 3)	A near planar, curved or undulating surface which is usually smooth, polished or slickensided.			
Crushed Seam (Note 3)	Seam with roughly parallel almost planar boundaries, composed of disoriented, usually angular fragments of the host rock substance which may be more weathered than the host rock. The seam has soil properties			
Infilled Seam	Seam of soil substance usually with distinct roughly parallel boundaries formed by the migration of soil into an open cavity or joint, infilled seams less than 1mm thick may be described as veneer or coating on joint surface.			
Extremely Weathered Seam	Seam of soil substance, often with gradational boundaries. Formad by weathering of the rock substance in place.			

Notes on Defects:

1. Usually borehole logs show the true dip of defects and face sketches and sections the apparent dip.
2. Partings and joints are not usually shown on the graphic log unless considered significant.
3. Sheared zones, sheared surfaces and crushed seams are faults in geological terms.

DEFECT SHAPE TERMS

Planar	The defect does not vary in orientation
Curved	The defect has a gradual change in orientation
Undulating	The defect has a wavy surface
Stepped	The defect has one or more well defined steps
Irregular	The defect has many sharp changes of orientation

Note: The assessment of defect shape is partly influenced by the scale of the observation.

ROUGHNESS TERMS

Slickensided	Grooved or striated surface, usually polished
Polished	Shiny smooth surface
Smooth	Smooth to touch. Few or no surface irregularities
Rough	Many small surface irregularities (amplitude generally less than 1mm). Feels like fine to coarse sand paper.
Very Rough	Many large surface irregularities (amplitude generally more than 1mm). Feels like, or coarser than very coarse sand paper.

COATING TERMS

Clean	No visible coating
Stained	No visible coating but surfaces are discoloured
Veneer	A visible coating of soil or mineral, too thin to measure; may be patchy
Veneer	A visible coating up to 1mm thick. Thicker soil material is usually described using appropriate defect terms (eg, infilled seam). Thicker rock strength material is usually described as a vein.

BLOCK SHAPE TERMS

Blocky	Approximately equidimensional
Tabular	Thickness much less than length or width
Columnar	Height much greater than cross section

72710 / 07-06

Appendix B - Geotechnical Laboratory Test Results

Coffs Harbour Laboratory

Coffey Corporate Services Pty Ltd
ABN 55 139 460 521
1/18 Hurley Drive
Coffs Harbour NSW 2450

Phone: +61 2 6691 7300
Fax: +61 2 6651 5194

Material Test Report

Report No: COFH16S-02043-1
Issue No: 1

Client:	Coffey Corporate Services Pty Ltd (Alstonville) 1/5 Bugden Avenue Alstonville NSW 2477
Principal:	
Project No.:	INFOCOFH00635AA
Project Name:	GEOTALST03696AA - Geotechnical, ASS and ESA at Skennars Head
Lot No.:	N/A **TRN:** N/A

Accredited for compliance with ISO/IEC 17025.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Approved Signatory: Cameron Crawford
(Laboratory Manager)
NATA Accredited Laboratory Number:431
Date of Issue: 1/08/2016

Sample Details

Sample ID:	COFH16S-02043
Client Sample:	1
Date Sampled:	27/06/2016
Source:	Site
Material:	Insitu
Specification:	No Specification
Sampling Method:	Submitted by client
Project Location:	Skennars Head, NSW
Sample Location:	BH2 5.0-5.45m

Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	76.0	
Date Tested		22/07/2016	
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	13.0	
Mould Length (mm)		250	
Curling		Yes	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.2	65	
Method		One Point	
Plastic Limit (%)	AS 1289.3.2.1	26	
Plasticity Index (%)	AS 1289.3.3.1	39	
Date Tested		27/07/2016	

Comments

N/A

Coffs Harbour Laboratory

Coffey Corporate Services Pty Ltd
ABN 55 139 460 521
1/18 Hurley Drive
Coffs Harbour NSW 2450

Phone: +61 2 6691 7300
Fax: +61 2 6651 5194

Material Test Report

Report No: COFH16S-02044-1
Issue No: 1

Client:	Coffey Corporate Services Pty Ltd (Alstonville) 1/5 Bugden Avenue Alstonville NSW 2477
Principal:	
Project No.:	INFOCOFH00635AA
Project Name:	GEOTALST03696AA - Geotechnical, ASS and ESA at Skennars Head
Lot No.:	N/A **TRN:** N/A

Accredited for compliance with ISO/IEC 17025.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Approved Signatory: Cameron Crawford
(Laboratory Manager)
NATA Accredited Laboratory Number:431
Date of Issue: 1/08/2016

Sample Details

Sample ID:	COFH16S-02044
Client Sample:	2
Date Sampled:	27/06/2016
Source:	Site
Material:	Insitu
Specification:	No Specification
Sampling Method:	Submitted by client
Project Location:	Skennars Head, NSW
Sample Location:	BH2 6.5-6.95m

Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	82.0	
Date Tested		22/07/2016	
Sample History	AS 1289.1.1	Air	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	17.0	
Mould Length (mm)		250	
Curling		Yes	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.2	67	
Method		One Point	
Plastic Limit (%)	AS 1289.3.2.1	26	
Plasticity Index (%)	AS 1289.3.3.1	41	
Date Tested		27/07/2016	

Comments

N/A

Coffs Harbour Laboratory

Coffey Corporate Services Pty Ltd
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1/18 Hurley Drive
Coffs Harbour NSW 2450

Phone: +61 2 6691 7300
Fax: +61 2 6651 5194

Material Test Report

Report No: COFH16S-02045-1
Issue No: 1

Client:	Coffey Corporate Services Pty Ltd (Alstonville) 1/5 Bugden Avenue Alstonville NSW 2477
Principal:	
Project No.:	INFOCOFH00635AA
Project Name:	GEOTALST03696AA - Geotechnical, ASS and ESA at Skennars Head
Lot No.:	N/A
TRN:	N/A

Accredited for compliance with ISO/IEC 17025.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Approved Signatory: Cameron Crawford
(Laboratory Manager)
NATA Accredited Laboratory Number:431
Date of Issue: 1/08/2016

Sample Details

Sample ID:	COFH16S-02045
Client Sample:	3
Date Sampled:	27/06/2016
Source:	Site
Material:	Insitu
Specification:	No Specification
Sampling Method:	Submitted by client
Project Location:	Skennars Head, NSW
Sample Location:	BH2 8.0-8.45m

Other Test Results

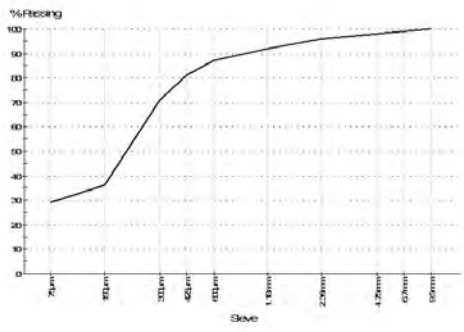
Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	30.5	
Date Tested		22/07/2016	
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	8.0	
Mould Length (mm)		250	
Curling		Yes	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.2	27	
Method		One Point	
Plastic Limit (%)	AS 1289.3.2.1	11	
Plasticity Index (%)	AS 1289.3.3.1	16	
Date Tested		27/07/2016	

Particle Size Distribution

Method:	AS 1289.3.6.1
Drying by:	Oven
Date Tested:	26/07/2016
Note:	Sample Washed

Sieve Size	% Passing	Limits
9.5mm	100	
6.7mm	99	
4.75mm	98	
2.36mm	96	
1.18mm	92	
600µm	87	
425µm	81	
300µm	71	
150µm	36	
75µm	29	

Chart



Comments

N/A

Coffs Harbour Laboratory

Coffey Corporate Services Pty Ltd
ABN 55 139 460 521
1/18 Hurley Drive
Coffs Harbour NSW 2450

Phone: +61 2 6691 7300
Fax: +61 2 6651 5194

Material Test Report

Report No: COFH16S-02046-1
Issue No: 1

Client:	Coffey Corporate Services Pty Ltd (Alstonville) 1/5 Bugden Avenue Alstonville NSW 2477
Principal:	
Project No.:	INFOCOFH00635AA
Project Name:	GEOTALST03696AA - Geotechnical, ASS and ESA at Skennars Head
Lot No.:	N/A
TRN:	N/A

Accredited for compliance with ISO/IEC 17025.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Approved Signatory: Cameron Crawford
(Laboratory Manager)
NATA Accredited Laboratory Number:431
Date of Issue: 1/08/2016

Sample Details

Sample ID:	COFH16S-02046
Client Sample:	4
Date Sampled:	27/06/2016
Source:	Site
Material:	Insitu
Specification:	No Specification
Sampling Method:	Submitted by client
Project Location:	Skennars Head, NSW
Sample Location:	BH1 3.5-3.95m

Other Test Results

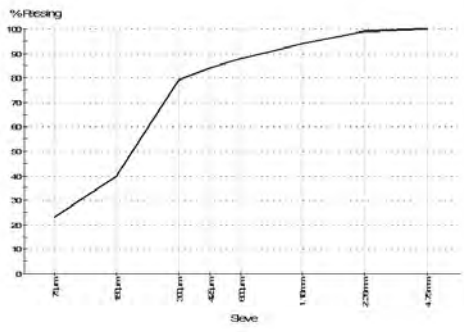
Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	45.1	
Date Tested		22/07/2016	
Sample History	AS 1289.1.1	Air	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	7.5	
Mould Length (mm)		250	
Curling		Yes	
Liquid Limit (%)	AS 1289.3.1.2	34	
Method		One Point	
Plastic Limit (%)	AS 1289.3.2.1	19	
Plasticity Index (%)	AS 1289.3.3.1	15	
Date Tested		28/07/2016	

Particle Size Distribution

Method:	AS 1289.3.6.1
Drying by:	Oven
Date Tested:	26/07/2016
Note:	Sample Washed

Sieve Size	% Passing	Limits
4.75mm	100	
2.36mm	99	
1.18mm	94	
600µm	88	
425µm	84	
300µm	79	
150µm	40	
75µm	23	

Chart



Comments

N/A

Appendix C - Acid Sulfate Soil Laboratory Certificates of Analysis

coffey

Chain of Custody

No: 19613

Laboratory Quotation / Order No: GEOTEST

Job No: 3696AA

Sheet 1 of 3

Dispatch to. (Address & Phone No.) Eurofins Unit F6 Bldg F 16 Mars Road Lane Cove West, 2066, NSW 9900 8400	Sampled by: ZC	Consigning Officer: ZC Date Dispatched: 29/6/16
Attention: Sample receipt 9900 8400	Project Manager: (report results to) Ravi Vleggaar rv@coffey.com.	Courier Service: TOLL Consignment Note No: 00903 OAKT6

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
RVleggaar.	29/6/16	2:25.	Sean	30/6	8:30

Comments	Sample Matrix	Container Type and Preservative	Sample No.	Date Sampled	Analyses Required: PAHs	TPHs	MAHs = BTEX	Metals:	Peroxide Screen	CRS Suite	Sample Condition on Receipt
BH1 0-0.5	Soil	Plastic Bag		27/6/16							230
0.5-1											
1-1.5											
1.5-2											
2-2.5											
BH2 0-0.5											
0.5-1											
1-1.5											
1.5-2											
2-2.5											
BH3 0-0.5				29/6/16							
0.5-1											
1-1.5											
1.5-2											
2-2.5											
BH 4 0-0.5				28/6/16							
0.5-1											

Special Laboratory Instructions:

Detection Limits:

Turnaround Required:

506299

JOB NUMBER MUST BE REFERENCED ON ALL SUBSEQUENT PAGES

642209-06

Copies: WHITE: Sign on release. YELLOW: If dispatched to interstate Lab, Lab to sign on receipt and fax back to Coffey. BLUE: To be returned with results.

coffey

Chain of Custody

No: 19614

Laboratory Quotation / Order No:

Job No: 3696AA

Sheet 2 of 3

Dispatch to: (Address & Phone No.) Eurofins Unit F6 Bldg F 16 MARS ROAD LANE COVE WEST, 2066, NSW 9900 8400	Sampled by: See Page 1	Consigning Officer: Date Dispatched:
Attention:	Project Manager: (report results to)	Courier Service: Consignment Note No:

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
			S.d	30/6	

Comments	Sample Matrix	Container Type and Preservative	Sample No.	Date Sampled	Analyses Required: PAHs	TPHs	MAHs = BTEX	Metals:		Peroxide Screen	CRS Suite									Sample Condition on Receipt
BH4 1-1.5	Soil	Plastic Bag		28/6/16																231
1.5-2																				
2-2.5																				
BH5 0-0.5																				
0.5-1																				
1-1.5																				
1.5-2																				
2-2.5																				
BH6 0-0.5																				
0.5-1																				
1-1.5																				
1.5-2																				
2-2.5																				
BH7 0-0.5				29/6/16																
0.5-1																				
1-1.5																				
1.5-2																				

Special Laboratory Instructions:

Detection Limits:

Turnaround Required:

JOB NUMBER MUST BE REFERENCED ON ALL SUBSEQUENT PAGES

6422D9-06

Copies: WHITE: Sign on release. YELLOW: If dispatched to interstate Lab, Lab to sign on receipt and fax back to Coffey. BLUE: To be returned with results.

coffey

Chain of Custody

No: 19615

Laboratory Quotation / Order No:

Job No: 3696AA

Sheet 3 of 3

Dispatch to: (Address & Phone No.) Eurofins unit F6 Bldg F 16 MARS ROAD Lane Cove West 2066 NSW 9900 8400	Sampled by: See page 1	Consigning Officer: 506299 Date Dispatched:
Attention:	Project Manager: (report results to)	Courier Service: Consignment Note No:

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
			Sea	30.6	

Comments	Sample Matrix	Container Type and Preservative	Sample No.	Date Sampled	Analyses Required: PAHs	TPHs	MAHs = BTEX	Metals:		Screen Peroxide	CRS Suite								Sample Condition on Receipt
BH7 2-2.5	Soil	Plastic Bag		29/6/16						/									232
BH8 0-0.5	↓	↓		28/6/16						/									
0.5-1				↓						/									
1-1.5										/									
1.5-2										/									

Special Laboratory Instructions:

Detection Limits:

Turnaround Required:

JOB NUMBER MUST BE REFERENCED ON ALL SUBSEQUENT PAGES

Copies: WHITE: Sign on release. YELLOW: If dispatched to interstate Lab, Lab to sign on receipt and fax back to Coffey BLUE: To be returned with results.

From: Zachary Cooper <Zachary.Cooper@coffey.com>
Sent: Thursday, 30 June 2016 1:23 PM
To: Ellen Wandala Gamage
Cc: Rian Vleggaar
Subject: RE: GEOTALST3696AA

Hi Ellen,

The bag with ASS written upon it is the correct bag. The other BH1 1-1.45 can be disregarded.

BH8 – 2-2.5 will also need to be peroxide screen, I must have forgot to write that on the chain of custody.

Thank you,

Zach

From: Rian Vleggaar
Sent: Thursday, 30 June 2016 1:06 PM
To: Ellen Wandala Gamage; Zachary Cooper
Cc: !AU04_CAU001_EnviroSampleNSW
Subject: RE: GEOTALST3696AA

Thanks Ellen, we'll get back to you soon,

Zach could you please advise Ellen

Rian

ES1621506299

From: Ellen Wandala Gamage [mailto:EllenWandalaGamage@eurofins.com]
Sent: Thursday, 30 June 2016 1:04 PM
To: Rian Vleggaar
Cc: !AU04_CAU001_EnviroSampleNSW
Subject: GEOTALST3696AA

Hi Rian,
Two bags have been received with the same ID BH1_1-1.45m one bag has ASS written upon it whilst the other has no other identifiers. Can you confirm which is the correct BH1_1-1.45 and is the other to be renamed?

Also an extra samples was received BH8 2-2.5 was this also for analysis?
Much appreciated
Ellen

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com web : www.eurofins.com.au

Melbourne
3-5 Kingston Town Close
Oakleigh Vic 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Sample Receipt Advice

Company name:	**Coffey Geotechnics Pty Ltd ALS**
Contact name:	Rian Vleggaar
Project name:	GEOTALST3696AA
COC number:	Not provided
Turn around time:	5 Day
Date/Time received:	Jun 30, 2016 8:30 AM
Eurofins | mgt reference:	**506299**

Sample information

☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.

☑ Sample Temperature of a random sample selected from the batch as recorded by Eurofins | mgt Sample Receipt : 4.9 degrees Celsius.

☑ All samples have been received as described on the above COC.

☑ COC has been completed correctly.

☑ Attempt to chill was evident.

☑ Appropriately preserved sample containers have been used.

☑ All samples were received in good condition.

☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.

☑ Appropriate sample containers have been used.

☒ Some samples have been subcontracted.

N/A Custody Seals intact (if used).

Notes

Extra sample received BH8 2-2.5 analysis conducted as requested

Contact notes

If you have any questions with respect to these samples please contact:

Nibha Vaidya on Phone : +61 (2) 9900 8400 or by e.mail: NibhaVaidya@eurofins.com

Results will be delivered electronically via e.mail to Rian Vleggaar - Rian.Vleggaar@coffey.com.

eurofins | mgt

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com web : www.eurofins.com.au

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NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Company Name: Coffey Geotechnics Pty Ltd ALS
Address: 1/5 Bugden Avenue
Alstonville
NSW 2477

Project Name: GEOTALST3696AA

Order No.:
Report #: 506299
Phone: 02 6628 3224
Fax: 02 6628 1833

Received: Jun 30, 2016 8:30 AM
Due: Jul 7, 2016
Priority: 5 Day
Contact Name: Rian Vleggaar

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Acid Sulfate Soils Field pH Test
Melbourne Laboratory - NATA Site # 1254 & 14271						
Sydney Laboratory - NATA Site # 18217						
Brisbane Laboratory - NATA Site # 20794						X
External Laboratory						
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**	
1	BH1 0-0.5	Jun 27, 2016		Soil	S16-Jn27155	X
2	BH1 0.5-1	Jun 27, 2016		Soil	S16-Jn27156	X
3	BH1 1-1.5	Jun 27, 2016		Soil	S16-Jn27157	X
4	BH1 1.5-2	Jun 27, 2016		Soil	S16-Jn27158	X
5	BH1 2-2.5	Jun 27, 2016		Soil	S16-Jn27159	X
6	BH2 0-0.5	Jun 27, 2016		Soil	S16-Jn27160	X
7	BH2 0.5-1	Jun 27, 2016		Soil	S16-Jn27161	X
8	BH2 1-1.5	Jun 27, 2016		Soil	S16-Jn27162	X
9	BH2 1.5-2	Jun 27, 2016		Soil	S16-Jn27163	X
10	BH2 2-2.5	Jun 27, 2016		Soil	S16-Jn27164	X
11	BH3 0-0.5	Jun 29, 2016		Soil	S16-Jn27165	X

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ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
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Site # 1254 & 14271

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Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Company Name: Coffey Geotechnics Pty Ltd ALS
Address: 1/5 Bugden Avenue
Alstonville
NSW 2477

Project Name: GEOTALST3696AA

Order No.:
Report #: 506299
Phone: 02 6628 3224
Fax: 02 6628 1833

Received: Jun 30, 2016 8:30 AM
Due: Jul 7, 2016
Priority: 5 Day
Contact Name: Rian Vleggaar

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Acid Sulfate Soils Field pH Test
Melbourne Laboratory - NATA Site # 1254 & 14271						
Sydney Laboratory - NATA Site # 18217						
Brisbane Laboratory - NATA Site # 20794						X
External Laboratory						
12	BH3 0.5-1	Jun 29, 2016		Soil	S16-Jn27166	X
13	BH3 1-1.5	Jun 29, 2016		Soil	S16-Jn27167	X
14	BH3 1.5-2	Jun 29, 2016		Soil	S16-Jn27168	X
15	BH3 2-2.5	Jun 29, 2016		Soil	S16-Jn27169	X
16	BH4 0-0.5	Jun 28, 2016		Soil	S16-Jn27170	X
17	BH4 0.5-1	Jun 28, 2016		Soil	S16-Jn27171	X
18	BH4 1-1.5	Jun 28, 2016		Soil	S16-Jn27172	X
19	BH4 1.5-2	Jun 28, 2016		Soil	S16-Jn27173	X
20	BH4 2-2.5	Jun 28, 2016		Soil	S16-Jn27174	X
21	BH5 0-0.5	Jun 28, 2016		Soil	S16-Jn27175	X
22	BH5 0.5-1	Jun 28, 2016		Soil	S16-Jn27176	X
23	BH5 1-1.5	Jun 28, 2016		Soil	S16-Jn27177	X

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NATA # 1261 Site # 20794

Company Name: Coffey Geotechnics Pty Ltd ALS
Address: 1/5 Bugden Avenue
Alstonville
NSW 2477

Project Name: GEOTALST3696AA

Order No.:
Report #: 506299
Phone: 02 6628 3224
Fax: 02 6628 1833

Received: Jun 30, 2016 8:30 AM
Due: Jul 7, 2016
Priority: 5 Day
Contact Name: Rian Vleggaar

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Acid Sulfate Soils Field pH Test
Melbourne Laboratory - NATA Site # 1254 & 14271						
Sydney Laboratory - NATA Site # 18217						
Brisbane Laboratory - NATA Site # 20794						X
External Laboratory						
24	BH5 1.5-2	Jun 28, 2016		Soil	S16-Jn27178	X
25	BH5 2-2.5	Jun 28, 2016		Soil	S16-Jn27179	X
26	BH6 0-0.5	Jun 28, 2016		Soil	S16-Jn27180	X
27	BH6 0.5-1	Jun 28, 2016		Soil	S16-Jn27181	X
28	BH6 1-1.5	Jun 28, 2016		Soil	S16-Jn27182	X
29	BH6 1.5-2	Jun 28, 2016		Soil	S16-Jn27183	X
30	BH6 2-2.5	Jun 28, 2016		Soil	S16-Jn27184	X
31	BH7 0-0.5	Jun 29, 2016		Soil	S16-Jn27185	X
32	BH7 0.5-1	Jun 29, 2016		Soil	S16-Jn27186	X
33	BH7 1-1.5	Jun 29, 2016		Soil	S16-Jn27187	X
34	BH7 1.5-2	Jun 29, 2016		Soil	S16-Jn27188	X
35	BH7 2-2.5	Jun 29, 2016		Soil	S16-Jn27189	X

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Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Company Name:	Coffey Geotechnics Pty Ltd ALS	**Order No.:**		**Received:**	Jun 30, 2016 8:30 AM
Address:	1/5 Bugden Avenue	**Report #:**	506299	**Due:**	Jul 7, 2016
	Alstonville	**Phone:**	02 6628 3224	**Priority:**	5 Day
	NSW 2477	**Fax:**	02 6628 1833	**Contact Name:**	Rian Vleggaar
Project Name:	GEOTALST3696AA				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Acid Sulfate Soils Field pH Test
Melbourne Laboratory - NATA Site # 1254 & 14271						
Sydney Laboratory - NATA Site # 18217						
Brisbane Laboratory - NATA Site # 20794						X
External Laboratory						
36	BH8 0-0.5	Jun 28, 2016		Soil	S16-Jn27190	X
37	BH8 0.5-1	Jun 28, 2016		Soil	S16-Jn27191	X
38	BH8 1-1.5	Jun 28, 2016		Soil	S16-Jn27192	X
39	BH8 1.5-2	Jun 28, 2016		Soil	S16-Jn27193	X
40	BH8 2-2.5	Jun 27, 2016		Soil	S16-Jn27234	X
Test Counts						40

Certificate of Analysis

Coffey Geotechnics Pty Ltd ALS
1/5 Bugden Avenue
Alstonville
NSW 2477

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Attention: **Rian Vleggaar**

Report **506299-S**
Project name GEOTALST3696AA
Received Date Jun 30, 2016

Client Sample ID			**BH1 0-0.5**	**BH1 0.5-1**	**BH1 1-1.5**	**BH1 1.5-2**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**S16-Jn27155**	**S16-Jn27156**	**S16-Jn27157**	**S16-Jn27158**
Date Sampled			**Jun 27, 2016**	**Jun 27, 2016**	**Jun 27, 2016**	**Jun 27, 2016**
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	5.5	5.5	4.5	4.6
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.3	3.9	3.3	2.3
Reaction Ratings*[S05]		comment	1.0	1.0	1.0	3.0

Client Sample ID			**BH1 2-2.5**	**BH2 0-0.5**	**BH2 0.5-1**	**BH2 1-1.5**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**S16-Jn27159**	**S16-Jn27160**	**S16-Jn27161**	**S16-Jn27162**
Date Sampled			**Jun 27, 2016**	**Jun 27, 2016**	**Jun 27, 2016**	**Jun 27, 2016**
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	5.3	5.9	6.3	6.1
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	1.6	4.1	4.6	4.4
Reaction Ratings*[S05]		comment	4.0	2.0	1.0	3.0

Client Sample ID			**BH2 1.5-2**	**BH2 2-2.5**	**BH3 0-0.5**	**BH3 0.5-1**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**S16-Jn27163**	**S16-Jn27164**	**S16-Jn27165**	**S16-Jn27166**
Date Sampled			**Jun 27, 2016**	**Jun 27, 2016**	**Jun 29, 2016**	**Jun 29, 2016**
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	6.2	6.0	5.8	4.9
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	4.4	3.1	4.1	3.9
Reaction Ratings*[S05]		comment	3.0	4.0	2.0	1.0

Client Sample ID			BH3 1-1.5	BH3 1.5-2	BH3 2-2.5	BH4 0-0.5
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins | mgt Sample No.			S16-Jn27167	S16-Jn27168	S16-Jn27169	S16-Jn27170
Date Sampled			Jun 29, 2016	Jun 29, 2016	Jun 29, 2016	Jun 28, 2016
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	4.9	4.8	4.6	4.8
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.7	3.5	3.5	1.8
Reaction Ratings*[S05]		comment	1.0	1.0	1.0	3.0

Client Sample ID			BH4 0.5-1	BH4 1-1.5	BH4 1.5-2	BH4 2-2.5
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins | mgt Sample No.			S16-Jn27171	S16-Jn27172	S16-Jn27173	S16-Jn27174
Date Sampled			Jun 28, 2016	Jun 28, 2016	Jun 28, 2016	Jun 28, 2016
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	4.8	4.9	5.0	5.8
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	2.7	2.4	2.5	2.2
Reaction Ratings*[S05]		comment	3.0	3.0	3.0	2.0

Client Sample ID			BH5 0-0.5	BH5 0.5-1	BH5 1-1.5	BH5 1.5-2
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins | mgt Sample No.			S16-Jn27175	S16-Jn27176	S16-Jn27177	S16-Jn27178
Date Sampled			Jun 28, 2016	Jun 28, 2016	Jun 28, 2016	Jun 28, 2016
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	5.6	5.5	5.6	5.9
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.3	3.7	3.5	3.5
Reaction Ratings*[S05]		comment	3.0	1.0	3.0	4.0

Client Sample ID			BH5 2-2.5	BH6 0-0.5	BH6 0.5-1	BH6 1-1.5
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins | mgt Sample No.			S16-Jn27179	S16-Jn27180	S16-Jn27181	S16-Jn27182
Date Sampled			Jun 28, 2016	Jun 28, 2016	Jun 28, 2016	Jun 28, 2016
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	6.0	4.4	4.9	4.4
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.6	3.1	2.6	2.9
Reaction Ratings*[S05]		comment	4.0	3.0	3.0	1.0

Client Sample ID			BH6 1.5-2	BH6 2-2.5	BH7 0-0.5	BH7 0.5-1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins | mgt Sample No.			S16-Jn27183	S16-Jn27184	S16-Jn27185	S16-Jn27186
Date Sampled			Jun 28, 2016	Jun 28, 2016	Jun 29, 2016	Jun 29, 2016
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	5.0	5.6	6.2	6.0
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	2.4	3.3	3.8	4.1
Reaction Ratings*[S05]		comment	3.0	3.0	3.0	3.0

Client Sample ID			BH7 1-1.5	BH7 1.5-2	BH7 2-2.5	BH8 0-0.5
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**S16-Jn27187**	**S16-Jn27188**	**S16-Jn27189**	**S16-Jn27190**
Date Sampled			**Jun 29, 2016**	**Jun 29, 2016**	**Jun 29, 2016**	**Jun 28, 2016**
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	6.5	6.6	6.1	5.1
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	4.3	4.0	2.1	2.0
Reaction Ratings*[S05]		comment	3.0	3.0	3.0	3.0

Client Sample ID			BH8 0.5-1	BH8 1-1.5	BH8 1.5-2	BH8 2-2.5
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**S16-Jn27191**	**S16-Jn27192**	**S16-Jn27193**	**S16-Jn27234**
Date Sampled			**Jun 28, 2016**	**Jun 28, 2016**	**Jun 28, 2016**	**Jun 27, 2016**
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	5.5	6.0	6.1	6.1
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.5	3.6	3.7	3.1
Reaction Ratings*[S05]		comment	2.0	3.0	3.0	3.0

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Acid Sulfate Soils Field pH Test	Brisbane	Jul 05, 2016	7 Day

- Method: LTM-GEN-7060

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Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Company Name:	Coffey Geotechnics Pty Ltd ALS	**Order No.:**		**Received:**	Jun 30, 2016 8:30 AM
Address:	1/5 Bugden Avenue	**Report #:**	506299	**Due:**	Jul 7, 2016
	Alstonville	**Phone:**	02 6628 3224	**Priority:**	5 Day
	NSW 2477	**Fax:**	02 6628 1833	**Contact Name:**	Rian Vleggaar
Project Name:	GEOTALST3696AA				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Acid Sulfate Soils Field pH Test
Melbourne Laboratory - NATA Site # 1254 & 14271						
Sydney Laboratory - NATA Site # 18217						
Brisbane Laboratory - NATA Site # 20794						X
External Laboratory						
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**	
1	BH1 0-0.5	Jun 27, 2016		Soil	S16-Jn27155	X
2	BH1 0.5-1	Jun 27, 2016		Soil	S16-Jn27156	X
3	BH1 1-1.5	Jun 27, 2016		Soil	S16-Jn27157	X
4	BH1 1.5-2	Jun 27, 2016		Soil	S16-Jn27158	X
5	BH1 2-2.5	Jun 27, 2016		Soil	S16-Jn27159	X
6	BH2 0-0.5	Jun 27, 2016		Soil	S16-Jn27160	X
7	BH2 0.5-1	Jun 27, 2016		Soil	S16-Jn27161	X
8	BH2 1-1.5	Jun 27, 2016		Soil	S16-Jn27162	X
9	BH2 1.5-2	Jun 27, 2016		Soil	S16-Jn27163	X
10	BH2 2-2.5	Jun 27, 2016		Soil	S16-Jn27164	X
11	BH3 0-0.5	Jun 29, 2016		Soil	S16-Jn27165	X

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Melbourne Laboratory - NATA Site # 1254 & 14271						
Sydney Laboratory - NATA Site # 18217						
Brisbane Laboratory - NATA Site # 20794						X
External Laboratory						
12	BH3 0.5-1	Jun 29, 2016		Soil	S16-Jn27166	X
13	BH3 1-1.5	Jun 29, 2016		Soil	S16-Jn27167	X
14	BH3 1.5-2	Jun 29, 2016		Soil	S16-Jn27168	X
15	BH3 2-2.5	Jun 29, 2016		Soil	S16-Jn27169	X
16	BH4 0-0.5	Jun 28, 2016		Soil	S16-Jn27170	X
17	BH4 0.5-1	Jun 28, 2016		Soil	S16-Jn27171	X
18	BH4 1-1.5	Jun 28, 2016		Soil	S16-Jn27172	X
19	BH4 1.5-2	Jun 28, 2016		Soil	S16-Jn27173	X
20	BH4 2-2.5	Jun 28, 2016		Soil	S16-Jn27174	X
21	BH5 0-0.5	Jun 28, 2016		Soil	S16-Jn27175	X
22	BH5 0.5-1	Jun 28, 2016		Soil	S16-Jn27176	X
23	BH5 1-1.5	Jun 28, 2016		Soil	S16-Jn27177	X

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Sample Detail						Acid Sulfate Soils Field pH Test
Melbourne Laboratory - NATA Site # 1254 & 14271						
Sydney Laboratory - NATA Site # 18217						
Brisbane Laboratory - NATA Site # 20794						X
External Laboratory						
24	BH5 1.5-2	Jun 28, 2016		Soil	S16-Jn27178	X
25	BH5 2-2.5	Jun 28, 2016		Soil	S16-Jn27179	X
26	BH6 0-0.5	Jun 28, 2016		Soil	S16-Jn27180	X
27	BH6 0.5-1	Jun 28, 2016		Soil	S16-Jn27181	X
28	BH6 1-1.5	Jun 28, 2016		Soil	S16-Jn27182	X
29	BH6 1.5-2	Jun 28, 2016		Soil	S16-Jn27183	X
30	BH6 2-2.5	Jun 28, 2016		Soil	S16-Jn27184	X
31	BH7 0-0.5	Jun 29, 2016		Soil	S16-Jn27185	X
32	BH7 0.5-1	Jun 29, 2016		Soil	S16-Jn27186	X
33	BH7 1-1.5	Jun 29, 2016		Soil	S16-Jn27187	X
34	BH7 1.5-2	Jun 29, 2016		Soil	S16-Jn27188	X
35	BH7 2-2.5	Jun 29, 2016		Soil	S16-Jn27189	X

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Brisbane Laboratory - NATA Site # 20794						X
External Laboratory						
36	BH8 0-0.5	Jun 28, 2016		Soil	S16-Jn27190	X
37	BH8 0.5-1	Jun 28, 2016		Soil	S16-Jn27191	X
38	BH8 1-1.5	Jun 28, 2016		Soil	S16-Jn27192	X
39	BH8 1.5-2	Jun 28, 2016		Soil	S16-Jn27193	X
40	BH8 2-2.5	Jun 27, 2016		Soil	S16-Jn27234	X
Test Counts						40

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per Kilogram

mg/l: milligrams per litre

ug/l: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100ml: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery
CRM	Certified Reference Material - reported as percent recovery
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs 20-130%

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Acid Sulfate Soils Field pH Test				Result 1	Result 2	RPD			
pH-F (Field pH test)*	S16-Jn27155	CP	pH Units	5.5	5.4	pass	30%	Pass	
pH-FOX (Field pH Peroxide test)*	S16-Jn27155	CP	pH Units	3.3	3.2	pass	30%	Pass	
Reaction Ratings*	S16-Jn27155	CP	comment	1.0	1.0	pass	30%	Pass	
Duplicate									
Acid Sulfate Soils Field pH Test				Result 1	Result 2	RPD			
pH-F (Field pH test)*	S16-Jn27165	CP	pH Units	5.8	5.6	pass	30%	Pass	
pH-FOX (Field pH Peroxide test)*	S16-Jn27165	CP	pH Units	4.1	4.1	pass	30%	Pass	
Reaction Ratings*	S16-Jn27165	CP	comment	2.0	2.0	pass	30%	Pass	
Duplicate									
Acid Sulfate Soils Field pH Test				Result 1	Result 2	RPD			
pH-F (Field pH test)*	S16-Jn27175	CP	pH Units	5.6	5.5	pass	30%	Pass	
pH-FOX (Field pH Peroxide test)*	S16-Jn27175	CP	pH Units	3.3	3.3	pass	30%	Pass	
Reaction Ratings*	S16-Jn27175	CP	comment	3.0	3.0	pass	30%	Pass	
Duplicate									
Acid Sulfate Soils Field pH Test				Result 1	Result 2	RPD			
pH-F (Field pH test)*	S16-Jn27185	CP	pH Units	6.2	6.2	pass	30%	Pass	
pH-FOX (Field pH Peroxide test)*	S16-Jn27185	CP	pH Units	3.8	3.7	pass	30%	Pass	
Reaction Ratings*	S16-Jn27185	CP	comment	3.0	3.0	pass	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
S05	Field Screen uses the following fizz rating to classify the rate the samples reacted to the peroxide: 1.0; No reaction to slight. 2.0; Moderate reaction. 3.0; Strong reaction with persistent froth. 4.0; Extreme reaction.

Authorised By

Nibha Vaidya Analytical Services Manager

Glenn Jackson
National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

EnviroSampleQLD

From: EnviroSampleQLD
Sent: Thursday, 7 July 2016 4:41 PM
To: Enquiries Adelaide
Subject: FW: Eurofins | mgt Test Results, Invoice - Report S06299 : Site GEOTALST3696AA

From: Nibha Vaidya [mailto:NibhaVaidya@eurofins.com]
Sent: Thursday, 7 July 2016 2:43 PM
To: EnviroSampleQLD
Cc: Myles Clark; Esther Yew
Subject: FW: Eurofins | mgt Test Results, Invoice - Report 506299 : Site GEOTALST3696AA

Additional CrS please

Nibha Vaidya
Phone : +61 2 9900 8415
Mobile : +61 499 900 805
Email : NibhaVaidya@eurofins.com

From: Rian Vleggaar [mailto:Rian.Vleggaar@coffey.com]
Sent: Thursday, 7 July 2016 2:12 PM
To: Nibha Vaidya
Subject: RE: Eurofins | mgt Test Results, Invoice - Report 506299 : Site GEOTALST3696AA

Thanks Nibha

Please conduct CRS Suites on the following samples

BH1 2-2.5
S16-
Jn27159

BH2 1-1.5
S16-
Jn27162

BH2 2-2.5
S16-
Jn27164

BH4 1-1.5
S16-
Jn27172

BH5 1.5-2
S16-
Jn27178

BH6 0.5-1
S16-
Jn27181

BH7 2-2.5
S16-
Jn27189

BH8 0-0.5
S16-
Jn27190

Kind regards

Rian Vleggaar
Geotechnical Engineer

t: +61 2 6628 3224

>>> **Ingenuity@coffey** – it's the ideas that count

-----Original Message-----
From: NibhaVaidya@eurofins.com [mailto:NibhaVaidya@eurofins.com]
Sent: Thursday, 7 July 2016 11:55 AM
To: Rian Vleggaar
Cc: Cassandra Jackson
Subject: Eurofins | mgt Test Results, Invoice - Report 506299 : Site GEOTALST3696AA

Hi Rian,

Please find attached results and invoice for your project detailed in the subject header.

Please let me know if I can be of any further assistance.

Kind Regards,

Nibha Vaidya
Analytical Services Manager

Eurofins | mgt
Unit F3, Parkview Building
16 Mars Road
LANE COVE WEST NSW 2066
AUSTRALIA

Phone : +61 2 9900 8415
Mobile : +61 499 900 805
Fax : +61 2 9420 2977

Email : NibhaVaidya@eurofins.com
Website : environment.eurofins.com.au

Metrological Traceability – what is it? Find out more by reading Eurofins | mgt's EnviroNote: http://www.eurofins.com/media/11863205/environote_1057_-_metrological_traceability.pdf

Eurofins | mgt expands to a truly dedicated national Business Development Team through two new appointments: ***Matt Deaves*** *(WA) and* ***Michael Horne*** *(QLD).*

For the latest information on Poly- and Perfluorinated Alkyl Substances (PFASs) please click here. NOTE: WA DER PFAS Guidelines addressed. Please click here for details.

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com web : www.eurofins.com.au

Melbourne
3-5 Kingston Town Close
Oakleigh Vic 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Sample Receipt Advice

Company name:	**Coffey Geotechnics Pty Ltd ALS**
Contact name:	Rian Vleggaar
Project name:	GEOTALST3696AA ADDITIONAL ANALYSIS
COC number:	Not provided
Turn around time:	5 Day
Date/Time received:	Jul 7, 2016
Eurofins | mgt reference:	**507201**

Sample information

☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.

☑ All samples have been received as described on the above COC.

☑ COC has been completed correctly.

☑ Attempt to chill was evident.

☑ Appropriately preserved sample containers have been used.

☑ All samples were received in good condition.

☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.

☑ Appropriate sample containers have been used.

☒ Some samples have been subcontracted.

N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Nibha Vaidya on Phone : +61 (2) 9900 8400 or by e.mail: NibhaVaidya@eurofins.com

Results will be delivered electronically via e.mail to Rian Vleggaar - Rian.Vleggaar@coffey.com.

eurofins | mgt

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
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NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Company Name:	Coffey Geotechnics Pty Ltd ALS	**Order No.:**		**Received:**	Jul 7, 2016 12:00 AM
Address:	1/5 Bugden Avenue	**Report #:**	507201	**Due:**	Jul 14, 2016
	Alstonville	**Phone:**	02 6628 3224	**Priority:**	5 Day
	NSW 2477	**Fax:**	02 6628 1833	**Contact Name:**	Rian Vleggaar
Project Name:	GEOTALST3696AA ADDITIONAL ANALYSIS				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Chromium Suite	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271							
Sydney Laboratory - NATA Site # 18217							
Brisbane Laboratory - NATA Site # 20794						X	X
External Laboratory							
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
1	BH1 2-2.5	Jun 27, 2016		Soil	B16-JI05812	X	X
2	BH2 1-1.5	Jun 27, 2016		Soil	B16-JI05813	X	X
3	BH2 2-2.5	Jun 27, 2016		Soil	B16-JI05814	X	X
4	BH4 1-1.5	Jun 28, 2016		Soil	B16-JI05815	X	X
5	BH5 1.5-2	Jun 28, 2016		Soil	B16-JI05816	X	X
6	BH6 0.5-1	Jun 28, 2016		Soil	B16-JI05817	X	X
7	BH7 2-2.5	Jun 29, 2016		Soil	B16-JI05818	X	X
8	BH8 0-0.5	Jun 28, 2016		Soil	B16-JI05819	X	X
Test Counts						8	8

Certificate of Analysis

Coffey Geotechnics Pty Ltd ALS
1/5 Bugden Avenue
Alstonville
NSW 2477

NATA Accredited
Accreditation Number 1261
Site Number 20794

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Attention: **Rian Vleggaar**

Report **507201-S**
Project name GEOTALST3696AA ADDITIONAL ANALYSIS
Received Date Jul 07, 2016

Client Sample ID **Sample Matrix** **Eurofins | mgt Sample No.** **Date Sampled** Test/Reference	LOR	Unit	**BH1 2-2.5** **Soil** **B16-JI05812** **Jun 27, 2016**	**BH2 1-1.5** **Soil** **B16-JI05813** **Jun 27, 2016**	**BH2 2-2.5** **Soil** **B16-JI05814** **Jun 27, 2016**	**BH4 1-1.5** **Soil** **B16-JI05815** **Jun 28, 2016**
Chromium Suite						
pH-KCL	0.1	pH Units	4.9	5.4	5.3	4.2
Acid trail - Titratable Actual Acidity	2	mol H+/t	76	17	14	250
sulfidic - TAA equiv. S% pyrite	0.02	% pyrite S	0.12	0.03	0.02	0.40
Chromium Reducible Sulfur[S04]	0.005	% S	< 0.005	0.010	0.16	0.024
Chromium Reducible Sulfur -acidity units	3	mol H+/t	< 3	6.0	100	15
Sulfur - KCl Extractable	0.02	% S	n/a	n/a	n/a	< 0.02
HCl Extractable Sulfur	0.02	% S	n/a	n/a	n/a	< 0.02
Net Acid soluble sulfur	0.02	% S	n/a	n/a	n/a	< 0.02
Net Acid soluble sulfur - acidity units	10	mol H+/t	n/a	n/a	n/a	< 10
Net Acid soluble sulfur - equivalent S% pyrite[S02]	0.02	% S	n/a	n/a	n/a	< 0.02
Acid Neutralising Capacity (ANCbt)	0.01	%CaCO3	n/a	n/a	n/a	n/a
Acid Neutralising Capacity - acidity (ANCbt)	2	mol H+/t	n/a	n/a	n/a	n/a
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)[S03]	0.02	% S	n/a	n/a	n/a	n/a
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
Net Acidity (Sulfur Units)	0.02	% S	0.12	0.04	0.18	0.43
Net Acidity (Acidity Units)	10	mol H+/t	76	23	110	270
Liming Rate[S01]	1	kg CaCO3/t	5.7	1.7	8.6	20
Extraneous Material						
<2mm Fraction	0.005	g	64	85	81	66
>2mm Fraction	0.005	g	< 0.005	< 0.005	< 0.005	< 0.005
Analysed Material	0.1	%	100	100	100	100
Extraneous Material	0.1	%	< 0.1	< 0.1	< 0.1	< 0.1
% Moisture	1	%	14	17	18	17

Client Sample ID			BH5 1.5-2	BH6 0.5-1	BH7 2-2.5	BH8 0-0.5
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**B16-JI05816**	**B16-JI05817**	**B16-JI05818**	**B16-JI05819**
Date Sampled			**Jun 28, 2016**	**Jun 28, 2016**	**Jun 29, 2016**	**Jun 28, 2016**
Test/Reference	LOR	Unit				
Chromium Suite						
pH-KCL	0.1	pH Units	5.2	5.2	5.2	4.6
Acid trail - Titratable Actual Acidity	2	mol H+/t	30	4.0	19	83
sulfidic - TAA equiv. S% pyrite	0.02	% pyrite S	0.05	< 0.02	0.03	0.13
Chromium Reducible Sulfur[S04]	0.005	% S	0.066	0.006	0.12	< 0.005
Chromium Reducible Sulfur -acidity units	3	mol H+/t	41	4.0	75	< 3
Sulfur - KCl Extractable	0.02	% S	n/a	n/a	n/a	n/a
HCl Extractable Sulfur	0.02	% S	n/a	n/a	n/a	n/a
Net Acid soluble sulfur	0.02	% S	n/a	n/a	n/a	n/a
Net Acid soluble sulfur - acidity units	10	mol H+/t	n/a	n/a	n/a	n/a
Net Acid soluble sulfur - equivalent S% pyrite[S02]	0.02	% S	n/a	n/a	n/a	n/a
Acid Neutralising Capacity (ANCbt)	0.01	%CaCO3	n/a	n/a	n/a	n/a
Acid Neutralising Capacity - acidity (ANCbt)	2	mol H+/t	n/a	n/a	n/a	n/a
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)[S03]	0.02	% S	n/a	n/a	n/a	n/a
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
Net Acidity (Sulfur Units)	0.02	% S	0.11	< 0.02	0.15	0.13
Net Acidity (Acidity Units)	10	mol H+/t	71	< 10	93	83
Liming Rate[S01]	1	kg CaCO3/t	5.3	< 1	7.0	6.3
Extraneous Material						
<2mm Fraction	0.005	g	84	93	95	72
>2mm Fraction	0.005	g	< 0.005	< 0.005	< 0.005	< 0.005
Analysed Material	0.1	%	100	100	100	100
Extraneous Material	0.1	%	< 0.1	< 0.1	< 0.1	< 0.1
% Moisture	1	%	17	14	18	19

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Chromium Suite			
Chromium Suite	Brisbane	Jul 12, 2016	6 Week
- Method: LTM-GEN-7070			
Extraneous Material	Brisbane	Jul 12, 2016	6 Week
- Method: LTM-GEN-7050/7070			
% Moisture	Brisbane	Jul 07, 2016	14 Day
- Method: LTM-GEN-7080 Moisture			

eurofins | mgt

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com web : www.eurofins.com.au

Melbourne
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Company Name:	Coffey Geotechnics Pty Ltd ALS	**Order No.:**		**Received:**	Jul 7, 2016 12:00 AM
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	NSW 2477	**Fax:**	02 6628 1833	**Contact Name:**	Rian Vleggaar
Project Name:	GEOTALST3696AA ADDITIONAL ANALYSIS				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Chromium Suite	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271							
Sydney Laboratory - NATA Site # 18217							
Brisbane Laboratory - NATA Site # 20794						X	X
External Laboratory							
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
1	BH1 2-2.5	Jun 27, 2016		Soil	B16-Jl05812	X	X
2	BH2 1-1.5	Jun 27, 2016		Soil	B16-Jl05813	X	X
3	BH2 2-2.5	Jun 27, 2016		Soil	B16-Jl05814	X	X
4	BH4 1-1.5	Jun 28, 2016		Soil	B16-Jl05815	X	X
5	BH5 1.5-2	Jun 28, 2016		Soil	B16-Jl05816	X	X
6	BH6 0.5-1	Jun 28, 2016		Soil	B16-Jl05817	X	X
7	BH7 2-2.5	Jun 29, 2016		Soil	B16-Jl05818	X	X
8	BH8 0-0.5	Jun 28, 2016		Soil	B16-Jl05819	X	X
Test Counts						8	8

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per Kilogram

mg/l: milligrams per litre

ug/l: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100ml: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery
CRM	Certified Reference Material - reported as percent recovery
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs 20-130%

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
LCS - % Recovery									
Chromium Suite									
Chromium Reducible Sulfur			%	105			70-130	Pass	
Acid Neutralising Capacity (ANCbt)			%	90			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	B16-JI05812	CP	%	14	14	3.0	30%	Pass	
Duplicate									
Chromium Suite				Result 1	Result 2	RPD			
pH-KCL	B16-JI05813	CP	pH Units	5.4	5.4	<1	30%	Pass	
Acid trail - Titratable Actual Acidity	B16-JI05813	CP	mol H+/t	17	17	<1	30%	Pass	
sulfidic - TAA equiv. S% pyrite	B16-JI05813	CP	% pyrite S	0.03	0.03	1.0	30%	Pass	
Chromium Reducible Sulfur	B16-JI05813	CP	% S	0.010	0.010	4.0	30%	Pass	
Chromium Reducible Sulfur -acidity units	B16-JI05813	CP	mol H+/t	6.0	6.0	4.0	30%	Pass	
Sulfur - KCl Extractable	B16-JI05813	CP	% S	n/a	n/a	n/a	30%	Pass	
HCl Extractable Sulfur	B16-JI05813	CP	% S	n/a	n/a	n/a	30%	Pass	
Net Acid soluble sulfur	B16-JI05813	CP	% S	n/a	n/a	n/a	30%	Pass	
Net Acid soluble sulfur - acidity units	B16-JI05813	CP	mol H+/t	n/a	n/a	n/a	30%	Pass	
Net Acid soluble sulfur - equivalent S% pyrite	B16-JI05813	CP	% S	n/a	n/a	n/a	30%	Pass	
Acid Neutralising Capacity (ANCbt)	B16-JI05813	CP	%CaCO3	n/a	n/a	n/a	30%	Pass	
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)	B16-JI05813	CP	% S	n/a	n/a	n/a	30%	Pass	
ANC Fineness Factor	B16-JI05813	CP	factor	1.5	1.5	<1	30%	Pass	
Net Acidity (Sulfur Units)	B16-JI05813	CP	% S	0.04	0.04	n/a	30%	Pass	
Net Acidity (Acidity Units)	B16-JI05813	CP	mol H+/t	23	23	n/a	30%	Pass	
Liming Rate	B16-JI05813	CP	kg CaCO3/t	1.7	1.7	2.0	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
S01	Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil' multiply 'reported results' x 'wet bulk density of soil in t/m3'
S02	Retained Acidity is Reported when the pHKCl is less than pH 4.5
S03	Acid Neutralising Capacity is only required if the pHKCl if greater than or equal to pH 6.5
S04	Acid Sulfate Soil Samples have a 24 hour holding time unless frozen or dried within that period

Authorised By

Nibha Vaidya	Analytical Services Manager
Bryan Wilson	Senior Analyst-Metal (QLD)
Jonathon Angell	Senior Analyst-Inorganic (QLD)

Glenn Jackson
National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

Appendix D - Site History Search Documents

Letter of Authorisation

Greenlife Properties Pty Ltd

ABN: 47 617 559 151

652 Pacific Pde TUGUN 4224

20 June 2016

Mr Rian Vleggaar
Senior Geotechnical Engineer
Coffey
Unit 1/5 Bugden Avenue
ALSTONVILLE, NSW, 2477

Dear Rian,

Geotechnical and Environmental Investigation, 67 Skennars Head Road, Skennars Head (Lot 239 DP 1201225)

I , Paul Craig, on behalf of the owner of land at 67 Skennars Head Road, Skennars Head (Lot 239 DP 1201225), provide our permission for Coffey Services Australia Pty Ltd (Coffey) to conduct background, legal and other searches required to prepare an environmental site assessment and investigations associated with future development of this land as described above.

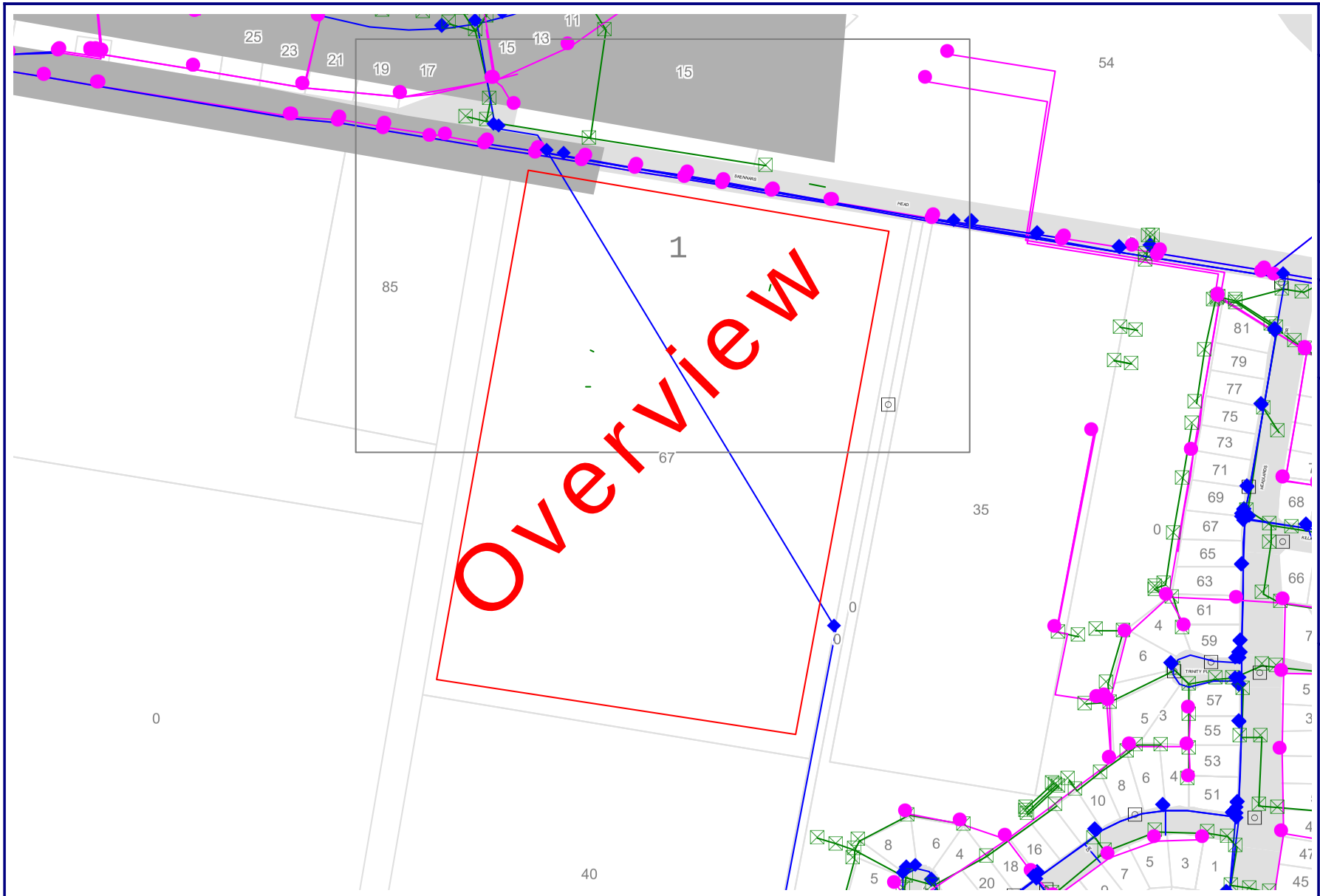
Please provide Coffey Geotechnics access to all relevant documents, plans and photographs necessary to complete their investigations.

Yours sincerely

Paul Craig

Land is Previously known as Lot 3 DP 251003

Services Search



Legend

WATER

- Water
- Recycled Water

SEWER

- Sewer

STORMWATER

- Stormwater

OTHER

- Information not complete
- SCIMS Survey Control Point
- Property Boundary ID: House Number (e.g. 4)
- Road Reserve
- Rivers

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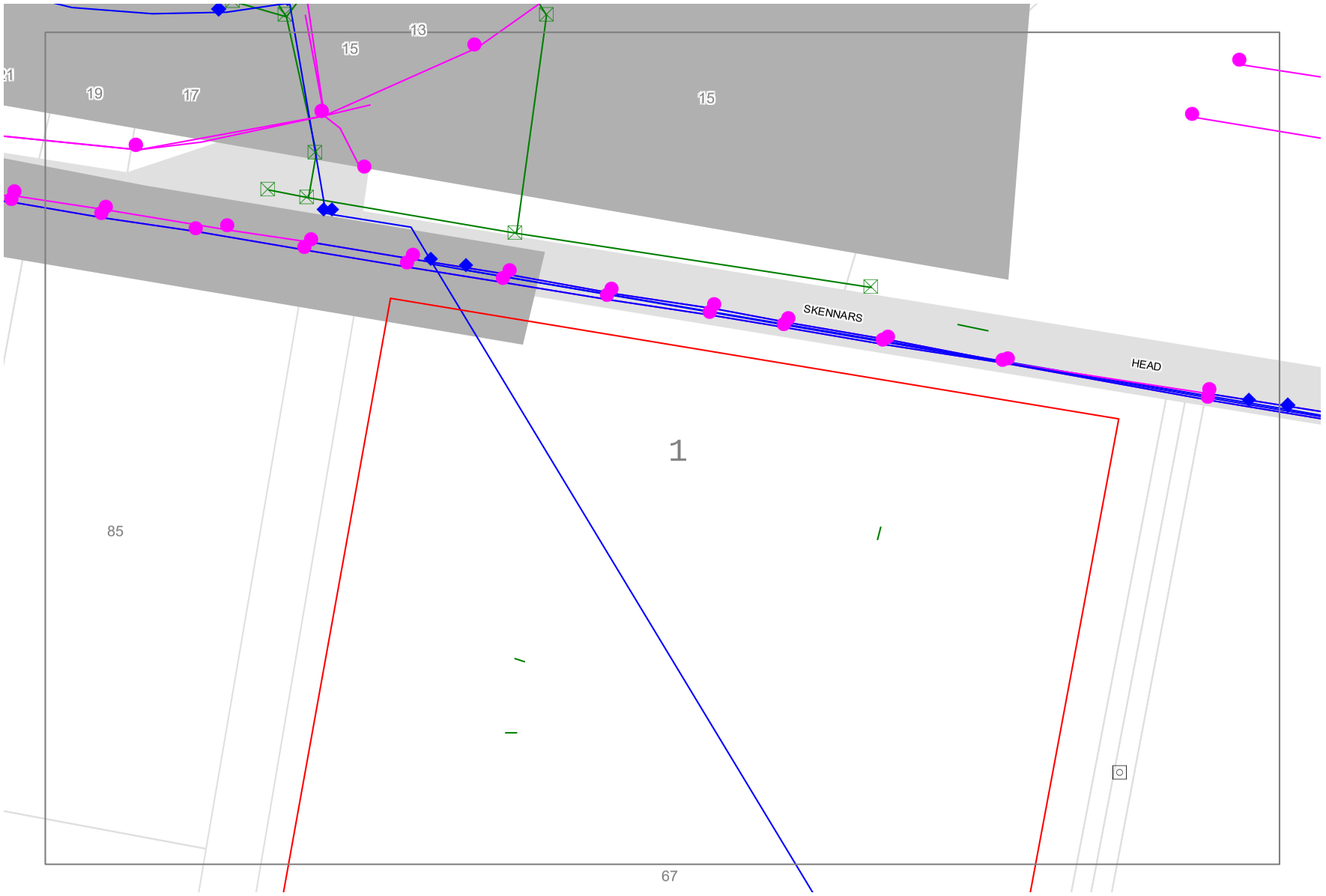
N W E S
Not to scale

Affected Infrastructure :	Council High Risk Assets
DBYD Sequence Number :	53664155
DBYD Job Number :	10848202
Location of Works :	40 Isabella Dr, Skennars Head, NSW, 2478

For all enquiries contact :
Civil Services Group
(02) 6686 4444
www.ballina.nsw.gov.au

ballina shire council

ISSUE DATE : 20/06/2016



Legend

WATER

- Water
- Recycled Water

SEWER

- Sewer

STORMWATER

- Stormwater

OTHER

- Information not complete
- SCIMS Survey Control Point
- Property Boundary ID: House Number (4)
- Road Reserve
- Rivers

DIAL BEFORE YOU DIG www.1100.com.au
The Essential First Step.

N W E S
Not to scale

Affected Infrastructure :	Council High Risk Assets
DBYD Sequence Number :	53664155
DBYD Job Number :	10848202
Location of Works :	40 Isabella Dr, Skennars Head, NSW, 2478

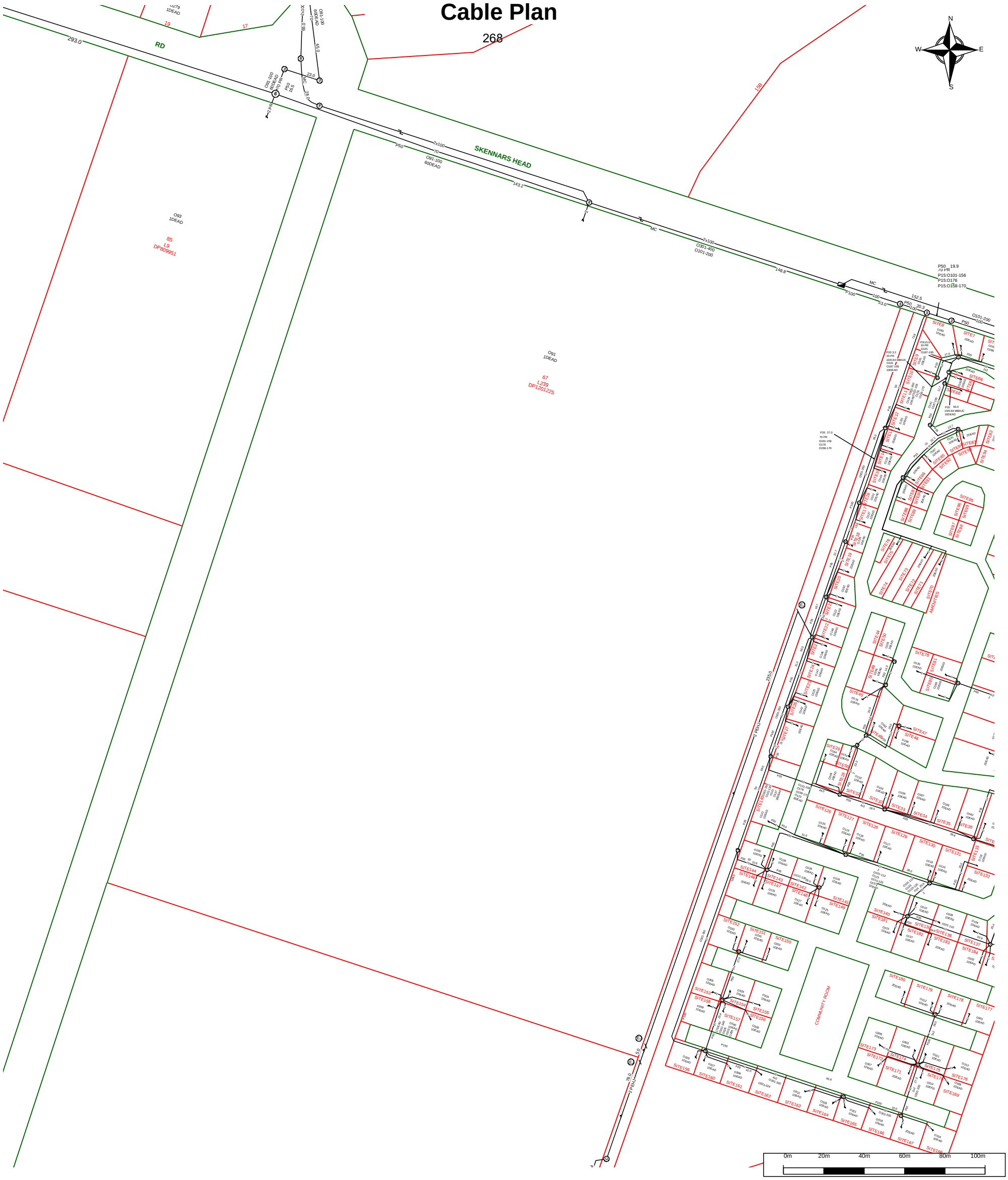
For all enquiries contact :
Civil Services Group
(02) 6686 4444
www.ballina.nsw.gov.au

ballina shire council

ISSUE DATE : 20/06/2016

Cable Plan

268



For all Telstra DBYD plan enquiries - email - Telstra.Plans@team.telstra.com For urgent onsite contact only - ph 1800 653 935 (bus hrs)	Sequence Number: 53664157
TELSTRA CORPORATION LIMITED A.C.N. 051 775 556	CAUTION: Fibre optic and/ or major network present in plot area. Please read the Duty of Care and contact Telstra Plan Services should you require any assistance.
Generated On 20/06/2016 10:31:14	

The above plan must be viewed in conjunction with the Mains Cable Plan on the following page

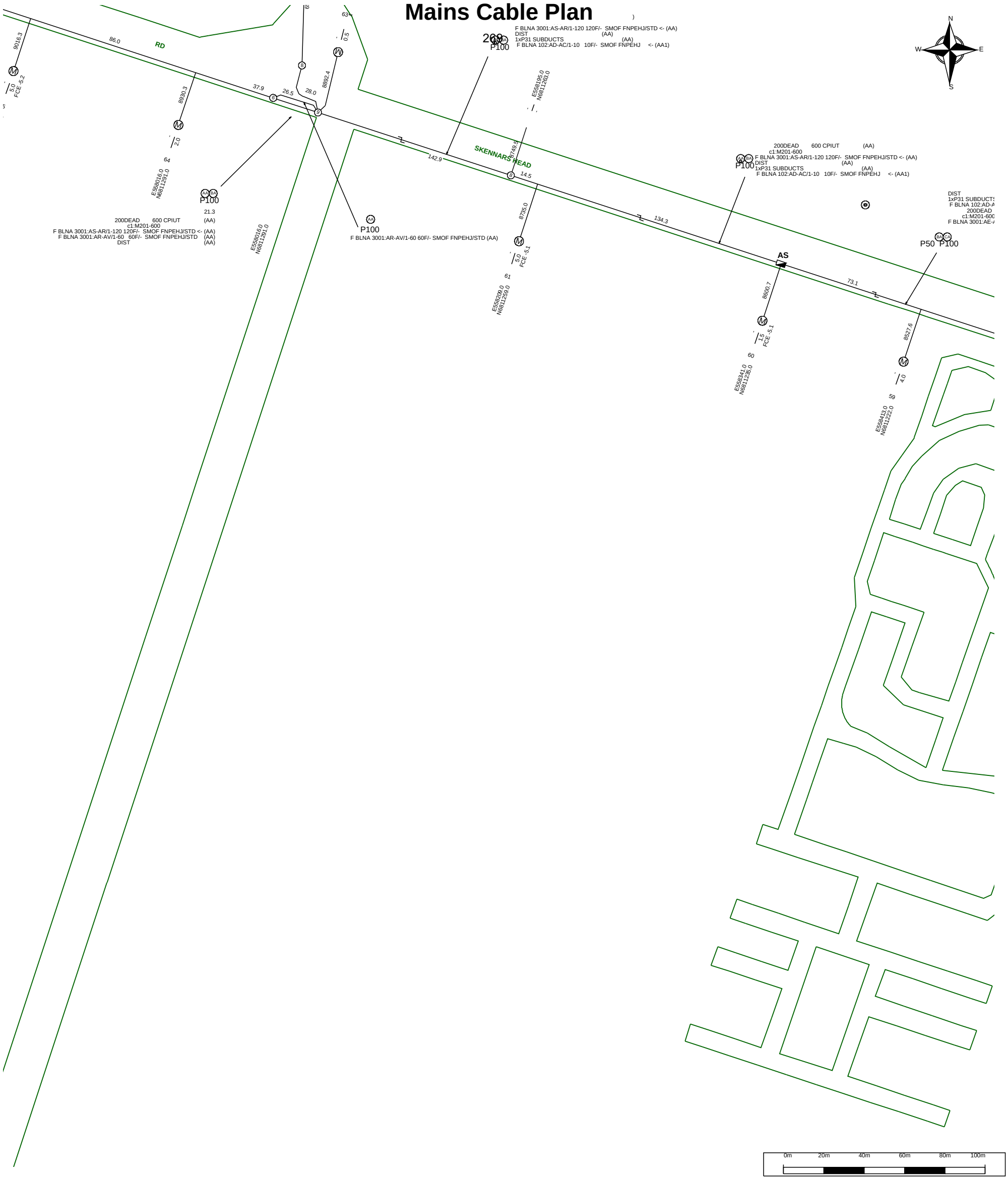
WARNING - Due to the nature of Telstra underground plant and the age of some cables and records, it is impossible to ascertain the precise location of all Telstra plant from Telstra's plans. The accuracy and/or completeness of the information supplied can not be guaranteed as property boundaries, depths and other natural landscape features may change over time, and accordingly the plans are indicative only. Telstra does not warrant or hold out that its plans are accurate and accepts no responsibility for any inaccuracy shown on the plans.

It is your responsibility to locate Telstra's underground plant by careful hand pot-holing prior to any excavation in the vicinity and to exercise due care during that excavation.

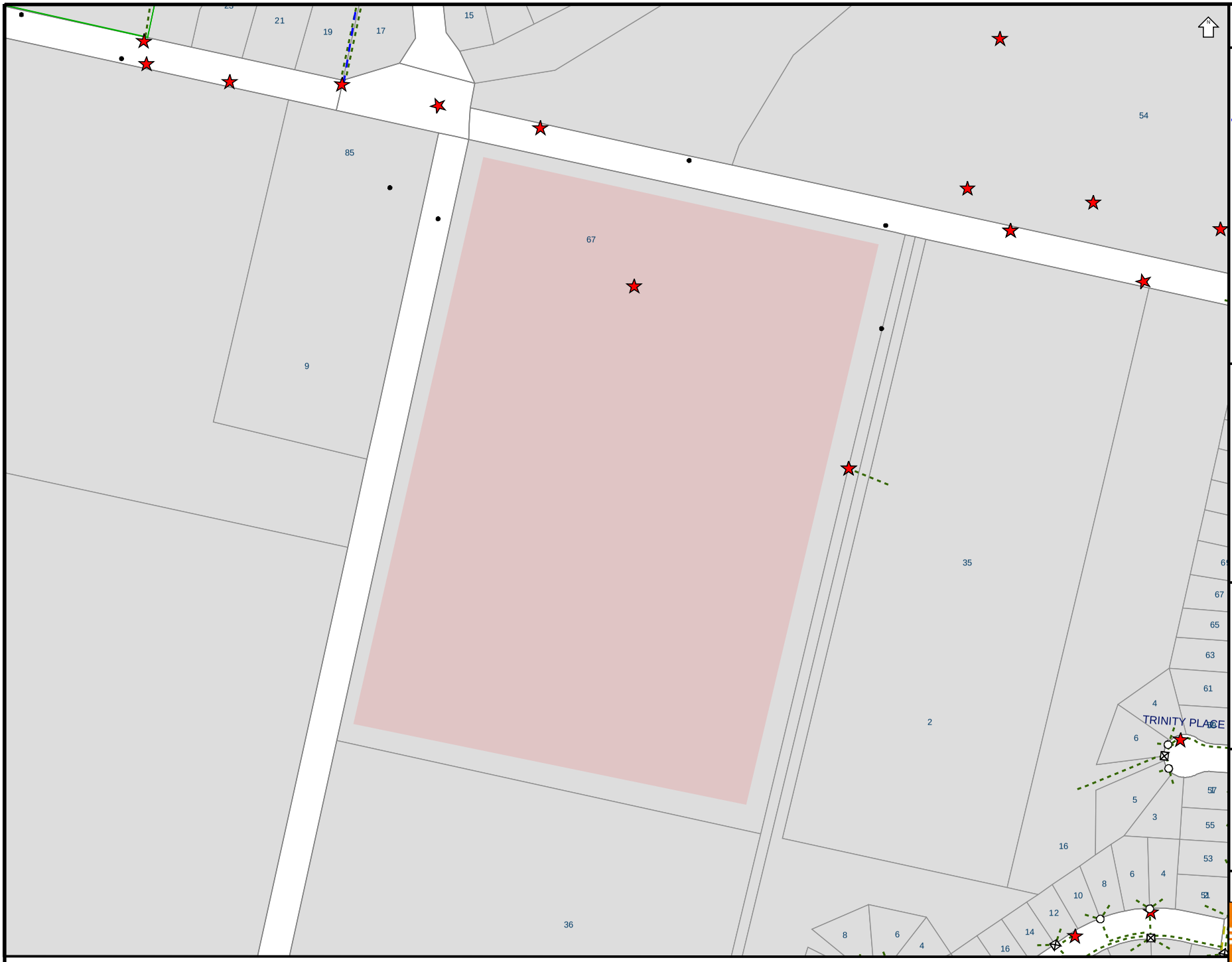
Please read and understand the information supplied in the duty of care statement attached with the Telstra plans. TELSTRA WILL SEEK COMPENSATION FOR LOSS CAUSED BY DAMAGE TO ITS PLANT.

Telstra plans and information supplied are valid for 60 days from the date of issue. If this timeframe has elapsed, please reapply for plans.

Mains Cable Plan



For all Telstra DBYD plan enquiries - email - Telstra.Plans@team.telstra.com For urgent onsite contact only - ph 1800 653 935 (bus hrs)	Sequence Number: 53664157
TELSTRA CORPORATION LIMITED A.C.N. 051 775 556	CAUTION: Fibre optic and/ or major network present in plot area. Please read the Duty of Care and contact Telstra Plan Services should you require any assistance.
Generated On 20/06/2016 10:31:17	



Overhead wires not shown
LOOK UP & LIVE!

LEGEND

- LV Underground Cable
- HV Underground Cable
- Underground Pipe
- Underground Earth or Wires
- Ground Substation
- Pole
- Cubicle
- Pit
- Area of Interest

Critical Assets
Contact Essential Energy on 13 23 91

- Zone Substation
- Underground Cable
- Underground Fibre

Proposed Works

- Area of proposed works

Proposed assets are shown as orange symbols

THE INFORMATION ON THIS MAP MAY NOT BE ACCURATE.
If details are incorrect, please notify Essential Energy on 13 23 91
(or fax 1800 354 636)

ISSUE DATE: 20/06/2016

You must resubmit your request if you have not started work within 4 weeks of the 'Issue Date' above

A4 | SCALE: 1:3292

Job Number: 10848202 Sequence number: 53664156 Job location: 40 Isabella Dr, Skennars Head Map Centre: 153° 35' 52.0", -28° 49' 30.5"

Title Search

ADVANCE LEGAL SEARCHERS PTY LTD

(ACN 147 943 842)
ABN 82 147 943 842

P.O. Box 149
Yagoona NSW 2199

Telephone: +612 9644 1679
Mobile: 0412 169 809
Facsimile: +612 8076 3026
Email: alsearch@optusnet.com.au

28th June, 2016

COFFEY ENVIRONMENTS PTY LIMITED
1/5 Bugden Avenue,
ALSTONVILLE NSW 2477

Attention: Rian Vleggaar

RE: **67 Skennars Head Road, Skennars Head**
Project No: GEOTALSTO3696AA

Current Search

Folio Identifier 239/1201225 (title attached)
DP 1201225 (plan attached)
Dated 20th June, 2016
Registered Proprietor:
GREENLIFE PROPERTIES PTY LTD

Title Tree
Lot 239 DP 1201225

Folio Identifier 239/1201225

See Notes (a) & (b)

(a)

Folio Identifier 3/251003

CTVol 13010 Fol 230

CTVol 7429 Fol 5

CTVol 5647 Fol's 185-188

CTVol 5530 Fol 143

CTVol 1840 Fol 85

****

(b)

Folio Identifier 36/1013547

Folio Identifier 13/584379

CTVol 13090 Fol 232

CTVol 13010 Fol 232

CTVol 12782 Fol 3

CTVol 907 Fol 83

****

Summary of proprietor(s)
Lot 239 DP 1201225

Year **Proprietor**

	(Lot 239 DP 1201225)
2015 – todate	Greenlife Properties Pty Ltd
2014 – 2015	Patrick James Kearney Anthony Thomas Kearney
2014 – 2014	Patrick James Kearney Anthony Thomas Kearney The Trustees for the Roman Catholic Church for the diocese of Lismore

See Notes (a) & (b)

Note (a)

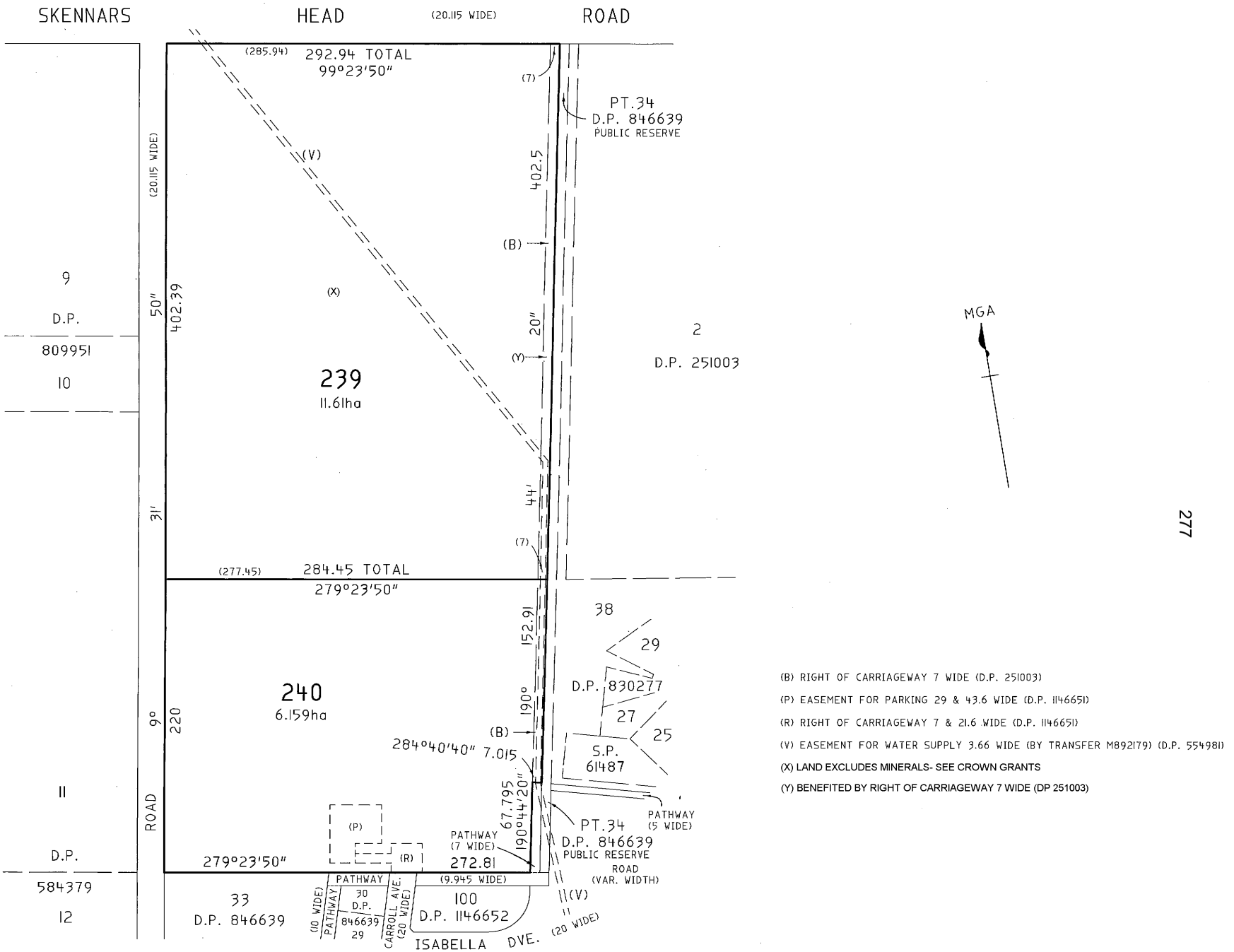
	(Lot 3 DP 251003)
2011 – 2014	Patrick James Kearney Anthony Thomas Kearney
1990 – 2011	Barry Phillip Crowley, retired builder
1987 – 1990	John Lachlan Macaulay, manager Elaine Regina Macaulay, wife
	(Lot 3 DP 251003 – CTVol 13010 Fol 230)
1976 – 1987	John Lachlan Macaulay, manager Elaine Regina Macaulay, wife
1976 – 1976	Joburn Pty. Ltd.
	(Portions 16 & 64, Parish Ballina – Area 138 Acres – CTVol 7429 Fol 5)
1974 – 1976	Joburn Pty. Ltd.
1971 – 1974	John Spence Blackburn, chartered accountant
1958 – 1971	Mary Ethel Cook, wife of Baden John Cook, farmer
	(Portions 16 & 64, Parish Ballina – Area 138 Acres – CTVol 5647 Fol's 185 - 188)
1957 – 1958	Mary Ethel Cook, wife of Baden John Cook, farmer
1957 – 1957	Norman Douglas Sharpe, store keeper Kenneth William Sharpe, store keeper Marjorie Elizabeth Sharpe, clerk
(1947 – 1958)	*(lease to Albert Henry Knight, farmer shown on CTVol 5647 Fol's 185-188)*
1947 – 1957	Henry Edwin Sharpe, storekeeper Norman Douglas Sharpe, grocery manager Kenneth William Sharpe, grocer Marjorie Elizabeth Sharpe, clerk
	(Portion 16 and 64 Parish Ballina – Area 138 Acres – CTVol 5530 Fol 143)
1946 – 1947	Norman Douglas Sharpe, grocery manager Kenneth William Sharpe, grocer Henry Edwin Sharp, storekeeper Marjorie Elizabeth Sharpe, clerk
1945 – 1946	Arthur Robert Taylor, farmer
(1946 – 1947)	*(lease to Albert Henry Knight, farmer shown on CTVol 5530 Fol 143)*
	(Portion 16, Parish Ballina – Area 100 Acres – CTVol 1840 Fol 85)
1945 – 1945	Arthur Robert Taylor, farmer
1921 – 1945	Samuel Hill Miller, farmer
(1916 – 1921)	*(lease to John Clifford, farmer shown on CTVol 1840 Fol 85)*
1911 – 1921	Charlotte Lucie Crawford, widow
(1907 – 1916)	*(lease to Thomas Stewart, farmer shown on CTVol 1840 Fol 85)*
1907 – 1911	William Crawford, farmer

****

Note (b)

	(Lot 36 DP 1013547)
2001 – 2014	The Trustees for the Roman Catholic Church for the diocese of Lismore
	(Lot 13 DP 584379)
1996 – 2001	The Trustees for the Roman Catholic Church for the diocese of Lismore
1988 – 1996	Kathleen Ann Newland, representative
	(Lot 13 DP 584379 – CTVol 13090 Fol 232)
1977 – 1988	Kathleen Ann Newland, representative
1976 – 1974	Joburn Pty Ltd
	(Lot 5 DP251003 – CTVol 13010 Fol's 232)
1976 – 1976	Joburn Pty Ltd
	(Lot A DP 911431 – CTVol 12783 Fol 3)
1975 – 1976	Joburn Pty Ltd
1975 – 1975	John Spence Blackburn, chartered accountant
	(Part of Portion 15, Parish of Ballina – Area 120 Acres – CTVol 970 Fol 83)
1971 – 1975	John Spence Blackburn, chartered accountant
(1968 – 1971)	*(lease to Kenneth Barnes, farmer)*
1952 – 1971	Albert Harold Sharpe, school teacher Hector Douglas Sharpe, postal employee
1929 – 1952	Ernest William Sharpe, farmer
1890 – 1929	John Sharpe, junior, farmer

****



(B) RIGHT OF CARRIAGEWAY 7 WIDE (D.P. 251003)

(P) EASEMENT FOR PARKING 29 & 43.6 WIDE (D.P. 1146651)

(R) RIGHT OF CARRIAGEWAY 7 & 21.6 WIDE (D.P. 1146651)

(V) EASEMENT FOR WATER SUPPLY 3.66 WIDE (BY TRANSFER M892179) (D.P. 554981)

(X) LAND EXCLUDES MINERALS- SEE CROWN GRANTS

(Y) BENEFITED BY RIGHT OF CARRIAGEWAY 7 WIDE (DP 251003)

Surveyor: MICHAEL GEORGE HAJJAR Date of Survey: 18 NOVEMBER 2012 Surveyor's Ref: 239DP REPORT File 2011M7100(1790) Comp	PLAN OF SUBDIVISION OF LOT 3 IN D.P. 251003 AND LOT 36 IN D.P. 1013547	LGA: BALLINA Locality: SKENNARS HEAD Subdivision No: 51/2012 Lengths are in metres. Reduction Ratio 1: 2000	Registered 29.9.2014	DP1201225 P

20 30 40 50 60 Table of mm 90 100 110 120 130 140 150

PLAN FORM 6 (2012) **WARNING: Creasing or folding will lead to rejection**

DEPOSITED PLAN ADMINISTRATION SHEET

Sheet 1 of 2 sheet(s)

Office Use Only

Registered: 29.9.2014

Title System: TORRENS

Purpose: SUBDIVISION

Jse Only

DP1201225 S

PLAN OF SUBDIVISION OF LOT 3 IN D.P. 251003 AND LOT 36 IN D.P. 1013547

LGA: BALLINA

Locality: SKENNARS HEAD

Parish: BALLINA

County: ROUS

Crown Lands NSW/Western Lands Office Approval

I, ... (Authorised Officer) in approving this plan certify that all necessary approvals in regard to the allocation of the land shown herein have been given.

Signature: .....

Date: .....

File Number: .....

Office: .....

Subdivision Certificate

I, MR. ANDREW SMITH

*Authorised Person/~~*General Manager/*Accredited Certifier~~, certify that the provisions of s.109J of the *Environmental Planning and Assessment Act 1979* have been satisfied in relation to the proposed subdivision, new road or reserve set out herein.

Signature: .....

Accreditation number: –

Consent Authority: Ballina Shire Council

Date of endorsement: 5 December 2012

Subdivision Certificate number: 51/2012

File number: DA 2011/272

*Strike through if inapplicable.

Survey Certificate

I, MICHAEL GEORGE HAJJAR

of P.O. BOX 1435 BALLINA NSW 2478

a surveyor registered under the *Surveying and Spatial Information Act 2002*, certify that:

*(a) The land shown in the plan was surveyed in accordance ~~with the~~ *Surveying and Spatial Information Regulation 2012*, is accurate ~~and the survey~~ was completed on .....

*(b) The part of the land shown in the plan (*being/*excluding ^.....) was surveyed in accordance with the *Surveying and Spatial Information Regulation 2012*, is accurate and the survey was completed on, ... the part not surveyed was compiled ~~in~~ accordance with that Regulation.

*(c) The land shown in this plan was compiled in accordance with the *Surveying and Spatial Information Regulation 2012*.

Signature: M. Hajjar Dated: 18 NOV. 2012

Surveyor ID: 1193

~~Datum Line:~~ .....

Type: *Urban/*Rural

The terrain is *Level-Undulating / ~~*Steep-Mountainous.~~

*Strike through if inapplicable.

^Specify the land actually surveyed or specify any land shown in the plan that is not the subject of the survey.

Statements of intention to dedicate public roads, public reserves and drainage reserves.

Plans used in the preparation of ~~survey~~/compilation.

DP554981 DP 584379 DP251003 DP830277 DP846639 DP1013547 DP1146651

If space is insufficient continue on PLAN FORM 6A

Signatures, Seals and Section 88B Statements should appear on PLAN FORM 6A

Surveyor's Reference: 239DP Report File 2011M7100(1790) Comp

PLAN FORM 6A (2012) WARNING: Creasing or folding will lead to rejection

DEPOSITED PLAN ADMINISTRATION SHEET

Sheet 2 of 2 sheet(s)

Office Use Only

Registered: 29.9.2014

Use Only

DP1201225

PLAN OF SUBDIVISION OF LOT 3 IN DP210003 AND LOT 36 IN DP1013547

Subdivision Certificate number: 51/2012

Date of Endorsement: 5 December 2012

This sheet is for the provision of the following information as required:

- A schedule of lots and addresses - See 60(c) *SSI Regulation 2012*
- Statements of intention to create and release affecting interests in accordance with section 88B *Conveyancing Act 1919*
- Signatures and seals- see 195D *Conveyancing Act 1919*
- Any information which cannot fit in the appropriate panel of sheet 1 of the administration sheets.

Lot	Street Number	Street Name	Street Type	Locality
239	67	Skennars Head	Road	Skennars Head
240	40	Isabella	Drive	Skennars Head

✠ Geoffrey Jarrett

COMMON SEAL ROMAN CATHOLIC CHURCH TRUST PROPERTY ACT 1936 * DIOCESE OF LISMORE *

The common seal of the Trustees of the Roman Catholic Church for the Diocese of Lismore was hereunto affixed in the presence of Most Reverend Geoffrey Hylton Jarrett. DD, Bishop of the Diocese of Lismore, under and in pursuance of a delegation made to him under section 9B of the Roman Catholic Church Trust Property Act. 1936.

✠ Anthony Kenny

A.K

P.K

If space is insufficient use additional annexure sheet

Surveyor's Reference: 239DP Report File 2011M7100(1790) Comp

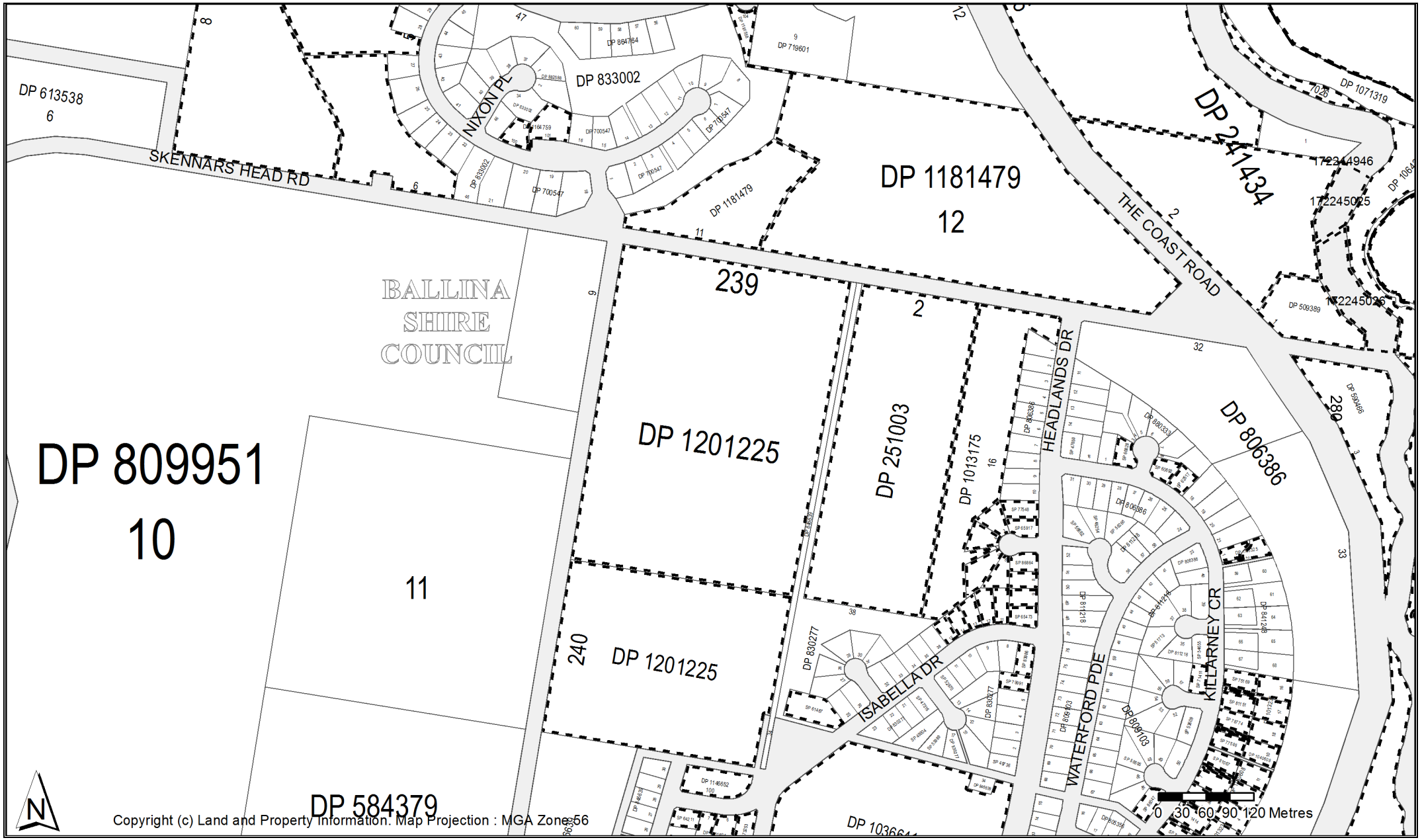
Cadastral Records Enquiry Report

Ref : coffey - skennars head

Requested Parcel : Lot 239 DP 1201225

Identified Parcel : Lot 239 DP 1201225

Locality : SKENNARS HEAD **LGA :** BALLINA **Parish :** BALLINA **County :** ROUS



This information is provided as a searching aid only. While every endeavour is made to ensure the current cadastral pattern is accurately reflected, the Registrar General cannot guarantee the information provided. For all ACTIVITY PRIOR to SEPT 2002 you must refer to the RGs Charting and Reference Maps.

	Status	Surv/Comp	Purpose
DP241434			
Lot(s): 2			
DP1053209	REGISTERED	SURVEY	EASEMENT
NSW GAZ. 13-08-2004 Folio : 6553 RESERVATION OF CROWN LAND (RESERVE NO. 1010068) - LOT 2 DP241434. RESERVE NO. 83506 IS REVOKED			
Lot(s): 5			
NSW GAZ. 13-08-2004 Folio : 6553 RESERVATION OF CROWN LAND (RESERVE NO. 1010068) - LOT 5 DP241434; DECLARATION PURSUANT TO SECTION 25A OF THE CROWN LANDS CONSOLIDATION ACT 1913 GOV. GAZ. 21-5-1982 FOLIO 2281			
DP251003			
Lot(s): 2			
DP1042493	REGISTERED	SURVEY	EASEMENT
DP509389			
Lot(s): 1			
NSW GAZ. 13-08-2004 Folio : 6553 RESERVATION OF CROWN LAND (RESERVE NO. 1010068) - LOT 1 DP509389			
DP590466			
Lot(s): 3			
NSW GAZ. 13-08-2004 Folio : 6553 RESERVATION OF CROWN LAND (RESERVE NO 10100068) - LOT 3 DP590466. RESERVE NO. 83506 IS REVOKED			
DP1001604			
Lot(s): 6, 7			
DP846639	HISTORICAL	SURVEY	SUBDIVISION
DP1013175			
Lot(s): 3, 4, 5, 6, 8, 9, 11, 12, 13, 14, 15, 16			
DP830277	HISTORICAL	SURVEY	SUBDIVISION
DP1013234			
Lot(s): 4, 5, 6			
DP809103	HISTORICAL	SURVEY	SUBDIVISION
DP1013235			
Lot(s): 16, 17, 18			
DP809103	HISTORICAL	SURVEY	SUBDIVISION
DP1013234	REGISTERED	SURVEY	SUBDIVISION
DP1040608	REGISTERED	SURVEY	SUBDIVISION
DP1036641			
Lot(s): 7			
DP846639	HISTORICAL	SURVEY	SUBDIVISION
DP1013547	REGISTERED	SURVEY	SUBDIVISION
DP1040608			
Lot(s): 7, 10, 11, 12			
DP809103	HISTORICAL	SURVEY	SUBDIVISION
DP1013234	REGISTERED	SURVEY	SUBDIVISION
DP1013235	REGISTERED	SURVEY	SUBDIVISION
DP1063883			
Lot(s): 7033			
NSW GAZ. 13-08-2004 Folio : 6553 RESERVATION OF CROWN LAND (RESERVE NO. 1010068) - LOT 7033 DP1063883			
DP1064254			
Lot(s): 7026			
NSW GAZ. 13-08-2004 Folio : 6553 RESERVATION OF CROWN LAND (RESERVE NO. 1010068) - LOT 7026 DP1064254			
DP1106325			
Lot(s): 1, 2			
DP806386	HISTORICAL	SURVEY	SUBDIVISION
DP1122060			
Lot(s): 7300			
NSW GAZ. 15-02-2008 Folio : 718 RESERVATION OF CROWN LAND RESERVE NO. 101408. LOT 7300 DP1122060			
DP1146652			
Lot(s): 100			
DP846639	HISTORICAL	SURVEY	SUBDIVISION
DP1013547	REGISTERED	SURVEY	SUBDIVISION
DP1146651	REGISTERED	SURVEY	EASEMENT

Caution: For all **ACTIVITY PRIOR to SEPT 2002** you must refer to the RGs Charting and Reference Maps.

	Status	Survey/Comp	Purpose
DP1164759			
Lot(s): 100, 101			
DP833002	HISTORICAL	SURVEY	SUBDIVISION
Lot(s): 101			
DP700547	HISTORICAL	SURVEY	SUBDIVISION
DP1181479			
Lot(s): 11, 12			
DP864764	HISTORICAL	SURVEY	SUBDIVISION
DP1154810	REGISTERED	SURVEY	SUBDIVISION
Lot(s): 12			
DP833002	HISTORICAL	SURVEY	SUBDIVISION
DP1191558			
Lot(s): 104			
DP864764	HISTORICAL	SURVEY	SUBDIVISION
DP1154810	REGISTERED	SURVEY	SUBDIVISION
DP1201225			
Lot(s): 239, 240			
DP584379	HISTORICAL	COMPILATION	SUBDIVISION
DP1013547	REGISTERED	SURVEY	SUBDIVISION
DP1146651	REGISTERED	SURVEY	EASEMENT
Lot(s): 239			
DP251003	HISTORICAL	SURVEY	SUBDIVISION
DP1216761			
Lot(s): 5, 6, 8			
DP864764	HISTORICAL	SURVEY	SUBDIVISION
DP1154810	REGISTERED	SURVEY	SUBDIVISION
DP1191558	REGISTERED	SURVEY	SUBDIVISION
SP60828			
DP880333	HISTORICAL	SURVEY	SUBDIVISION
SP60892			
DP880333	HISTORICAL	SURVEY	SUBDIVISION
SP61487			
DP830277	HISTORICAL	SURVEY	SUBDIVISION
SP62517			
DP880333	HISTORICAL	SURVEY	SUBDIVISION
SP64211			
DP846639	HISTORICAL	SURVEY	SUBDIVISION
SP65473			
DP830277	HISTORICAL	SURVEY	SUBDIVISION
DP1013175	REGISTERED	SURVEY	SUBDIVISION
SP65917			
DP830277	HISTORICAL	SURVEY	SUBDIVISION
DP1013175	REGISTERED	SURVEY	SUBDIVISION
SP69836			
DP809103	HISTORICAL	SURVEY	SUBDIVISION
DP1013234	REGISTERED	SURVEY	SUBDIVISION
SP70784			
DP809103	HISTORICAL	SURVEY	SUBDIVISION
DP1013234	REGISTERED	SURVEY	SUBDIVISION
SP71411			
DP809103	HISTORICAL	SURVEY	SUBDIVISION
SP71414			
DP809103	HISTORICAL	SURVEY	SUBDIVISION
DP1013234	REGISTERED	SURVEY	SUBDIVISION
SP73253			
DP846639	HISTORICAL	SURVEY	SUBDIVISION
DP1001604	REGISTERED	SURVEY	SUBDIVISION

	Status	Survey/Comp	Purpose
SP75169			
DP809103	HISTORICAL	SURVEY	SUBDIVISION
DP1013234	REGISTERED	SURVEY	SUBDIVISION
DP1013235	REGISTERED	SURVEY	SUBDIVISION
DP1040608	REGISTERED	SURVEY	SUBDIVISION
SP88715	REGISTERED	COMPILATION	STRATA SUBDIVISION PLAN
SP77548			
DP830277	HISTORICAL	SURVEY	SUBDIVISION
DP1013175	REGISTERED	SURVEY	SUBDIVISION
SP77585			
DP809103	HISTORICAL	SURVEY	SUBDIVISION
DP1013234	REGISTERED	SURVEY	SUBDIVISION
DP1013235	REGISTERED	SURVEY	SUBDIVISION
DP1040608	REGISTERED	SURVEY	SUBDIVISION
SP78774			
DP809103	HISTORICAL	SURVEY	SUBDIVISION
DP1013234	REGISTERED	SURVEY	SUBDIVISION
DP1013235	REGISTERED	SURVEY	SUBDIVISION
DP1040608	REGISTERED	SURVEY	SUBDIVISION
SP79991			
DP830277	HISTORICAL	SURVEY	SUBDIVISION
SP81067			
DP809103	HISTORICAL	SURVEY	SUBDIVISION
DP1013234	REGISTERED	SURVEY	SUBDIVISION
DP1013235	REGISTERED	SURVEY	SUBDIVISION
DP1040608	REGISTERED	SURVEY	SUBDIVISION
SP81151			
DP809103	HISTORICAL	SURVEY	SUBDIVISION
DP1013234	REGISTERED	SURVEY	SUBDIVISION
DP1013235	REGISTERED	SURVEY	SUBDIVISION
DP1040608	REGISTERED	SURVEY	SUBDIVISION
SP83986			
DP830277	HISTORICAL	SURVEY	SUBDIVISION
SP86547			
DP809103	HISTORICAL	SURVEY	SUBDIVISION
SP86864			
DP830277	HISTORICAL	SURVEY	SUBDIVISION
DP1013175	REGISTERED	SURVEY	SUBDIVISION
Road			
Polygon Id(s): 172244946, 172245025			
NSW GAZ. 05-03-2015 Folio : 670			
TRANSFER OF CROWN ROAD TO COUNCIL			
Polygon Id(s): 172245025, 172245026			
DP1053209	REGISTERED	SURVEY	EASEMENT

Plan	Surv/Comp	284	Purpose
DP241434	SURVEY		SUBDIVISION
DP251003	SURVEY		SUBDIVISION
DP509389	SURVEY		SUBDIVISION
DP584379	COMPILATION		SUBDIVISION
DP590466	COMPILATION		RESUMPTION OR ACQUISITION
DP613538	SURVEY		SUBDIVISION
DP700547	SURVEY		SUBDIVISION
DP715304	SURVEY		SUBDIVISION
DP719601	COMPILATION		SUBDIVISION
DP805356	SURVEY		SUBDIVISION
DP806386	SURVEY		SUBDIVISION
DP809103	SURVEY		SUBDIVISION
DP809951	SURVEY		SUBDIVISION
DP811218	SURVEY		SUBDIVISION
DP814039	SURVEY		SUBDIVISION
DP830277	SURVEY		SUBDIVISION
DP833002	SURVEY		SUBDIVISION
DP841248	SURVEY		SUBDIVISION
DP846639	SURVEY		SUBDIVISION
DP864764	SURVEY		SUBDIVISION
DP880333	SURVEY		SUBDIVISION
DP882588	SURVEY		SUBDIVISION
DP1001604	SURVEY		SUBDIVISION
DP1013175	SURVEY		SUBDIVISION
DP1013234	SURVEY		SUBDIVISION
DP1013235	SURVEY		SUBDIVISION
DP1036641	SURVEY		SUBDIVISION
DP1040608	SURVEY		SUBDIVISION
DP1063883	COMPILATION		DEPARTMENTAL
DP1064254	COMPILATION		DEPARTMENTAL
DP1071319	COMPILATION		DEPARTMENTAL
DP1106325	SURVEY		SUBDIVISION
DP1122060	COMPILATION		CROWN LAND CONVERSION
DP1146652	SURVEY		CONSOLIDATION
DP1164759	SURVEY		SUBDIVISION
DP1181479	SURVEY		SUBDIVISION
DP1191558	SURVEY		SUBDIVISION
DP1201225	COMPILATION		SUBDIVISION
DP1216761	SURVEY		SUBDIVISION
SP46254	COMPILATION		STRATA PLAN
SP47316	COMPILATION		STRATA PLAN
SP47650	COMPILATION		STRATA PLAN
SP49736	COMPILATION		STRATA PLAN
SP49904	COMPILATION		STRATA PLAN
SP51713	COMPILATION		STRATA PLAN
SP52970	COMPILATION		STRATA PLAN
SP53609	COMPILATION		STRATA PLAN
SP53989	COMPILATION		STRATA PLAN
SP54655	COMPILATION		STRATA PLAN
SP56662	COMPILATION		STRATA PLAN
SP58266	COMPILATION		STRATA PLAN
SP58595	COMPILATION		STRATA PLAN
SP60828	COMPILATION		STRATA PLAN
SP60892	COMPILATION		STRATA PLAN
SP61487	COMPILATION		STRATA PLAN
SP62517	COMPILATION		STRATA PLAN
SP64211	COMPILATION		STRATA PLAN
SP65473	COMPILATION		STRATA PLAN
SP65917	COMPILATION		STRATA PLAN
SP69836	COMPILATION		STRATA PLAN
SP70784	COMPILATION		STRATA PLAN
SP71411	COMPILATION		STRATA PLAN
SP71414	COMPILATION		STRATA PLAN
SP73253	COMPILATION		STRATA PLAN
SP75169	COMPILATION		STRATA PLAN
SP77548	COMPILATION		STRATA PLAN
SP77585	COMPILATION		STRATA PLAN
SP78774	COMPILATION		STRATA PLAN
SP79991	COMPILATION		STRATA PLAN

Requested Parcel : Lot 239 DP 1201225 **Identified Parcel :** Lot 239 DP 1201225

Locality : SKENNARS HEAD **LGA :** BALLINA **Parish :** BALLINA **County :** ROUS

Plan	Surv/Comp	285	Purpose
SP81067	COMPILATION		STRATA PLAN
SP81151	COMPILATION		STRATA PLAN
SP83986	COMPILATION		STRATA PLAN
SP86547	COMPILATION		STRATA PLAN
SP86864	COMPILATION		STRATA PLAN

[redacted]ICATE OF TITLE

NEW SOUTH WALES — [redacted]286 PROPERTY ACT, 1900

12782003

Vol. 12782 Fol. 3

Crown Grant Vol.951 Fol.191

Prior Title Vol.970 Fol. 83

Edition issued 16-5-1975

CANCELLED W

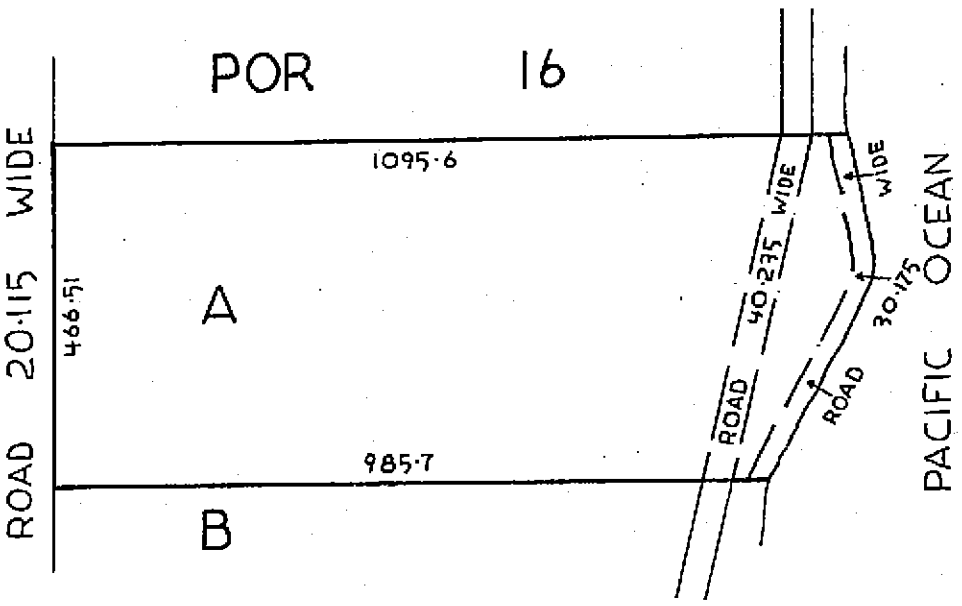
(Page 1) Vol. 12782 Fol. 3

I certify that the person described in the First Schedule is the registered proprietor of the undermentioned estate in the land within described subject nevertheless to such exceptions encumbrances and interests as are shown in the Second Schedule.

Registrar General.

PLAN SHOWING LOCATION OF LAND

LENGTHS ARE IN METRES



AREA : 46·64 ha
THIS AREA DOES NOT INCLUDE
THE AREA OF THE ROADS

P.145684 J.M. REDUCTION RATIO 1:1000

ESTATE AND LAND REFERRED TO

Estate in Fee Simple in Lot A in Deposited Plan 911431 in the Shire of Tintenbar Parish of Ballina and County of Rous. EXCEPTING THEREOUT the roads shown in the plan hereon.

FIRST SCHEDULE

~~JOHN SPENCE BLACKBURN of Lis[redacted] Chartered Accountant.~~

SECOND SCHEDULE

1. Reservations and conditions, if any, contained in the Crown Grant above referred to.
2. Easement for Water Supply created by Transfer No.M892179 and more fully set out therein affecting that part of the land above described shown as "Easement for Water Supply 12 ft wide" in Deposited Plan 554981.

Vol. 12782 Fol. 3

FIRST SCHEDULE (continued)

REGISTERED PROPRIETOR	INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	ENTERED	Signature of Registrar General
Joburn Pty. Ltd.	Transfer	P145688	———	13. 6. 1975	

This deed is cancelled as to whole of the land comprised in the within mentioned Certificate of Title

New Certificates of Title have issued on 15-3-1976

for lots in Deposited Plan No. 251003 as follows:-

Lots 1 to 8 Vol. 13010 Fols 228 to 235 respectively.

REGISTRAR GENERAL

SECOND SCHEDULE (continued)

INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	PARTICULARS	ENTERED	Signature of Registrar General	CANCELLATION		
Mortgage	P145689	———	to Lismore Management Pty. Limited	13.6.1975				
88 BINSI	P499905		Interests created pursuant to Section 88B Conveyancing Act, 1919,					
			by the registration of Deposited Plan 251003.	24-2-1976				

(Page 2 of 2 pages)

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED

287

CERTIFICATE OF TITLE

NEW SOUTH WALES

PROPERTY ACT, 1900

Vol. 13010 Fol. 230

Crown Grant Vol. 322 Fol.67

Prior Title Vol.7429 Fol.5

EDITION ISSUED

15 3 1976

I certify that the person described in the First Schedule is the registered proprietor of the undermentioned estate in the land within described subject nevertheless to such exceptions encumbrances and interests as are shown in the Second Schedule.

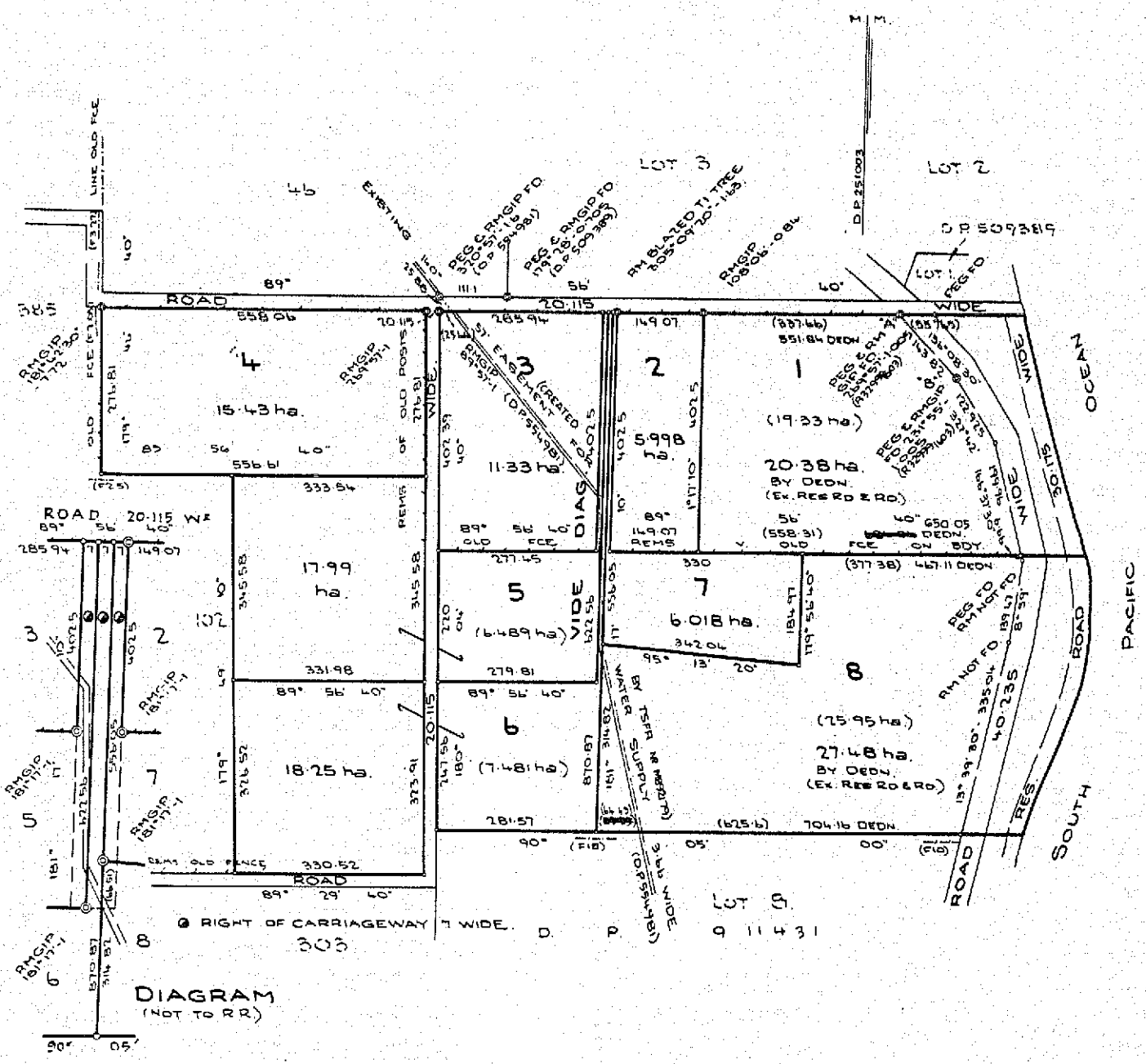
CANCELLED

Registrar General.

SEE AUTO FOLIO

PLAN SHOWING LOCATION OF LAND

LENGTHS ARE IN METRES



ESTATE AND LAND REFERRED TO

Estate in Fee Simple in Lot 3 in Deposited Plan 251003 at Skennars Head in the Shire of Tintenbar Parish of Ballina and County of Rous. EXCEPTING THEREOUT the minerals reserved by the Crown Grant.

FIRST SCHEDULE

~~JOBURN PTY. LTD.~~

SECOND SCHEDULE

1. Reservations and conditions, if any, contained in the Crown Grant above referred to.
2. Easement for Water Supply created by Transfer No.M892178 affecting the part of the land above described 3.66 metres wide in the plan hereon.
~~3. Mortgage No.P145689 to Lismore Management Pty. Limited Registered 13-6-1975.~~ Discharged P876195.

GRM EF(SB)

Vol. 13010 Fol. 230

FIRST SCHEDULE (continued)

REGISTERED PROPRIETOR	INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	ENTERED	Signature of Registrar General
John Lachlan MacAulay of Balkna, manager and Elaine Regina MacAulay his wife as joint tenants.	Transfer	P876196	—	14.9.1976	

P876195A
T861344 DM

SECOND SCHEDULE (continued)

INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	PARTICULARS	ENTERED	Signature of Registrar General	CANCELLATION		
Mortgage	P876197		to Commonwealth Savings Bank of Australia	14.9.1976		Discharged	T861344	

(Page 2 of 2 pages)

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED

289

[redacted]ICATE OF TITLE

13010232

NEW SOUTH WALES

290 PROPERTY ACT, 1900

Vol. 13010 Fol. 232

Crown Grants Vol. 951 Fol.191
Vol.1764 Fol.196

Prior Titles Vol.12782 Fol. 3
Vol.12798 Fol. 5

CANCELLED W
EDITION ISSUED
15 3 1976

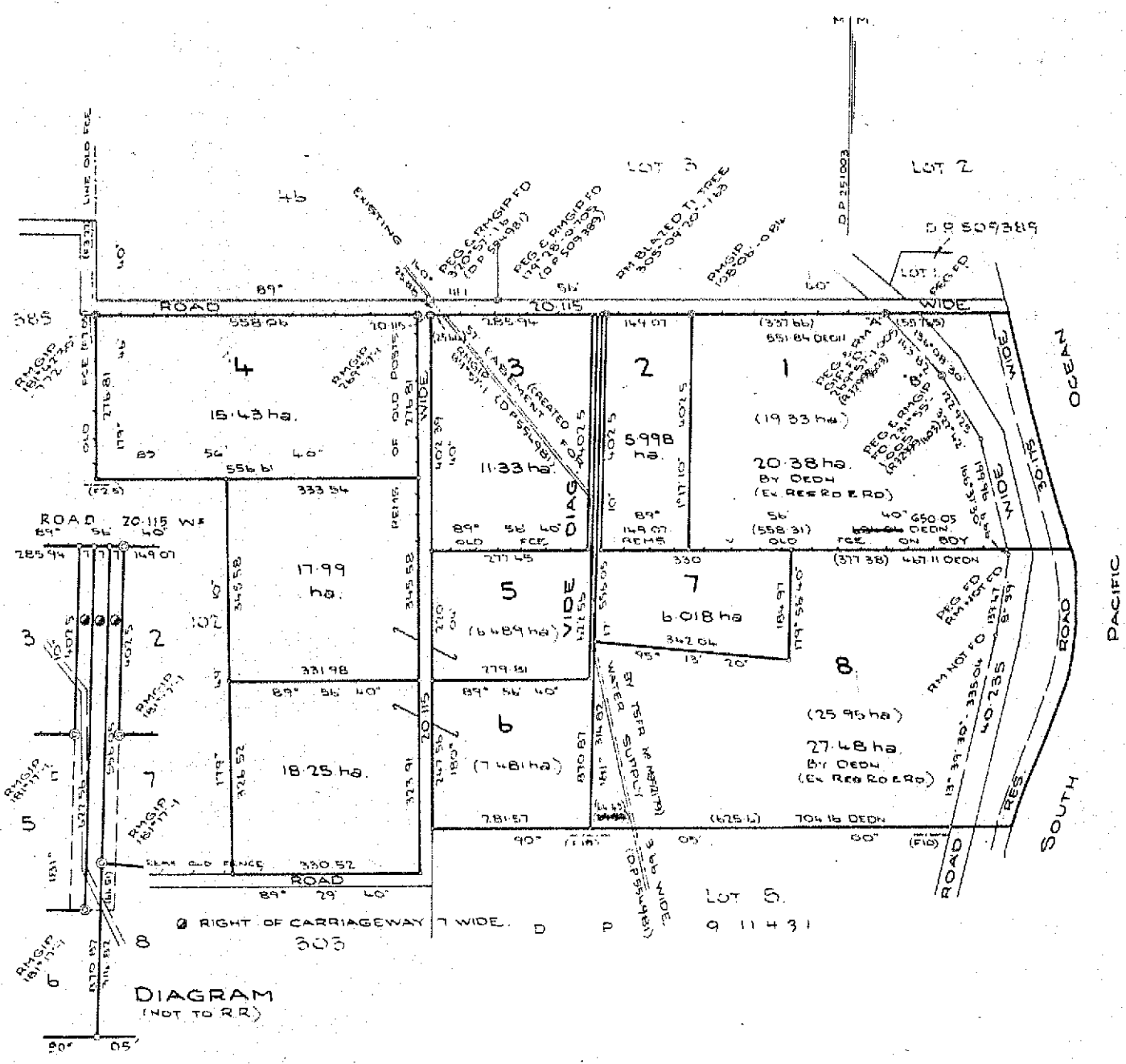
(Page 1) Vol. 13010 Fol. 232

I certify that the person described in the First Schedule is the registered proprietor of the undermentioned estate in the land within described subject nevertheless to such exceptions encumbrances and interests as are shown in the Second Schedule.

Registrar General.

PLAN SHOWING LOCATION OF LAND

LENGTHS ARE IN METRES



ESTATE AND LAND REFERRED TO

Estate in Fee Simple in Lot 5 in Deposited Plan 251003 at Skennars Head in the Shire of Tintenbar Parish of Ballina and County of Rous. EXCEPTING THEREOUT the minerals reserved by Crown Grant Volume 1764 Folio 196.

FIRST SCHEDULE

JOBURN PTY. LTD.

SECOND SCHEDULE

1. Reservations and conditions, if any, contained in the Crown Grants above referred to.
2. Easement for Water Supply created by Transfer No.M892179 affecting the part of the land above described 3.66 metres wide shown in the plan hereon.
3. Mortgage No.P145689 to Lismore Management Pty. Limited. Registered 13-6-1975.
4. Right of Carriageway affecting the part of the land above described 7 metres wide shown in the plan hereon created by the registration of Deposited Plan 251003. See P499905.
5. Right of Carriageway appurtenant to the land above described created by the registration of Deposited Plan 251003. See P499905.

Vol. 13010 Fol. 232

FIRST SCHEDULE (continued)

REGISTERED PROPRIETOR	INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	ENTERED	Signature of Registrar General

NEW CERTIFICATE(S) OF TITLE ISSUING ON DP 584379
NO DEALING TO BE REGISTERED WITHOUT REFERENCE TO SURVEY DRAFTING BRANCH

SECOND SCHEDULE (continued)

INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	PARTICULARS	ENTERED	Signature of Registrar General	CANCELLATION		

This deed is cancelled as to whole
New Certificates of Title have issued on 19-7-76
for lots in Deposited Plan 584379
Lots 11 to 14 Vol 13090 Fol 230 & 233 respectively.

REGISTRAR GENERAL

(Page 2 of 2 pages)

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED

DP584379

291

CERTIFICATE OF TITLE

NEW SOUTH WALES

282 PROPERTY ACT, 1900

Vol. 13090 Fol. 232

Crown Grant Vol. 951 Fol.191

Prior Title Vol.13010 Fol.232

EDITION ISSUED

19 7 1976

I certify that the person described in the First Schedule is the registered proprietor of the undermentioned estate in the land within described subject nevertheless to such exceptions encumbrances and interests as are shown in the Second Schedule.

CANCELLED

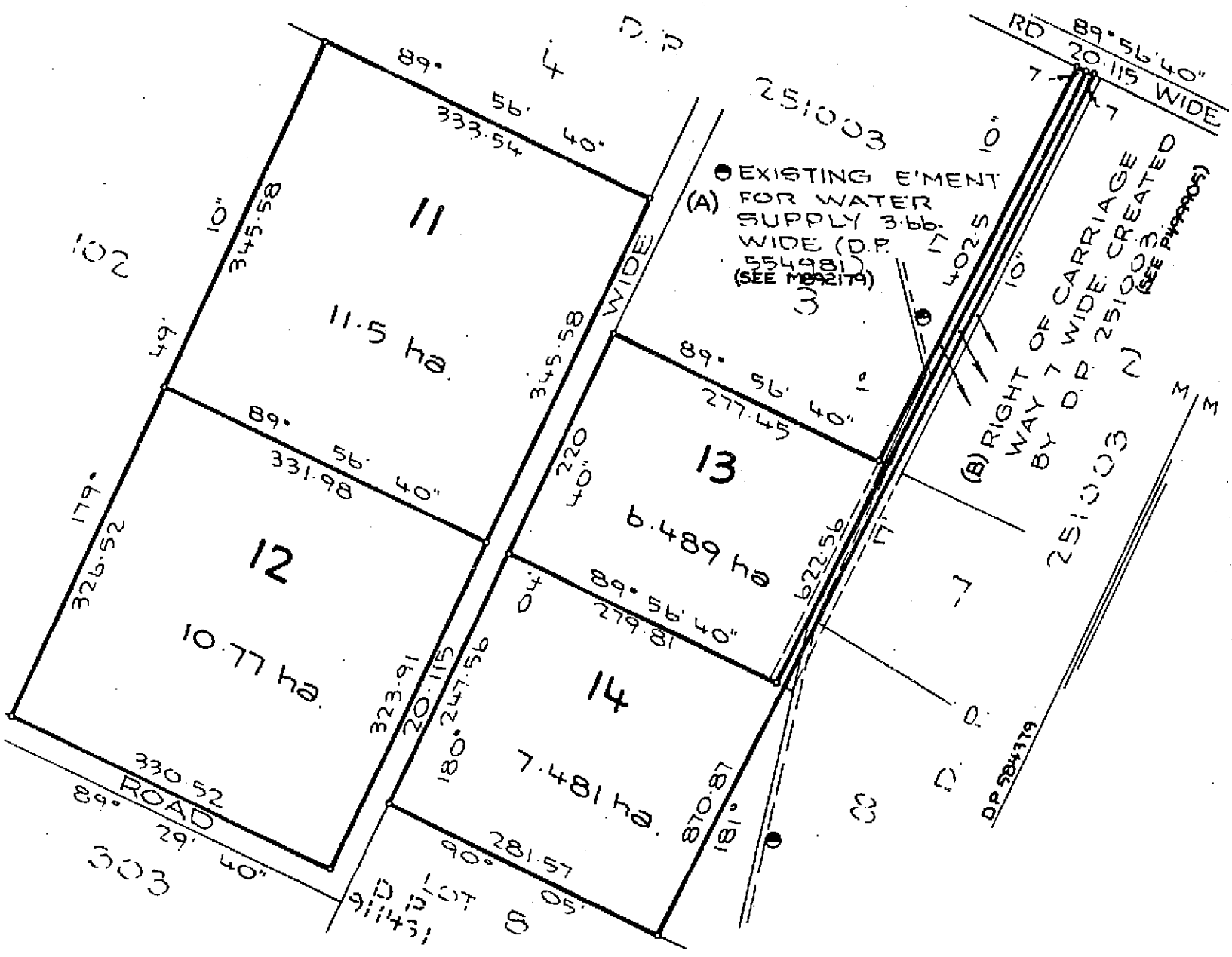
Registrar General.

SEE AUTO FOLIO

(Page 1) Vol. 13090 Fol. 232

PLAN SHOWING LOCATION OF LAND

LENGTHS ARE IN METRES



ESTATE AND LAND REFERRED TO

S Estate in Fee Simple in Lot 13 in Deposited Plan 584379 at Skennars Head in the Shire of Tintenbar Parish of Ballina and County of Rous.

FIRST SCHEDULE

~~JOBURN CITY, LTD.~~

GRY

SECOND SCHEDULE

1. Reservations and conditions, if any, contained in the Crown Grant above referred to.
2. Easement for Water Supply created by Transfer No.M892179 affecting the part of the land above described designated (A) in the plan hereon. DP584379
3. ~~Mortgage No.P145689 to Lismore Management Pty. Limited. Registered 13-6-1975.~~ DISCHARGED AS 340101
4. Right of Carriageway affecting the part of the land above described designated (B) in the DP584379 plan hereon created by the registration of Deposited Plan 251003 See P499905.
5. Right of Carriageway appurtenant to the land above described created by the registration of Deposited Plan 251003 See P499905.

Vol. 13090 Fol. 232

FIRST SCHEDULE (continued)

REGISTERED PROPRIETOR	INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	ENTERED	Signature of Registrar General
Kathleen Ann Newland of Skennar's Head, Representative.	Transfer	Q340102	-------	24-8-1977	

CANCELLED

SEE AUTO FOLIO

SECOND SCHEDULE (continued)

INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	PARTICULARS	ENTERED	Signature of Registrar General	CANCELLATION		

(Page 2 of 2 pages)

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED

Form: 03TA
Release: 3.0
www.lpma.nsw.gov.au

TRANSMISSION APPLICATION

New South Wales
Section 93 Real Property Act 1900

AG441905M

PRIVACY NOTE: Section 31B of the Real Property Act 1900 (RP Act) authorises the Registrar General to collect the information required by this form for the establishment and maintenance of the Real Property Act Register. Section 96B RP Act requires that the Register is made available to any person for search upon payment of a fee, if any.

STAMP DUTY

Office of State Revenue use only

RELODGED

LAND TORRENS TITLE

(B) REGISTERED DEALING
29 AUG 2017

(C) LODGED BY

TIME: 4.00

Folio Identifier 3/251003

Number	Torrens Title

Document Collection Box	Name, Address or DX, Telephone, and Customer Account Number if any	CODE
5D	LLPN: 123005 B MORRIS, HAYES & EDGAR DX 420 SYDNEY PH: 9232-2411 Reference: 5CG 2524 ~~AS AGENTS FOR~~ STAFFORD	TA

(D) DECEASED REGISTERED PROPRIETOR: Barry Phillip Crowley

(E) APPLICANT: Patrick James KEARNEY and Anthony Thomas KEARNEY

(F) I, the applicant, being entitled as executor of the estate of the deceased registered proprietor (who died on 15 December 2009) pursuant to probate No. 2010/00274889 granted on 20 August 2010 to Anthony Thomas KEARNEY and Patrick James KEARNEY (a certified copy of which is lodged herewith) apply to be registered as proprietor of the estate or interest of the deceased registered proprietor in the abovementioned land.

DATE 14 September 2017

(G) I certify that the person(s) signing opposite, with whom I am personally acquainted or as to whose identity I am otherwise satisfied, signed this instrument in my presence.

Certified correct for the purposes of the Real Property Act 1900 by the Applicant.

Signature of witness: Naomi R. Stafford

Signature of Applicant:

Naomi Ruth Stafford

Name of witness: NAOMI RUTH STAFFORD

Address of witness: 105 RIVER ST, BALLINA

105 RIVER STREET,
BALLINA 2478

(H) CONSENT OF EXECUTOR, ADMINISTRATOR OR TRUSTEE

I, _____ of the deceased registered proprietor, consent to this application.

Signature of witness: Signature of

Name of witness:

Address of witness:

(I) *This section is to be completed where a notice of sale is required and the relevant data has been forwarded to LPMA through eNOS.*

The applicant's AGENT certifies that the eNOS data relevant to this dealing has been submitted and stored under eNOS ID No. 39915 Full name: Michelle Martin Signature:

PBK

ALL HANDWRITING MUST BE IN BLOCK CAPITALS.

1003

LAND AND PROPERTY MANAGEMENT AUTHORITY
Office use only—
Evidence sighted ~~and returned~~:

Licence: -05-11-638
Licensee: Softdocs
Hosie & Partners

TRANSFER

New South Wales
Real Property Act 1900
295

AI912989D

PRIVACY NOTE: Section 31B of the Real Property Act 1900 (RP Act) authorises the Registrar General to collect the information required by this form for the establishment and maintenance of the Real Property Act Register. Section 96B RP Act requires that the Register is made available to any person for search upon payment of a fee, if any.

STAMP DUTY

LJ Kane
Authorised to
Amend 22/9/2014

Office of State Revenue use only

NEW SOUTH WALES DUTY
01-07-2014 0007659203-001
TRANSFER
DUTIABLE AMOUNT $ **********10,000.00
DUTY $ **********125.00

(A) **TORRENS TITLE**

Part Lot 36 in Deposited Plan 1013547 now comprised in Lot 239 in Deposited Plan 1201225

(B) **LODGED BY**

Document Collection Box	Name, Address or DX, Telephone, and Customer Account Number if any	CODES
BOX 30P	L J KANE & CO LLPN 123818G Reference (optional): HOS - R C Church	T TW

(C) **TRANSFEROR**

THE TRUSTEES OF THE ROMAN CATHOLIC CHURCH FOR THE DIOCESE OF LISMORE

(D) **CONSIDERATION** The transferor acknowledges receipt of the consideration of $1.00 and as regards the land

(E) **ESTATE** specified above transfers to the transferee an estate in fee simple.

(F) **SHARE TRANSFERRED**

(G) Encumbrances (if applicable):

(H) **TRANSFEREE**

LJ Kane
Authorised to
Amend
(I) 22/9/14
DATE

PATRICK JAMES KEARNEY AND ANTHONY THOMAS KEARNEY

TENANCY: Tenants in Common in equal shares.

D.O. / NOT / DATE

(J) The Common Seal of The Trustees of the Roman Catholic Church for the Diocese of Lismore was hereunto affixed in the presence of the Most Reverend Geoffrey Jarrett Bishop of Lismore under and in pursuance of a delegation made to him under Section 9B of the Roman Catholic Church Trust Property Act, 1936.

COMMON SEAL ROMAN CATHOLIC CHURCH TRUST PROPERTY ACT 1936 DIOCESE OF LISMORE

+Geoffrey Jarrett

Signature of authorised person:

Certified correct for the purposes of the Real Property Act 1900 by the person whose signature appears below.

I certify I am an eligible witness and that the transferee signed this dealing in my presence.
Signature of witness:
Name of witness: Naomi Ruth Stafford
Address of witness: 165 Martin Street, Ballina

Signature: of transferee:

~~Signatory's name:~~
~~Capacity:~~

(K) The transferee / transferee's solicitor / transferee's agent certifies that the eNOS data relevant to this dealing has been submitted and stored under eNOS ID No. [ ] Full Name: ..... Signature: .....

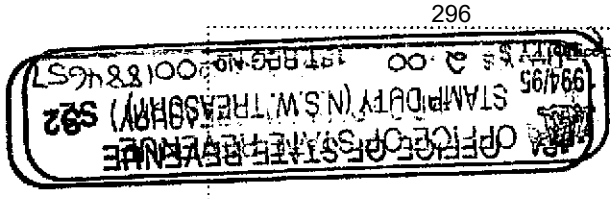
** s117 RP Act requires that you must have known the signatory for more than 12 months or have sighted identifying documentation.*

TRANSFER

Real Property Act, 1900

296

O
831926 E



(A) **LAND TRANSFERRED**

Show no more than 20 References to Title.
If appropriate, specify the share transferred.

FOLIO IDENTIFIER 13/584379

(B) **LODGED BY**

L.T.O. Box	Name, Address or DX and Telephone
	L. J. KANE & CO. RGO Box 30P REFERENCE (max. 15 characters): HAYLE - NEWLAND

(C) **TRANSFEROR** KATHLEEN ANN NEWLAND

(D) acknowledges receipt of the consideration of $319,468.43

and as regards the land specified above transfers to the Transferee an estate in fee simple

(E) subject to the following **ENCUMBRANCES** 1. ..... 2. ..... 3. .....

(F) **TRANSFEREE**

T TS (s713 LGA) TW (Sheriff)	THE TRUSTEES FOR THE ROMAN CATHOLIC CHURCH FOR THE DIOCESE OF LISMORE.

(G) ~~TENANCY:~~

(H) We certify this dealing correct for the purposes of the Real Property Act, 1900. **DATED** 22/12/95

Signed in my presence by the Transferor who is personally known to me.

Rochelle See
Signature of Witness

ROCHELLE SEE
Name of Witness (BLOCK LETTERS)

5049 SAN JULIO AVENUE
SANTA BARBARA, CA. 93111
Address of Witness

Kathleen Ann Newland
Signature of Transferor

Signed in my presence by the Transferee who is personally known to me.

Signature of Witness

Name of Witness (BLOCK LETTERS)

Address of Witness

Signature of Transferee's Solicitor
(R. HOSIE)

INSTRUCTIONS FOR FILLING OUT THIS FORM ARE AVAILABLE FROM THE LAND TITLES OFFICE

CHECKED BY (office use only) ST

Ausdoc Commercial and Law Stationers 1991

STAMP DUTY

OFFICE USE ONLY

Z 239314

TRANSFER

REAL PROPERTY ACT, 1900

T

CB	1 of 1	X
$	47	

$21/1

Torrens Title Reference	If Part Only, Delete Whole and Give Details	Location
Certificate of Title Volume 13010 folio 230 NEW 3/251003	WHOLE	At Skennars Head Parish of Ballina County of Rous

DESCRIPTION OF LAND Note (a)

TRANSFEROR Note (b)

JOHN LACHLAN MACAULAY and ELAINE REGINA MACAULAY

ESTATE Note (c)

(the abovenamed TRANSFEROR) hereby acknowledges receipt of the consideration of $ 330,000.00 and transfers an estate in fee simple in the land above described to the TRANSFEREE

TRANSFEREE Note (d)

BARRY PHILLIP CROWLEY of Fox Street, Ballina, Retired Builder

OFFICE USE ONLY S

TENANCY Note (e)

as joint tenants/tenants in common

PRIOR ENCUMBRANCES Note (f)

subject to the following PRIOR ENCUMBRANCES 1. ..... 2. ..... 3. .....

DATE 3 - 9 - 1990

We hereby certify this dealing to be correct for the purposes of the Real Property Act, 1900.

EXECUTION Note (g)

Signed in my presence by the transferor who is personally known to me

Signature of Witness

C. G. R. LOMAX

Name of Witness (BLOCK LETTERS)

BALLINA

Address and occupation of Witness

SOLICITOR

E L Macaulay
E R Macaulay

Signature of Transferor

Note (g)

Signed in my presence by the transferee who is personally known to me

Signature of Witness

Name of Witness (BLOCK LETTERS)

Address and occupation of Witness

Solicitor for the

D. Johnston

Signature of Transferee

TO BE COMPLETED BY LODGING PARTY Notes (h) and (i)

LODGED BY

Morris, Hayes & Edgar
LAW STATIONERS
99 ELIZABETH STREET
SYDNEY
DX 420 AN0287 232-2411
35 D

Delivery Box Number

LOCATION OF DOCUMENTS

CT	OTHER	
✓		Herewith.
		In L.T.O. with
		Produced by

OFFICE USE ONLY

Checked	Passed	REGISTERED - -19	Secondary Directions		
Signed	Extra Fee	20 SEP 1990	Delivery Directions	CT	35D

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: 239/1201225

SEARCH DATE	TIME	EDITION NO	DATE
20/6/2016	3:24 PM	2	9/6/2015

LAND

LOT 239 IN DEPOSITED PLAN 1201225
AT SKENNARS HEAD
LOCAL GOVERNMENT AREA BALLINA
PARISH OF BALLINA COUNTY OF ROUS
TITLE DIAGRAM DP1201225

FIRST SCHEDULE

GREENLIFE PROPERTIES PTY LTD (T AJ547628)

SECOND SCHEDULE (5 NOTIFICATIONS)

1 RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)
2 LAND EXCLUDES MINERALS - SEE CROWN GRANTS
3 M892179 EASEMENT FOR WATER SUPPLY 3.66 METRE(S) WIDE AFFECTING THE PART(S) SHOWN SO BURDENED IN THE TITLE DIAGRAM
4 DP251003 RIGHT OF CARRIAGEWAY 7 METRE(S) WIDE AFFECTING THE PART(S) SHOWN SO BURDENED IN THE TITLE DIAGRAM
5 DP251003 RIGHT OF CARRIAGEWAY 7 METRE(S) WIDE APPURTENANT TO THE PART(S) SHOWN SO BENEFITED IN THE TITLE DIAGRAM

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

coffey -skennars PRINTED ON 20/6/2016

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - HISTORICAL SEARCH

SEARCH DATE
20/6/2016 3:31PM

FOLIO: 3/251003

First Title(s): SEE PRIOR TITLE(S)
Prior Title(s): VOL 13010 FOL 230

Recorded	Number	Type of Instrument	C.T. Issue
5/6/1987		TITLE AUTOMATION PROJECT	LOT RECORDED FOLIO NOT CREATED
5/11/1987		CONVERTED TO COMPUTER FOLIO	FOLIO CREATED CT NOT ISSUED
20/9/1990	Z239314	TRANSFER	EDITION 1
6/5/2005	AB459514	MORTGAGE	EDITION 2
28/12/2006	AC833954	DISCHARGE OF MORTGAGE	EDITION 3
30/8/2011	AG441905	TRANSMISSION APPLICATION	EDITION 4
19/3/2014	AI448642	DEPARTMENTAL DEALING	EDITION 5
29/9/2014	DP1201225	DEPOSITED PLAN	FOLIO CANCELLED

*** END OF SEARCH ***

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - HISTORICAL SEARCH

SEARCH DATE

24/6/2016 1:01PM

FOLIO: 13/584379

First Title(s): SEE PRIOR TITLE(S)
Prior Title(s): VOL 13090 FOL 232

Recorded	Number	Type of Instrument	C.T. Issue
28/3/1988		TITLE AUTOMATION PROJECT	LOT RECORDED FOLIO NOT CREATED
9/9/1988		CONVERTED TO COMPUTER FOLIO	FOLIO CREATED CT NOT ISSUED
28/8/1995	O472132	APPLICATION FOR REPLACEMENT CERTIFICATE OF TITLE	EDITION 1
11/1/1996	O831926	TRANSFER	EDITION 2
15/3/2001	DP1013547	DEPOSITED PLAN	FOLIO CANCELLED RESIDUE REMAINS

*** END OF SEARCH ***

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - HISTORICAL SEARCH

SEARCH DATE
24/6/2016 1:00PM

FOLIO: 36/1013547

First Title(s): VOL 951 FOL 191 VOL 322 FOL 67
Prior Title(s): 13/584379

Recorded	Number	Type of Instrument	C.T. Issue
15/3/2001	DP1013547	DEPOSITED PLAN	FOLIO CREATED EDITION 1
23/12/2009	DP1146651	DEPOSITED PLAN	EDITION 2
29/9/2014	DP1201225	DEPOSITED PLAN	FOLIO CANCELLED

*** END OF SEARCH ***

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - HISTORICAL SEARCH

SEARCH DATE

20/6/2016 3:26PM

FOLIO: 239/1201225

First Title(s): VOL 322 FOL 67
Prior Title(s): 3/251003 36/1013547

Recorded	Number	Type of Instrument	C.T. Issue
29/9/2014	DP1201225	DEPOSITED PLAN	FOLIO CREATED CT NOT ISSUED
29/9/2014	AI912989	TRANSFER WITHOUT MONETARY CONSIDERATION	EDITION 1
9/6/2015	AJ547628	TRANSFER	EDITION 2

*** END OF SEARCH ***

Ballina Shire Council Records

89/76

P 693

Application No. 89/76

Tintenbar Shire Council

(Local Government Act, 1919)

Building Application Under Ordinance No. 70

To the Shire Clerk,

Date 27. 4. 19 76

Council Chambers, Alstonville.

Sir,

Herewith I forward $52-00, being the amount of the necessary fees, and hereby apply for the Council's approval of the plans and specifications, two copies of which are submitted herewith, of the building proposed to be erected upon the land described below, and in accordance with such plans and specifications.

This building is intended for Residential purposes.

DESCRIPTION OF LAND

~~Por.~~ or Lot No. 3 Section No. Sub. plans 16.64.302. Parish Ballina.

Road or Street Shannon Hd. Road Town or Village

Area 11.33 ha. Frontage 285-94 Depth 402-39.

Name of Owner John Lochlan & Elaine Regina MacAulay.

Address 16 Cawarra pt, Ballina.

Name of Builder J. L. MacAulay.

Address 16 Cawarra pt. Ballina.

DP 28703.

SUMMARY OF SPECIFICATION

Note : Sizes must be given.

18×10.

Foundation 18×18×6 No. of Stories 1 Damp Proof Course Material Alkathene

Material of Outer Walls B/V. Partition Walls Versiboard Material of Roof Tiles

Floor Joists 4×2 Ceiling Joists Gang Nail Roof Trusses Wall Plates Rafters Bearers 4×3.

Corner Studs 3×3. Other Studs 3×2 Height of Rooms, floor to ceiling 8'0"

Proposed Method of Drainage Absorption trench.

(Note : System of drainage must be to the approval of Council's Building Surveyor)

Particulars of Closet Accommodation Septic Is Bathroom or Laundry Detached ? —

(Closet must be strictly in accordance with Local Government Ordinance 44)

NOTE.—State whether materials to be used are all new or otherwise—

All new materials.

Estimated Total Value of Building : $ 23000.

Estimated Total Value of Fencing : $

Applicant { Signature J. MacAulay
Address 16 Cawarra St Ballina.

Note :—The form below this line is for use of Council only.

Report on Application

Water. 30-00 R.

27/4/76

BUILDING FEE $ 52-00. R. No. 8386 Date 27/4/76

~~SEPTIC TANK~~ $ —

SANITARY FEE $ —

DEVELOPMENT APPLICATION $ 5-00

$ 57-00.

Building Surveyor

E X T E N T O F W O R K

The work to be executed under this contract comprises

erection of A BRICK VENEER DWELLING

F O R

J.L. & E.R. MACAULAY

L O C A T I O N

LOT 3, PART PORT. 16, T.V. 7429, F. 5, SKENNARS HEAD RD., SHIRE OF TINTENBAR.

This specification shall apply to all sections of the job when multiple buildings or units unless otherwise specified.

Brief Specification of Type of Construction

Ground floor - ~~Concrete slab~~ wood floor

First and other floors -

Ground floor walls - Brick veneer

First and other floor walls -

Roof covering - Concrete tiles or terra cotta tiles

I N D E X

PRELIMINARIES

A.1 SIGNING CLAUSE This is the Specification referred to in our Agreement dated this day of 19

A.2 The Contract is to be on the form of Agreement and Schedule of Conditions as, or similar to the Master Builders standard contract.

A.3 REQUIREMENTS When involved, the requirements of the Lending Society as per their Schedule of "Acceptable Standards of Construction" shall be deemed to form part of this Specification. If any conflict in standard asises, the higher standard shall prevail.
The fixing instructions of building material manufacturers of materials used in this contract shall deemed to be part of this contract.

A.4 VISIT SITE Tenderers are advised to visit the site of the proposed works before tendering and to satisfy themselves as to the extent of the facilities available, and to examine the site for all conditions that may affect contract work. Levels when indicated are approximate and tenderers are to check for exact levels. No extras will be allowed for failure to observe requirements of this clause.

A.5 MEANING The meaning of these plans and specifications is a first class job which shall be carried out in a thorough and workman - -like manner. Only skilled labour is to be employed in all trades. All materials to be new and the best of their respective kinds.

A.6 MATERIALS AND WORKMANSHIP Except as may be otherwise described in the specification, all materials are to be new and materials and workmanship are to be of the best quality throughout and subject to the approval of the owner. The builder shall make weitten request to the owner for approval of the substitution of any materials or construction other than those specified herein or shown on drawings, and of materials etc. proposed to be used when approved materials etc. are specified without mentioning any standard by name. Except where otherwise stated the standard of quality shall be that which would fully comply with the relevant SAA Specification and/or code.

A.7 ALTERATIONS Any minor alteration in the course of erection shall not vitiate the contract or affect the time for completion, provided no unreasonable delay is caused in giving authority or instructions of such alterations.

A.8 OBVIOUS WORK When a construction or item of work is to be obviously inferred or is usual and proper in the class of work generalised in this specification, the same is to be included notwithstanding that such construction or such necessary item is not specially mentioned in the specification or shown on drawing.

A.9 OMISSIONS Should any error or omissions appear in the specifications or plans the builder is to notify the owner and have same rectified, otherwise it is agreed that the owners directions be accepted.

A.10 CONDITIONS OF CONTRACT The whole of the works to be carried out under the Conditions of Agreement as adopted by the Master Builders Association and in accordance with Ordinance No. 70 of the Local Government Act. Carefully examine and provide amounts in tender for all items in this specification.
The contract to be -

(a) Lump sum contract
(b) Rise and fall contract

A.11 ACCESS FOR OWNERS AND LENDING AUTHORITY INSPECTORS The builder shall at all times afford access to the above or their deputies, and give all assistance to facilitate the inspection of work both on the site and/or in shops.

A.12 TIME FOR COMPLETION The contract is to be completed with all possible speed, and no delays will be countenanced. Materials are to be placed on order immediately on signing of the contract.

A.13 SETTING OUT The builder shall set out the whole of the works and be responsible for same.

A.14 CERTIFICATES Certificates from the various authorities as to the satisfactory compliance with their requirements must be lodged with the owner before final payment will be made.

A.15 BUILDING FEES (a) The builder is required to apply for and obtain a building licence from the local authority before proceeding to set out the work. The builder must also allow for making applications and receive approval from all other authorities or departments concerned and payment of any fees and charges involved.
(b) The owner will obtain approval and pay building fees. All other fees to be paid by builder.

A.16 AWARDS The builder shall observe all awards and pay all claims in respect of rates of pay and allowances, fares and travelling time, holiday pay, long service leave, payroll tax, insurance of workmen's tools and all other statutory requirements relating to the employment of labour.

A.17 INSURANCE The insurance policy against the loss or damage by fire and/or explosion etc. taken out and maintained in the joint names of the proprietor and the builder shall apply to all work excuted and material and goods delivered to the site. The policy and all other insurance policies shall be with an insurance company to the approval of the owner. Policies or cover notes must be submitted to the owner before the first progress payment is made.

A.18 WORKER'S COMPENSATION INSURANCE The builder is to insure all workmen on the site or elsewhere employed in connection with the work under the Worker's Compensation Act or any Act amending same which the proprietor may become liable under common law.

A.19 PUBLIC RISK INSURANCE The builder shall hold the proprietor harmless from any claims for structural damage to property or injury to persons happening from any neglect, default, want of care or misconduct on the part of the builder or anyone in his employ during the execution of the works and he shall insure in an office approved by the owner against public risk for a sum sufficient to indemnify the proprietor against any or all claims that may be made.

A.20 STAMP DUTY The builder shall pay Stamp Duty on the contract, which will be signed under seal if the proprietor is a corporate body.

A.21 ASSIGNMENT OF RIGHTS The builder shall not assign his rights under this contract to any other contractor without approval of owner.

A22 TOOLS, PLANT AND TRANSPORT The contractor shall provide all necessary tools, plant and transport necessary to the completion of this contract.

A.23 LATRINES The builder shall provide temporary latrine accomodation for his workmen in accordance with the requirements of the local authority; he shall maintain same in a clean and sanitary condition and obliterate all traces of same at completion of works.

A.24 DRAWINGS Figured dimensions upon the drawings must be taken in preferance to scaled dimensions. All dimensions shall be checked by the builder and verified on the site. All plans and specifications shall be kept continuously on the works in good order.

A.25 BUILDER'S LICENCING ACT The builder is to hold a licence under the Builder's Licencing Act. The builder is to erect a sign at the front of the building site when building work commences, as required by Regulation 21 of the Act. The sign is to show -

1. The builder's name
2. The words "Licenced Builder"
3. The licence number

A.26 MAKING GOOD The builder shall be responsible for and shall make good any damage to fencing, footways, roads and surfaces generally and any other work which may be disturbed or injured by cartage or other operations in carrying out this contract and shall attend upon, cut away for, and make good after, all trades including nominated sub-contractors and must leave the whole in as good a state of repair as they were in when he commenced the works.

A.27 TEMPORARY SERVICES The builder shall arrange with respective authorities for the supply of electricity power and water for all purposes in the execution of the works and shall pay all charges in connection herewith.

A.28 CLEANING UP ON COMPLETION Remove all building and other rubbish, plant etc., clean new windows, remove all stains from all parts of the building, including cleaning down all exposed brickwork if required, and leave the whole of the premises clean and in perfect order, fit for immediate occupation; also ease joinery, oil all locks and label and hand over all keys.

This is the Specification referred to in our Agreement

dated this .....day of 19

BUILDER .....

WITNESS .....

PROPRIETOR .....

WITNESS .....

EXCAVATOR

B.1 SITE EXCAVATION Excavate, fill and generally prepare the site as shown on the drawings, formed and finished with uniform slopes and in general carry out such further excavations as may be required to obtain the finished levels. Clear the building area of all trees, stumps, shrubs and other obstructions; grub up all roots and fill in holes with the best excavated soil thoroughly consolidated. Strip off all grass and vegetable soil under concrete slabs.

B.2 TRENCHES Excavation for all footings to have level bottoms stepped as necessary. Trenches when excavated are to be in the solid natural earth and not in fill. If it is found that this is not so when trenches are excavated to planned dimensions they must be taken down to natural ground. The bottoms of all excavations are to be not less than the depth of the footings below the natural ground surface.

B.3 MAINTAIN EXCAVATION The Builder shall support and maintain the sides of all excavations and keep excavations clear of fallen materials by adequate shoring, sheeting, planking and strutting as may be required by the nature of the soil.
The Builder shall keep all excavations clear of seepage and surface water during the construction by draining, pumping or bailing as required and provide pumps and form temporary drains and levees necessary to ensure dry conditions.

B.4 SERVICES Excavate for all drains, seepage drains, surface drains, pits and sumps, and pipes for water, electric mains, etc. as may be required. Trenches are to have true bottoms, graded as required, plumb sides, and, after inspection and approval of services, to be back-filled, well consolidated and rammed.
Excavate for stormwater drains in positions shown on plan to provide a minimum cover of 150 mm.

B.5 SUPERFLUOUS EXCAVATED MATERIAL All superfluous excavated material is to be spread and levelled on the site or removed at the direction of the owner.

DRAINER

C.1 GENERALLY Excavate for the whole of the underground services and lay the runs of glazed stoneware socketted drain pipes of the diameters shown on the drawings together with all required bends, sloped junctions, inspection pipes and other necessary parts. The drawings show the general layout of drainage and are diagrammatic only.
Care must be exercised in setting out and determining general falls of the drains so that the maximum gradients are obtained. All pipes and fittings shall be first quality socketted, salt glaze ware, straight, true in bore, free of cracks and all other defects. Each pipe shall be properly bored so that the invert is a true and even gradient, laid firmly on barrel, evenly graded from point to point and rubber ring jointed.
Drains must not be laid within 600 mm of footings of buildings where running parallel with same.
Cleaning eyes to be fitted in straight runs at intervals of 6 m and at each junction, bend or change of direction.
Each P.T. floor waste shall be fitted with an approved drainers grate, set at a level to enable the floor to be graded to same.

In unsewered areas where sewerage is likely in the near future all internal drainage to be for future sewerage connection and Certificate of Approval obtained from the prospective sewerage authority.
In sewered areas drainage to be connected to nearest sewer main to requirements of appropriate authority.

C.2 GREASE TRAP In unsewered areas the wastes from kitchen sinks to pass through an approved grease trap and connected to the drains as shown on plans.

C.3 STORM WATER DRAINAGE Storm water drainage to be carried out in accordance with the requirements of the local authority and laid so as to discharge into the street water tables as shown on the drawings. Terminate at rainwater downpipes with upturn bend to receive downpipe. 90 mm P.V.C. piping may be used in lieu of vitrified clay pipes.

C.4 BACKFILLING AND SURPLUS MATERIAL No backfilling of trenches, both for soil and waste or stormwater drainage shall commence before inspection and approval by an officer of the appropriate authority.

C.5 CERTIFICATE Obtain the authority's Certificate of Satisfactory Completion and hand to owner.

C.6 ABSORPTION TRENCH When required, and shown on plans, the absorption trenches are to be of lengths shown on the site plan and constructed of concrete boxes with cavity all round filled with gravel, or other approved types. Trenches are to be taken down to suitable drainage material and not less than 600 mm deep.

C.7 SEPTIC TANK If shown on site plan provide and instal a septic tank of approved manufacture and capacity, to be installed strictly to the approval of the Health Department and the relevant authority.

C.8 COLLECTION TANK If shown on plan provide and instal a collection tank of approved manufacture and capacity, to be installed strictly to the approval of the Health Department and the relevant authority. Provide an approved allarm bell if required.

C O N C R E T O R

D.1 MATERIALS 1. Cement: Portland cement shall conform to ASS No. A2 and subsequent revisions thereof. The cement used shall be supplied in unopened and undamaged bags bearing the manufacturer's brand and date of manufacture.

2. Aggregates: (a) Fine aggregate shall consist of sand having clean, hard, strong, durable, uncoated grain and shall be free from injurious amounts of dust, lumps, soft or flaky particles, shale alkali, organic matter, loam or other deleterious matter. It should preferably be coarse river sand.

(b) Coarse aggregate with the exception of lightweight aggregates shall comply with the requirements of AS A77 and shall consist of crushed stone, gravel or other inert material with similar characteristics or combinations thereof having clean, hard, strong, durable uncoated particles free from laminated pieces, alkali, organic or other deleterious matter. The maximum size of aggregate permitted will be 20 mm.

3. Water: For concrete shall be clean and free from injurious amounts of oil, acid, alkali, organic matter or other deleterious substances. It shall be neither brackish nor salty and water not potable for human beings shall not be used.

D.2 PROPORTIONING AND MIXING Generally all concrete is to be proportioned by volume in the following proportions:- one part of cement, two parts of sand, four parts of 20 mm gauge metal and a sufficient amount of water to provide a workable mix.
Unless otherwise specified minimum concrete strengths are to be:-

Footings - 15 M.P.A.
Slabs and paving - 20 M.P.A.

The mixing of the concrete shall be carried out in a batch mixer of approved type which will ensure a uniform distribution of the ingredients throughout the mass, so that the material is uniform and homogenous.
Mixing time per batch shall be not less than three minutes.
Readimix concrete may be used as an alternative method and shall comply with the requirements of AS A64 for mixing and delivery.

D.3 REINFORCEMENT Reinforcement shall comply with the relevant Australian Standard Specifications. Reinforcements shall be accurately positioned and secured against displacement by using annealed iron wire of not less than 18 SWG and shall be supported by concrete or metal chairs or spacers or metal hangers.

D.4 PLACING AND CURING Concrete shall be carefully handled and placed to avoid segretion, and shall be adequately compacted by means of mechanical vibrators or rodding and spading to ensure maximum compaction.
After placing, all concrete is to be covered and left undisturbed for at least two days for footings fully set in the ground and seven days for exposed footings and beams and slabs, before being built on. The concrete shall be kept continuously damp during the above specified periods.
Formwork to the vertical surfaces of exposed beams and slabs shall not be stripped sooner than two days after placing; bottom formwork shall remain in place a minimum of seven days before stripping.

D.5 FLOOR SLAB FINISH All floor slabs are to be finished as laid and are to be dusted with dry cement and screenings one to three, and trowelled to a smooth even surface with a steel trowl or mechanical trowelling machine.

D.6 EXTENT OF WORK (a) Footings - Unless otherwise specified on structural engineering drawings the following footings, where applicable, shall apply. (The footings applicable tothe building in question have been underlined.)

Wall Thickness	Footing Size	Brick Buildings Reinforcement
Single Story 75mm to 110 mm	450 x 250	4.. No. 4 mild steel rods or 6.. 10mm dia. mild steel rods and mild steel stirrups at 1000mm centres or Two layers of No. F818 hard drawn steel reinforcing fabric or No. F8TM trench mesh with mild steel stirrups at 1500mm centres.
200mm to 300mm	600 x 250	6.. No. 4 mild steel rods or 10.. 10mm dia. mild steel rods and mild steel stirrups at 1000mm centres, or Two layers of No. F818 hard drawn steel reinforcing fabric, or No. F8TM trench mesh with mild steel stirrups at 1500mm centres.

Wall Thickness	Footing Size	Reinforcement
		Brick Buildings
Two Storey 75mm to 110mm	450 x 300	As for 75mm to 110mm single story work.
200mm to 300mm	600 x 300	As for 200mm to 300mm single story work
		Brick Veneer Buildings
Single Storey 75mm to 110mm	450 x 250	4.. No. 4 mild steel rods or 6.. 10mm dia. mild steel rods and mild steel stirrups at 1000mm centres, or Two layers of No. F818 hard drawn steel reinforcing fabric, or No. F8TM trench mesh with mild steel stirrups at 1500mm centres.
Two Storey 75mm to 110mm	450 x 300	As above.
		Timber Frame Buildings
Single Storey Up to 1500mm high 75mm to 110mm	300 x 150	4.. 10mm dia. mild steel rods and mild steel stirrups at 1000mm centres, or Two layers of No. F818 hard drawn steel reinforcing fabric, or No. F8TM trench mesh with mild steel stirrups at 1500mm centres.
Over 1500mm high 75mm to 110mm	400 x 225	As above.

Piers Footings under piers to be 450 x 450 x 150.

(b) Concrete Slab on Ground Floors The area to be covered by the slab shall be cleared of top soil and vegetable growth and well drained with sub-surface drains, if required to divert any seepage flow.

Filling under floor slab shall be of approved granular material free from clay and silt. Compact filling under floor slab in layers not exceeding 150mm compacted thickness. On top of filling place 50mm minimum thickness of clean sand and bring to proper level surface for waterproof membrane specified.

Waterproof Membrane Provide a minimum 100VM thick polythene membrane to entire area under floor slab. Continue membrane across on top of brick bearing walls to perimeter foundation walls. When more than one sheet is required, a 300mm overlap should be used and care - fully taped with a 50mm pressure sensitive polythene tape. Reinforcing of slabs shall be laid on concrete chairs with flat snag-free bases. Any polythene which is damaged shall be patched or replaced prior to pouring concrete.

Concrete slab thickness to be minimum 100mm unless shown otherwise on plans and reinforced with F62 mesh.

(c) Suspended Reinforced Concrete Slabs All concrete slabs within or adjoining the building are to be suspended. Solid filling is NOT permitted. Temporary formwork must be removed.
Unless otherwise specified, the following shall apply for residential purposes.
Simply supported one way slabs with a minimum 110mm bearing and 20mm fabric cover from underside of slab.

Span	Slab Thickness	Steel Fabric
To 2100mm	100mm	F928
To 2400mm	100mm	F718
To 3000mm	115mm	F818
To 3300mm	115mm	F918
To 3600mm	125mm	F1018
To 4200mm	150mm	F1018
To 4500mm	150mm	F1118
To 4800mm	165mm	F1118

(d) Reinforced Concrete Stair Flights and Landings Concrete slabs of stair flights and landings are to have a minimum thickness of 115mm and 1000mm in width and are to be reinforced with No. F918 hard drawn steel fabric with the main wires running across the span.
Low set steps of concrete with 12mm rendered finish or alternatively brickwork with precast concrete treads may be used.

(e) Concrete Paving Car tracks and driveways are to be 100mm thick with minimum reinforcing of F42 fabric.
Other paving 75mm thick. Finish paving monolighically and provide contraction joints full thickness of concrete where necessary.

D.7 SHEET FLOORING Compressed asbestos cement sheet flooring of not less than 18mm thick may be used in lieu of suspended concrete floors. Sheets are to be glued and screwed to floor joists spaced at a max. of 450mm centres and adequately flashed and suitably finished in accordance with manufactur's instructions.

D.8 FOOTPATH CROSSING When the street frontage is kerbed and guttered allow for the driveway to continue to back of kerb.

B R I C K L A Y E R

E.1 BRICKS Bricks to piers and rendered work to be hard, sound and well burned commons, those for face work to be selected face bricks of approved type and colour.

E.2 FACING BRICKS Facing bricks are to be selected facing bricks, uniform in size, of selected tones in colour.

E.3 TYPE

E.4 MORTAR Mortar to consist of four parts of clean sharp sand free from impurities, and one part fresh Portland cement, mixed with clean fresh water to which may be added lime or a proprietary brand of plasticiser sufficient for ease of working.

E.5 BRICKWORK GENERALLY Bricks to be well soaked with water when made by the dry-pressing process. Brickwork to be laid in stretcher bond generally; no part to be carried up more than scaffold hight above the rest; raked back at end of lengths; beds and joints not to exceed 10mm in thickness; to be well flushed up; solid work grouted every course; joints in external facework to be recessed with a steel jointer with the following finish -

(a) Ironed joint
(b) Raked joint

E.6 WALLS GENERALLY All exterior brick walls to be in cement mortar, to be of the several forms and dimensions shown or figured, carried up plumb and level; door, window and other openings to be formed as shown with reveals and jambs perfectly plumb and with all required checks for frames. The external walls are to be built with a min. 40mm cavity to studs and fixed with galvanised kinked wire bond ties set approx. every 900mm in each fourth course, fixed to studs or adjoining cavity wall. Wall ties to be kept free from mortar droppings. At completion all facework is to be cleaned down to remove all discolouration.

E.7 DAMPCOURSES (a) Brick and Brick Veneer On all brickwork and piers at underside of floor bearers or as directed, bituminous coated non-ferrous metal or embossed black polythene dampcourse is to be set, lapped 150mm at joints and laid in two runs in cavity walling. To walls surrounding concrete floors an additional run of dampcourse is to be laid, one full course above floor level and stepped down to meet lower dampcourse where other walls abut walls of bathroom, shower reces, laundry or W.C.

(b) Fibro etc. To all brickwork supporting concrete floors bituminous coated non-ferrous metal, or embossed black polythene dampcourse is to be laid full width of walling and lapped 150mm at all joints, set one course below slab.

E.8 SLEEPER PIERS AND ANT CAPS The free sleeper piers to be each 225 x 225mm, the attached piers to be spaced to lineup with the others, each 225 x 110mm built off the footings of the main wall. Each free sleeper pier to be fitted with a sheet of 26 gauge galv. steel projecting 50mm beyond the pier all round with edges turned down 15mm and each attached pier to be capped with a similar sheet of steel projecting 50mm beyond the face and free edges turned down as last and turned up at back the full height of the sleeper plate and kept 40mm clear of the wall face.

E.9 VENTILATION All Buildings
Below Floor The space between the ground and the underside of the floor shall be thoughly ventilated and cross ventilated by means of suitable and sufficient air bricks set in external walls or by other effectual methods, to provide openings in the external walls having an unobstructed area of not less than 2 100 mm2/m of external wall; and not less than 200mm in depth in every part. Similarly, ventilation is to be provided under verandahs and/or suspended concrete floor slabs and no section of the under floor area shall be constructed in such a manner that will hold pockets of still air.

E.10 WEEP HOLES All Buildings Perpend joints are to be left open in external brick walls spaced at approx. every 600mm immediately over flashing of all exposed openings and above chimney tray, also to brick retaining walls and fender walls, etc. as required or directed.

E.11 WINDOW SILLS The window sill to be formed with bricks matching the facework, unless otherwise specified, set on edge in cement mortar to an approved tilt, projecting 12mm beyond the facework. In no instance are the bricks to cross the cavity.

E.12 CONTROLL JOINTS IN BRICK WALLS Vertical control joints shall be placed in brick walls at a maximum of 18m centres in external walls and a maximum of 36m centres in internal walls. Vertical control joints shall be continuous throughout the height of the wall and where the control joints are exposed to the weather they shall be caulked with a durable, flexible caulking material. The minimum width of the control joint shall be 10mm.

STEEL AND METALWORKER

G.1 LINTELS Brick and Brick Veneer Buildings Over all openings in brick walling mild steel angles or bars, one to be provided to each 75mm or 110mm thickness of brickwork, all having at least 110mm bearing at each end. All angles or bars are to be hot dipped galvanized before fixing.

Spans	Steel Lintels
Up to 1200mm	One 76 x 10 bar.
Up to 1500mm	One 76 x 76 x 10 angle.
Up to 2400mm	One 127 x 76 x 10 anble.
Up to 3000mm	One 152 x 89 x 10 angle.

G.2 GENERAL All pipe railings, stair framings, pipe supports, etc. are to be hot dipped galvanised with welds treated with cold galvanised paint. All bolts, coach screws, nails, etc. used externally, to be hot dipped galvanised.

G.3 ALUMINIUM WINDOWS AND DOORS Unless otherwise specificed all aluminium windows and doors to be anodised finish, of types and sizes as shown on plans .

G.4 SPECIAL FINISH

G.5 FLYSCREENS Flyscreens are to be of similar finish to windows and doors and are to be fitted to all windows and doors except -

G.6 SHOWER SCREENS Allow for supply and fixing of screens and/or sliding doors to shower recesses when shown on plan. Unless otherwise specified glass to be reinforced obscure glass.

CARPENTER AND JOINER

H.1 TIMBER All timber is to be the best of approved kinds specified. All timber is to be sound, well seasoned, and free from sapwood, shakes, white ants, gum veins and all other defects, and sawn square to the full sizes specified.

H.2 TIMBER WORK GENERALLY The whole of the carpenter's and joiner's work throughout to be framed, trimmed and finished in the best and most workmanlike manner; All necessary templates, linings, blocks, stops, ironwork and ironmongery to be provided and fixed, all trimming, grooving, tonguing, rebating, housing, beading, mitring, throating, etc. incidental to carpenter's and joiner's work to be done although not specially mentioned herein. Trimmers and trimming joists and rafters to be 12mm thicker than ordinary timbers.
All timbers and boarding exposed to view to be wrot.
All parts usually framed or intended or specified to be framed to be morticed and tenoned; dowelling will not be permitted unless specially specified.
All joinery to be primed on all faces before leaving joinery shop.

H.3 C.A.38 CODE With lending society or owners approval the Australian Standard CA38 Light Timber Framing Code may be used in lieu of the following specified sizes.

H.4 TIMBER FLOORS GENERALLY Are to be constructed with 100 x 75 hardwood bearers at no more than 1800mm centres, set on edge, in long lengths, halved and spiked at joints.
Depths shall be increased by 25mm for each additional 600mm or portion thereof by which the span exceeds 1800mm. Width shall be increased to a minimum of 100mm where either span or spacing exceeds 3000mm.
Bearers for the job in question shall be -

Valleys to be laid with single length boards.
A manhole is to be trimmed for and formed in a directed ceiling, to be not less than 600mm x 450mm, fitted with a ledged cover faced with the same material as the ceiling and set flush with the ceiling.
The eaves to be boxed for flat soffit with a 50 x 38 horizontal member nailed to the foot of each rafter, carried back to the wall face and there secured to and including a 50 x 25 continuous batten nailed to face of studs.
Unless otherwise specified or shown on plans a 200 x 25 fascia to be planted on the ends of rafters set to project 25mm below the eaves soffit, grooved to take eaves lining. The eaves to be lined with 4.5mm thick asbestos cement secured at each bearing with hollow pointed galv. nails, the angle at eaves soffit to be fitted with quod or similar at the wall face. Sheets to be "V" jointed.
Roof must not be strutted off hangers or ceiling joists.

H.9 TIMBER ROOF TRUSSES These are to be fabricated in a properly equipped factory and fixed, all in strict accordance with manufacturer's engineering details and specifications. Timber used to be strictly as prescribed. Maximum spacing 900mm, fix trusses to plates with patented metal brackets, fix 75 x 25 diagonal bracing to rafters and to tie beams of gable roof buildings.
The thickness of the top plate to be increased by 25mm where roof trusses supporting a tile roof are placed more than 50mm from a stud wall. Alternately it may be nogged under the plate where required with same size timber as plate.

H.10 TIMBER FRAMED CARCASE The walls to have 75mm or 100mm studs as shown on plan, grouped in threes at angles and spread not more than 600mm centres elsewhere, the foot and head of each checked into the vermin and top plates respectively and well spiked.
Top and bottom plates 50mm thick in long lengths, halved at joinings over stud bearings, at angles and intersections, checked 10mm deep for head of studs and well spiked to same.
Ground floor walls of two storey buildings to consist of 100 x 50 bottom plates, 100 x 75 top plates with 100 x 50 studs.
Each wall to be diagonally braced where possible or as directed with 50 x 15 checked in flush with studs and plates.
Door, window and other openings to be trimmed with studs 50mm thick, checked and spiked into position. For openings over 1800mm wide use 75mm thick studs.
Patented galvanized steel nail plates may be used with butt joints in lieu of halved joints for any framing.

H.11 NOGGING To be fixed between studs at not more than 1200mm centres. Where wall cladding is to be jointed thereon noggings are to be 38mm thick and finished flush with the face of the frame.
Where cladding is not to be jointed in such a manner noggings may be 25mm thick and be finished not more than 6mm behind the face of the frame. Skirting blocks of same section as bottom plates and not less than 225mm long, to be spiked to plates. Skirting blocks are not required where wall linings extend below the top of the bottom plate and skirtings are less than 75mm high.

H.12 HEADS Heads to be of timber having a stress grade of 1250f or better. To be accurately checked into studs at least 10mm for openings to 1800mm wide and at least 18mm for openings up to 3650mm wide.
The following heads to apply where applicable -

Where Supporting Conventional Roof Construction

For Tiled Roof Construction	For Sheet Roof Construction (metal or asbestos cement)
Up to 1200mm span - 75 x 75 or 100 x 38	50 x 75
Up to 1500mm - 125 x 50 or 100 x 100	125 x 38
Up to 1800mm - 175 x 50 or 150 x 75	125 x 50 or 100 x 100
Up to 2150mm - 200 x 50 or 175 x 75	150 x 50 or 125 x 100
Up to 2450mm - 225 x 50 or 200 x 75	175 x 50 or 150 x 75
Up to 2750mm - 250 x 50 or 225 x 75	200 x 50 or 175 x 75
Up to 3050mm - 275 x 50 or 250 x 75	225 x 50 or 200 x 75

Where Supporting Roof Trusses at 900mm Centres

Span of Truss

Span	6100mm	7600mm	9100mm
Up to -	For tiled roof construction:		
1200mm -	125x50 or 150x38	150x50 or 175x38	150x5o or 175x38
1500mm -	175x50 or 150x75	175x50 or 150x75	200x50 or 175x75
1800mm -	200x50 or 175x75	225x50 or 200x75	225x50 or 200x75
2150mm -	225x50 or 200x75	250x50 or 225x75	275x50 or 250x75
2450mm -	275x50 or 250x75	275x50 or 250x75	300x50 or 275x75
2750mm -	300x50 or 275x75	300x50 or 275x75	325x50 or 275x75
3050mm -	325x50 or 275x75	300x75	325x75
Up to -	For sheet roof construction (metal or asbestos cement):		
1200mm -	100x50	100x50 or 100x75	100x50 or 100x75
1500mm -	125x50 or 100x100	150x50 or 125x75	150x50 or 125x75
1800mm -	150x50 or 125x100	175x50 or 150x75	175x50 or 150x75
2150mm -	175x50 or 150x 75	200x50 or 175x75	200x50 or 175x75
2450mm -	200x50 or 175x 75	225x50 or 200x75	240x50 or 200x75
2750mm -	225x50 or 200x 75	250x50 or 225x75	260x50 or 225x75
3050mm -	250x50 or 225x 75	275x50 or 250x75	290x50 or 250x75

Verandah plates to be classed under heads.

H.13 THRESHOLD With timber floors the threshold to each external doorway to be cut out of 150 x 38, nosed and projecting beyond the architrave, returned at ends 150mm beyond the reveals and set flush with the adjoining floor; the joists to be doubled and checked to receive the threshold pieces.

With concrete slab floors, terrazzo, 38mm thick, properly bedded in mortar and laid full width of opening with fall out.

H.14 WINDOW REVEALS To all metal windows set in brick veneer or timber frame, provide 20mm thick timber reveals.

H.15 SKIRTINGS Excepting in wet rooms the skirtings throughout to be
(a) 75 x 12 bullnose or splay.
(b)

H.16 ARCHITRAVES The architraves throughout to be -
(a) 75 x 12 bullnose or splay.
(b)

Neatly mitre and securely fix architraves.
The architraves to doors to be carried down to floors, and those to windows to finish picture frame style.

H.17 DOORS All internal doors to be 2040 x 520 - 620 - 720 - 820 x 35 (as required) flush panel.
(a) Masonite sheeted
(b) Ply sheeted
(c)

Fit doors to rebated door jambs of -
(a) Timber
(b)

Doors as indicated on plan to be sliding type; fit with approved sliding door tracks and flush pulls. Cover track with suitable pelmet.

Exterior doors to be 35 - 40mm thick waterproof doors.

Front doors to be -
(a) Flush panel ply
(b)

Rear doors to be -
(a) Flush panel ply
(b)

H.18 GARAGE DOORS Supply and fix to garage door openings doors of types as shown on plan.

Special finish -

H.19 LINEN & OTHER SIMILAR CUPBOARDS Construct cupboards where shown on plan and to dimensions indicated.
Linen cupboards to be fitted with shelving 300 - 450mm apart.
Sit cupboards on framed and sheeted false floor and carry up full height of wall. Fit doors of the following material and type with approved catch and handle. Doors to be of -

(a) Laminated plastic particle board
(b) Louvre
(c)

H.20 WARDROBES AND DRESSING TABLES Construct wardrobes and dressing tables where shown on plan in a similar manner to linen cupboards,with hat shelf and hanging rods provided. Doors to be of -

(a) Laminated plastic particle board
(b) Louvre
(c)

Top dressing tables with selected laminated plastic.
Fit nest of drawers/shelves in wardrobes.

H.21 HARDWARE Supply and fix all approved locksets, latchsets, catches, fasteners, lifts, door stops, shower curtain rail, two 900mm towl rails, soap holders and any other fittings necessary to complete the job.

H.22 KITCHEN CUPBOARDS Supply and fix bench cupboards and overhead cupboards as shown on plan. Provide a properly constructed frame to support kitchen sink and to form cupboards. Raise cupboard floor and form toe recess. Allow for fitting nest of drawers , top drawer to have divisions for cuttlery. Fit selected handles and catches to drawers and doors.
Cover tops with selected laminated plastic.
Enclose frame and fit the following doors -

(a) Laminated plastic particle board
(b)

Fit the following doors to overhead cupboards -

(a) Sliding glass with recessed finger pulls
(b) Doors as bench cupboards
(c)

H.23 PANTRY Supply and fix pantry cupboard if and as shown on plan. Space shelves from 150 to 400mm apart. Fit the following doors to pantry cupboard -

(a) As bench cupboards
(b)

H.24 VANITY CUPBOARD Supply and fix vanity cupboard to size and shape shown on plan. Top vanity cupboard with selected laminated plastic and fit selected vanity basin. Fit the following items to the vanity cupboard -

(a) Nest of drawers
(b) Laminated plastic finish doors
(c)
(d)

H.25 SHAVING CABINET Fit the following shaving cabinets to bathrooms -

H.26 BATH VENTS Ventilate the underside of the bath tub by means of two air vents placed at side of bath.

H.27 GABLE ENDS Properly frame down gable ends and sheet as shown on plan.

H.28 FENCING The following fencing is to be allowed for and carried out -

H.29 EXTERNAL WALL SHEETING If not brick external walls the following sheeting is to be fixed to external walls, sheeting being fixed to manufacturer's specifications -

H.30 INTERNAL STAIRS Where internal stairs are shown on plan, properly construct steps with 38mm thick softwood stringers and bullnose treads and 12mm thick risers. Wedge treads at back. Unless otherwise specified provide polished timber handrailing fixed to chrome brackets. Finish stairs for the following finish -

(a) Estapol finish (three coats)
(b) To be covered

H.31 DOOR SEALS Fit Hills Daniel door seals to the following doors -

R O O F E R A N D R O O F P L U M B E R

I.1 TERRA COTTA TILES To be glazed and manufactured in accordance with AS A13. Tiles to be laced with copper wire every alternate tile and eaves. Verge tiles to be priperly bedded and secured.
Tile colour to be -

I.2 CONCRETE TILES To conform to AS A12 and AS A158 and to be produced by manufacturers who provide a comprehensive guarantee.
Tiles to have end lap of not less than 75mm.
Tiles to be wired, nailed or otherwise fixed to manufacturers specifications.
Tile colour to be selected by owners -

(a) Standard colour
(b)

I.3 SARKING (All Buildings) Sarking to be anti-glare double sided aluminium foil covered fabric. Fix sarking over rafters to ensure the discharge of water, without ponding, into the eaves.
Anti-ponding boards must be of sufficient width to ensure a fall toward the gutter and of sufficient strength to support sarking without sagging between roof rafters.

(a) ~~The roof is not to be sarked~~
(b) The roof is to be sarked

~~I.4 METAL TRAY DECK Supply selected roof decking as shown below~~ and fix to manufacturer's specifications.

Type -

I.5 CORRUGATED ASBESTOS CEMENT ROOFING Fix super six sheets with galvanized round head screws with metal and felt washers set in mastic to each run of battens, with side and end laps all in accordance with manufacturers directions.
Provide all necessary accessories and the roof is to be adequately bird proofed.

I.6 CORRUGATED STEEL ROOFING To be 26 gauge galvanized steel fixed 60mm roofing nails and lead washers to every alternate corrugation at ends and every fourth corrugation intermediately. All hips and ridges are to be covered with 450mm wide stock capping.

I.7 GUTTERING Fix guttering to fascia board specified, with patent fixing clips, spaced according to manufacturers directions. Form block ends as required and cut gutter to form thimble outlet connections for downpipes.
Guttering to be of the following material -

(a) ~~Galvanized steel fascia gutter~~
(b) Aluminium fascia gutter
(c)

I.8 DOWNPIPES Fasten downpipes to walls and connect to thimble outlet and cement into stormwater upstand.
Downpipes to be of similar material as guttering, allow for -

I.9 FLASHINGS (All Buildings) Lead flashing is to be provided around chimney stacks, vent stacks, etc., down roof slopes, along flat roofs, hoods and wherever else required.
The lead is to be dressed down on to roof slopes with vertical faces stepped; lead wedged and pointed in cement mortar, as required.
Valley gutter to be 450mm wide with beaded edges of

(a) Galvanized steel
(b) Aluminium

P L U M B E R

J.1 WATER SERVICE To be connected to all fittings from the supply authority's main in accordance with its requirements. To be copper throughout of the following size -

20mm for detatched dwellings.
Residential flat buildings, incl. meter, as required by the local authority.

Water outlets to be in copper of sizes required by the local authority and to be provided as follows -

One front yard on stand pipe
One back yard on stand pipe
Other stand pipes -
Kitchen sinks
Laundry tubs
Washing machine taps
Bath
Shower recesses
Hand basins
Water heaters
Toilets

J.2 PLATING All piping, fittings, cover plates, valves, stopcocks, etc., exposed to view internally are to be heavily nickel plated and chromium plated.

J.3 HOT WATER SERVICE Connect hot water service to supply main in accordance with manufacturer's specifications. Piping to be in copper of sizes required by the local authority and supplied to the following points -

Kitchen sinks
Laundry tubs
Washing machine taps
Bath
Shower recesses
Hand basins

J.4 DRAINAGE Instal floor wastes in all wet rooms and connect to drainage line as previously specified or to exterior wall of building to flap valve, where allowed.
If sewerage is available connect all wastes, including toilets, to sewerage main, to local authority's requirements.
If sewerage is not available connect toilets to septic tanks in accordance with the local authority's requirements, and connect all other wastes to soakage trenches as shown on plan with waste from kitchen sinks passing through an approved grease trap to drainage lines. Provide all back vents requested by the local authority.

J.5 FITTINGS Fittings to be of average types and selected by owner.
Unless otherwise specified allow for areated spout to kitchen sink, spout to bath, spout to vanity basin, telescopic laundry arm to laundry tubs.

E L E C T R I C I A N

K.1 WIRING The installation shall comply with the S.A.A. Wiring Rules and service and installation rules of the local authority.

K.2 LIGHTS Switches are to be flush silent action, with moulded plastic plates of approved colour and dezign. Allow for -

One way light switching
Two way light switching

K.3 POWER POINTS General purpose outlets shall be flush combination three pin (flat) of approved colour and dezign. Allow for -

Single power points
Double power points

K.4 STOVE AND HOT WATER SERVICE Allow for connecting electric stoves where shown on plan and hot water service on -

(a) Restricted hours
(b) Off peak

K.5 METER BOX Construct to local supply electricity authority specifications one meter box in approved location.

K.6 ADDITIONAL WIRING Allow for connection of the following items -

(a) Exhaust fan to
(b)
(c)

WALL & CEILING FINISHES

L.1 GENERAL Wall and ceiling linings as specified to be fixed and finished in accordance with the manufacturer's instructions.
Wall and ceiling sheets that are to be set to be fixed at right angles to ceiling battens or studs with staggered butt joints. Double nail with galv. flat head clouts to manufacturer's directions. Cover all nail heads with jointing compound. Final coat of jointing compound shall be sanded when dry. Butt joints to be taped with reinforcing tape supplied by the manufacturer, flush jointed and sanded smooth.
Asbestos cement or other sheeting to be "V" jointed to be securely nailed with galv. soft sheet nails, sheets fixed with neat butt joints.
Tilux to be neatly scribed to fittings and glued to walls, with manufacturer's mouldings used for joints.

L.2 INTERNAL WALL LININGS The following rooms to have wall linings as follows -

Bedrooms - GYPROCK & VERSILUX
Dining room -
Lounge -
Halls -
Kitchen -
W.C. -
Bathroom -
Laundry -
Garage -

L.3 CEILINGS The following rooms to have ceiling linings as follows -

Bedrooms -
Dining room -
Lounge - GYPROCK
Halls -
Kitchen -
Bathroom -
W.C. -
Laundry -
Garage -

L.4 CORNICE Ceilings to have cornice as follows -

(a) Fibrous or gypsum plaster board to set ceilings
(b) 25mm quod or 25 x 25 DAR to V jointed ceilings
(c)

L.5 CEMENT RENDER Cement render to compose of one part cement, four parts sand.
Generally apply render to all internal wall surfaces as specified below, finishing 12mm thick. Finish with sponge to evenly textured sand face without perceptible joints or breals.
Render to window reveals where window lugs occur is to finish min. 15mm thick.
Where different base surfaces abut and are rendered, provide knife joint full depth of render at junction.
Cement render the following walls -

L.6 MISCELLANEOUS FINISHES

CERAMIC TILER

M.1 FLOOR TILING Apply cement topping composed of one part cement and three parts sand, to floor surface, minimum thickness 25mm to allow for all requisite falls to floor waste, etc. Cover with selected first quality semi-glazed or other approved floor tiles. Neatly trim around floor wastes, fittings and walls. Finish tiles to external openings with nosing tiles and to internal doorways with aluminium angle. On completion, point tiles with waterproof grey cement.
The following floors as shown on plan to be tiled -

(a) Bathrooms
(b) Shower recesses
(c) W.C's.
(d) Laundries
(e)

M.2 WALL TILING Wall tiles shall be 150 x 150 or 200 x 100, as required, glazed finish ceramic tiles. Finish edges of tiled area with R.E. tiles. Provide and build in two 150 x 75 bath vents, selected soapholders to shower recesses and, to above bath, if required, and any other fittings further specified.
Wall tiles to be -

(a) Selected colour to -
(b) White to -

Fix wall tiles to the following surface -

(a) Asbestos cement sheets with approved adhesive.
(b) Rendered scratch coat over paper and wire with cement mortar bed.
(c) Masonary wall with cement mortar bed.

On completion finish with white grout joints cleaned down on completion.
The following walls to be tiled -

(a) Bathroom walls to -
(b) Shower recess walls to 1800mm high.
(c) Skirting to W.C.
(d) Kitchen walls above bench and behind sink and stove to -
(e)
(f)

GLAZIER

N.1 GLAZING (All Buildings) All sashes, doors (where applicable) and lights to be glazed with drawn sheet or float glass, free from all blemishes and flaws. All glass in timber to be back-puttied, and sprigged into primed or oiled rebates and weather puttied. Glazing to metal doors and windows to be carried out in a satisfactory manner in accordance with the window or door manufacturer's recommendation. Bathroom and W.C. windows to have obscure glass.
Provide coloured glass where shown on plan.

N.2 SPECIAL GLASS

N.3 MIRRORS Supply and fit the following glass mirrors -

P A I N T E R

0.1 PAINTING (All Buildings) External joinery intended to be painted is to have a priming coat on all faces at place of assembly with equal parts of red and white lead or other approved primer paint. Where joinery is to be other than painted it is to be treated at place of assembly with a priming oil including wood preservative and a water repellant. All other exposed external woodwork also shall be similarly primed.
All exposed external woodwork to receive two coats of approved paint in addition to primer. Paint to be of best quality materials or selected brand of ready mixed paint.
Exposed timber with oil or stain external finish shall receive not less than two further coats after fixing.
All internal woodwork to be stained or estapolled to receive two coats, painted work three coats.
All internal walls and ceilings to be adequately treated and prepared.
Finish ceilings with flat plastic or flat enamel paint.
All exposed ironwork usually painted and all service pipes exposed to view to receive one coat of metal primer then one coat of gloss paint.
Finish kitchen and wet rooms with a semi-gloss or full gloss paint as required.
Finish other walls with -

(a) Flat finish
(b) Vinyl acrylic finish
(c)

Finish internal woodwork and doors with -

(a) ~~Paint finish~~
(b) Estapol finish

All colours to be selected by owner.

0.2 OTHER FINISHES

0.3 WALLPAPER Wallpaper will be supplied by owners. Allow for wallpapering the following walls -

PRIME COST ITEMS

P.1 P.C. ITEMS The P.C. Items shall be nett and shall include the cost of packing and carriage and delivery to the building site. The builder shall not purchase or instal any P.C. Item without the prior approval of the owner.

Electric Stove -

Mains Pressure Water Heater -

Stainless Steel Kitchen Sink -

~~White Toilet Suite -~~

Coloured Toilet Suite -

Bath -

~~Double Stainless Steel Laundry Tubs & Cabinet -~~

Single Stainless Steel Sudsmiser Laundry Tubs & Cabinet -

Deluxe Clothes Hoist -

Vanity Unit -

Light Fittings -

Exhaust Fan -

Hardware -

Front Door -

-15-

BUILDERS LICENSING BOARD

This work can only be carried out by a licensed builder or by the owner under an owner/builders permit granted by the Builders Licensing Board.
The licensed builder must take out Insurance with the Builders Licensing Board.

SHIRE OF TINTENBAR

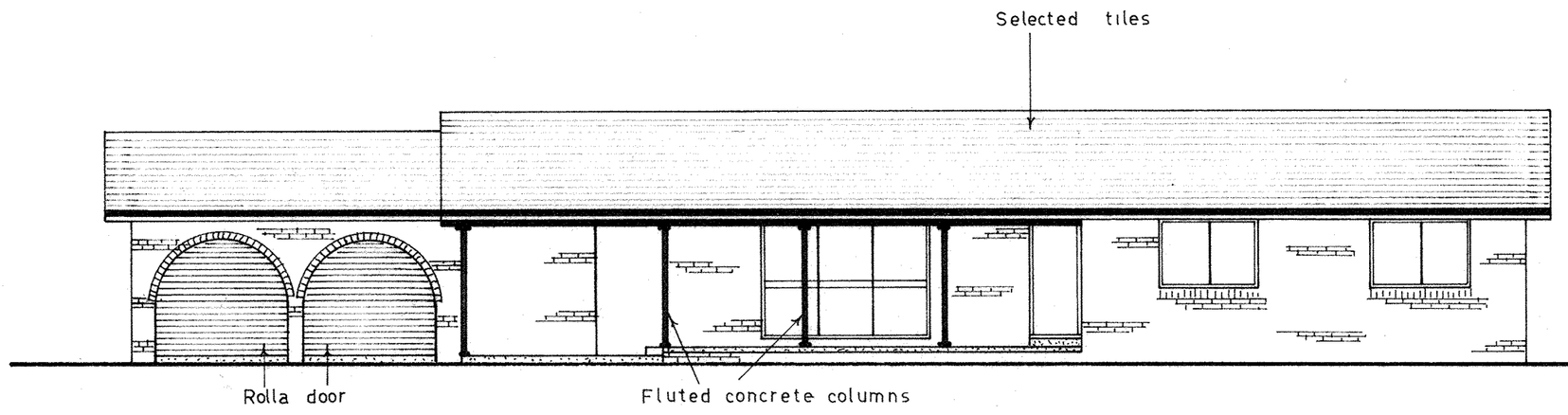
BUILDING PERMIT NO. 89/76

APPROVED SUBJECT TO THE PROVISIONS OF PART XI. LOCAL GOVERNMENT ACT. ORDINANCE 71 AND CONDITIONS ATTACHED.

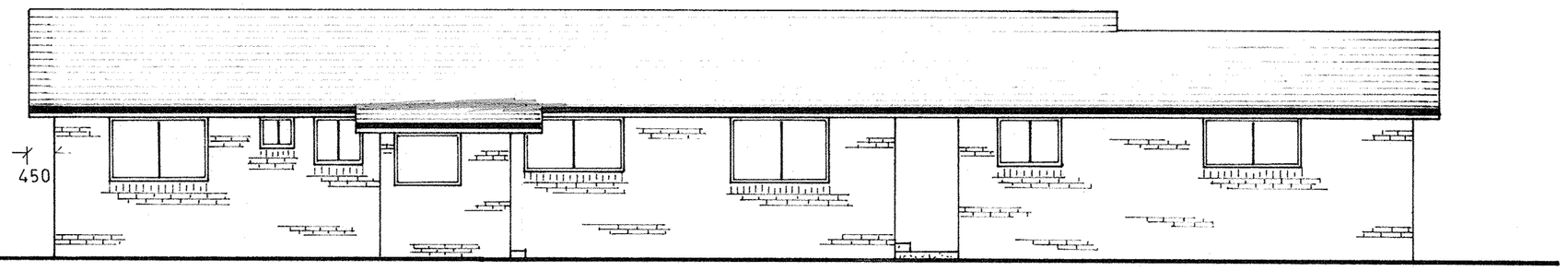
G L Peaire
SHIRE CLERK

28/4/76 19.....

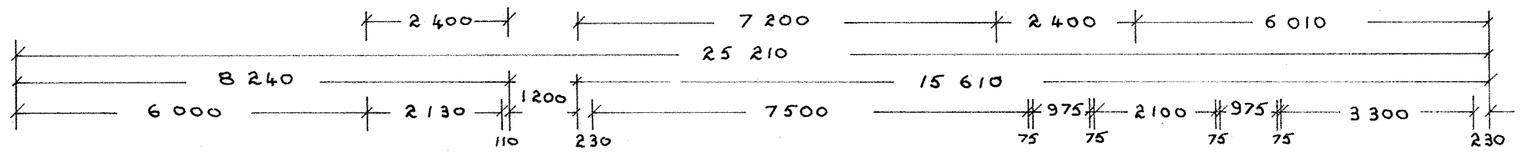
PER

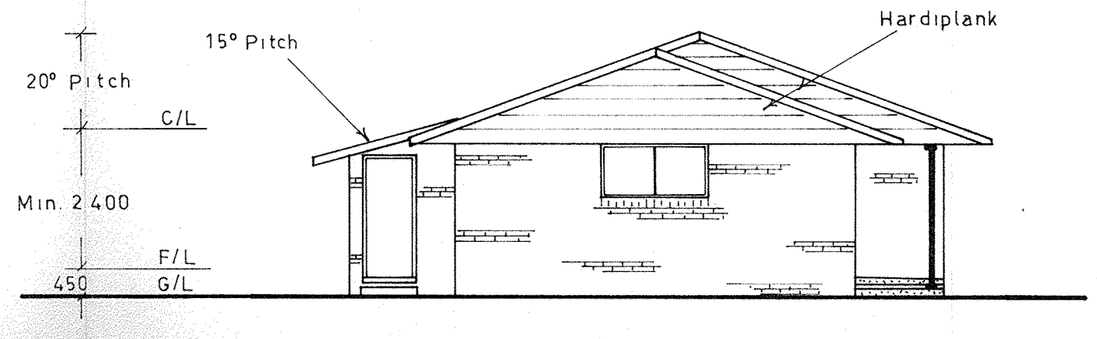


FRONT ELEVATION

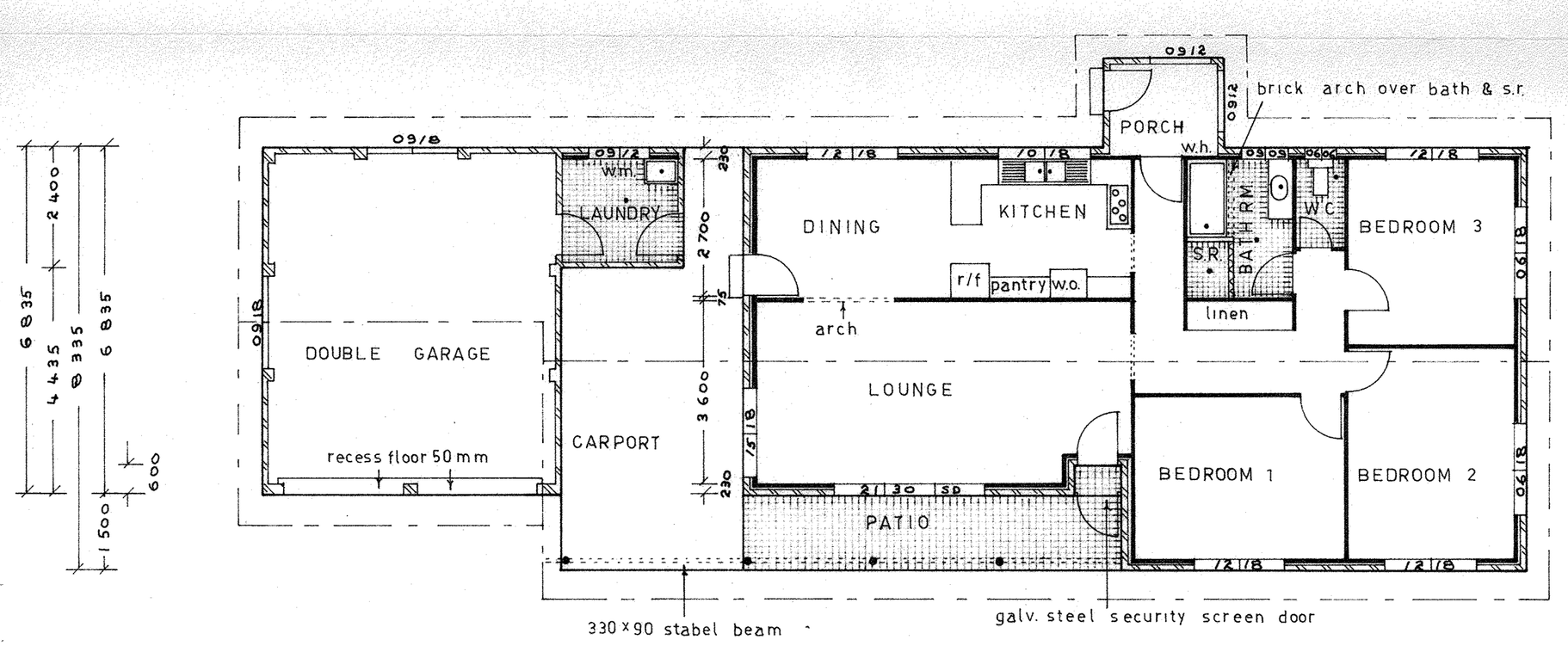


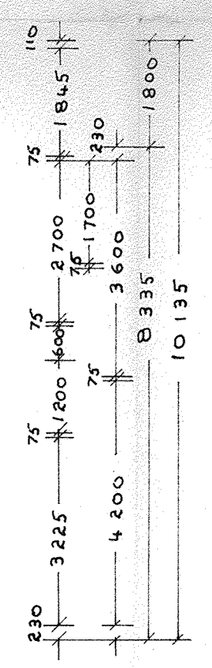
BACK ELEVATION



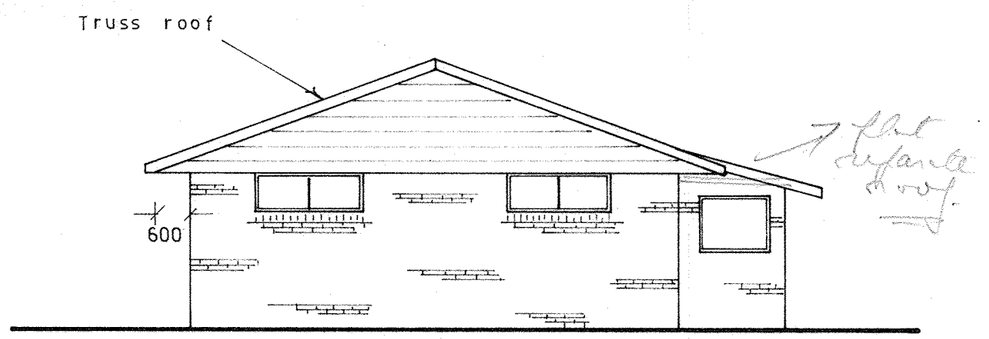


SIDE ELEVATION





FLOOR PLAN



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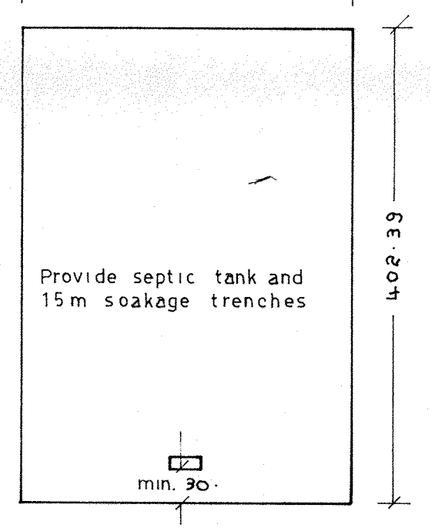


SKENNARS HEAD ROAD

SITE PLAN

AREA	1 18·207 m2
PORCH	4·32 m2
LAUNDRY	5·76 m2
GARAGE	41·01 m2
PATIO	11·902 m2
CARPORT	18·846 m2
TOTAL	200·045 m2

PROPOSED DWELLING TO BE ERECTED FOR J. L. & E. R. MACAULAY, LOT 3, PART PORT. 16, T.V. 7429, F. 5, SKENNARS HEAD RD., SHIRE OF TINTENBAR.

SCALE : 1 = 100 —— SITE PLAN : 1 = 5000

A. J. PICKUP 12/3/76 No. 709

BUILDERS LICENSING BOARD

This work can only be carried out by a licensed builder or by the owner under an owner/builders permit granted by the Builders Licensing Board.
The licensed builder must take out Insurance with the Builders Licensing Board.

SHIRE OF TINTENBAR

BUILDING PERMIT NO. 89/76

APPROVED SUBJECT TO THE PROVISIONS OF PART XI. LOCAL GOVERNMENT ACT. ORDINANCE 71 AND CONDITIONS ATTACHED.

G. L. Pearce
SHIRE CLERK.
Per

28/6/76 19....

P 653.

Application No. 85/82

Shire of Ballina

(Local Government Act, 1919)

Building Application Under Ordinance No. 70

To the Shire Clerk,
Council Chambers, Ballina

Date 14. 4. 19 82.

Sir,

Herewith I forward $ 9.00, being the amount of the necessary fees, and hereby apply for the Council's approval of the plans and specifications, TWO COPIES of which are submitted herewith, of the building proposed to be erected upon the land described below, and in accordance with such plans and specifications. (Plans to be prints, or drawn with ink. Specifications to be typed or written with Ink).

(ROURKEY)

This building is intended to be used as MACHINERY SHED WORKSHOP

State if building materials to be used are new or otherwise NEW

DESCRIPTION OF LAND

251003.

Lot No. 3 Portion No. 16 Section No. F5 D.P. No. ~~TV 7429~~

Street Name SKENNARS HEAD RD Street Number

Town or Village SKENNARS HEAD Frontage 286 metres Depth 420 metres

Name of Owner J L MACAULAY

Address ABOVE

Name of Builder J L MACAULAY

Address SKENNARS HEAD

Licence No.

Builder's Contract Price $
or
Estimated Total Value of Building $ 1800-00

Applicant Signature J L Macaulay
Address Skennars Head

NOTE :— The form below this line is for use of Council only

Report on Application

RECOMMENDED 4-6-82

Building Fee	$ 9.00	Receipt No.	7585	Date	14.4.82
Deposit on Footpath	$	Receipt No.		Date	
Deposit on Kerb	$	Receipt No.		Date	
Deposit on Crossing	$	Receipt No.		Date	
Builders Sanitary Service	$	Receipt No.		Date	
Water Tapping Fee	$	Receipt No.		Date	
Septic Tank Fee	$	Receipt No.		Date	
Other Charges	$	Receipt No.		Date	
Sewer Plan Fees	$	Receipt No.		Date	
D.A. Fee	$	Receipt No.		Date	
B.L. Insurance	$	Receipt No.		Date	

SEE REVERSE SIDE FOR INSTRUCTION FOR PREPARATION OF PLANS

Shire of Ballina

P.O. BOX No. 450
BALLINA, N.S.W. 2478
TELEPHONE No. 86 4444 (STD 066)

All communications should be Addressed to the Shire Clerk.

IN REPLY PLEASE

B.53

QUOTE THIS NUMBER

COUNCIL COPY OF BUILDING PERMIT

J.L. Macaulay,
Skennars Head Road,
SKENNARS HEAD. N.S.W. 2478

16th April, 1982.

Dear Sir,

BUILDING APPLICATION

Please find enclosed Building Permit Number 85/82 together with one copy of your plans and specifications for a new farm shed at Lot 3, Skennars Head Road, Skennars Head -

which has been approved subject to the conditions stated on the Permit and twenty four (24) hours notice being given to this office so that the building may be inspected at the following stages:-

(1) When the foundation trenches are open, the steel reinforcement in position before the concrete is poured.

(2) When the steel is in position before any concrete floor slabs are poured.

(3) When the drainage pipe lines beneath the building have been laid by the plumber so that a water test can be carried out.

(4) When the absorption trenches have been dug before they are backfilled.

(5) On the completion of the frame work with external brick walls erected and roof covering in position before the internal wall and ceilings are fixed.

(6) On the completion of the building before occupation.

Yours faithfully,

G.L. Pearse,
SHIRE CLERK.

THE COUNCIL OF THE SHIRE OF BALLINA

Building Permit

Local Government Act, 1919

No. 85/82

THIS IS TO CERTIFY that the Plans and Specifications numbered 85/82

submitted by J. MACAULAY¢

for a new farm shed

at lot 3, Skennars Head Road, Skennars Head.

classification of building under Ordinance 70 10

have been approved by the above Council subject to the following Special Conditions :—

Pipe all roof stormwater clear of the building.

Name of Owner J.L. MACAULAY

Name of Builder OWNER

This approval shall not extend to and shall not affect the rights of the Council in respect of any matter appearing in or arising out of such Plans and Specifications which is not in conformity with the Local Government Act, 1919, and the Ordinances thereunder.

This approval shall be void if the building work to which it refers is not substantially commenced within 12 months after the date of the building approval.

Dated 16th April, 19 82

Shire Clerk

6M481

SHIRE OF BALLINA

BUILDING PERMIT No. 85/82

APPROVED SUBJECT TO THE PROVISIONS OF PART XI. LOCAL GOVERNMENT ACT. ORDINANCE 70 AND CONDITIONS ATTACHED TO BUILDING PERMIT NUMBER 85/82

SHIRE CLERK

16 APR 1982 19 Per

Section 311 Local Government Act, 1919

Council is satisfied that—

☐ a) the amount, if any, payable under Part VI of the Builders Licensing Act, 1971 as an insurance premium has been duly paid;
OR

☑ b) no amount is payable in respect of the building work.

CERTIFIED BY

SPECIFICATIONS

TIMBER FRAME 100X50mm H/W PLATES

STUDS 100X38mm H/WOOD 600mm CENTRES

ROOF 125X38 RAFTERS H/W 900mm CENTRES

BATTENS 75X38 H/WOOD 900 CENTRES

ROOF LYSAGHTS TRIMDECK COLORBOND

WALL CLADDING LYSAGHTS EASY CLAD COLORBOND

SLIDING DOORS TRIMDECK COLORBOND ON 50X50mm SQUARE SECTION STEEL FRAME

CONCRETE FLOOR 100mm R/MIX CONGRETE F62 MESH

GAL HOLD DOWN BOLTS 900mm CENTRES

PROPOSED MACHINERY SHED + WORKSHOP FOR J MACAULAY

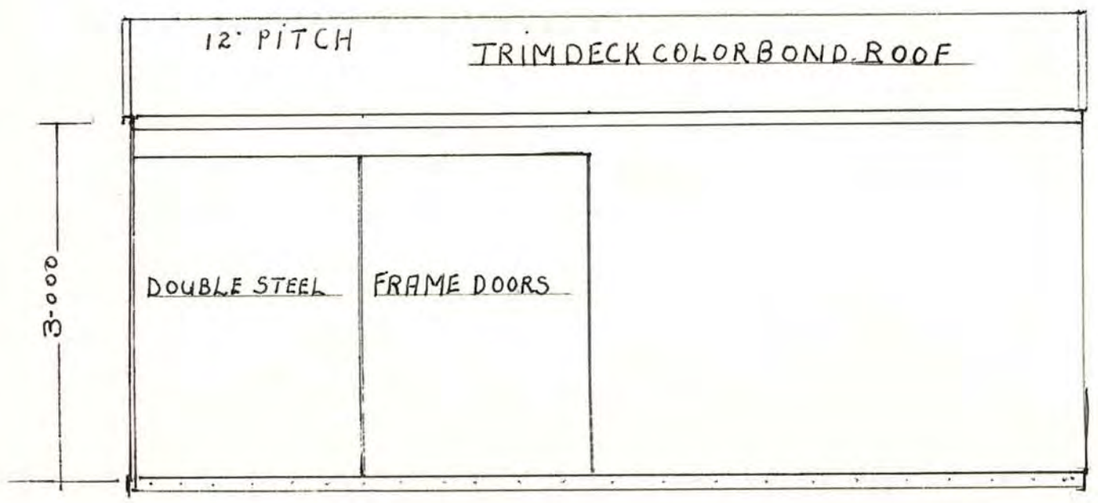
LOT 3 PART PORTION 16 TV 7429 F5

SKENNARS HEAD

SCALE 1:50 AREA 45.6 m².

5-4-82.

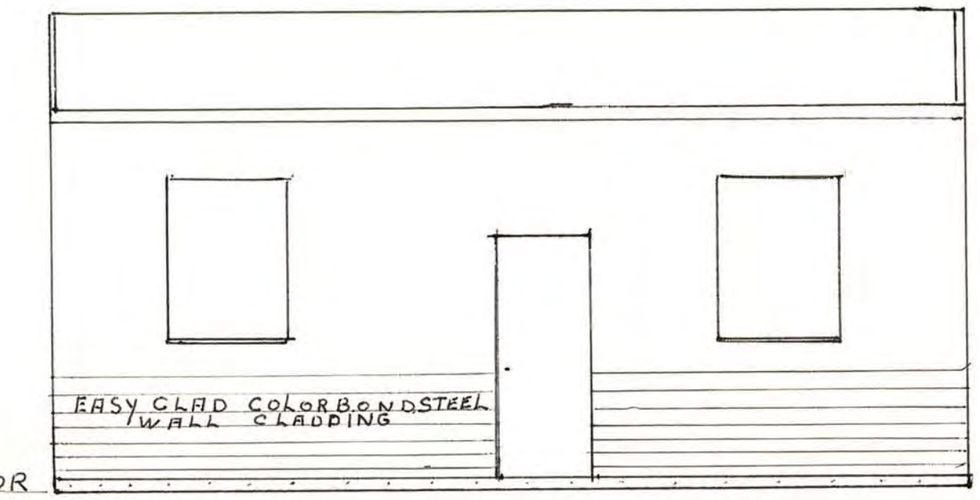
12° PITCH TRIMDECK COLORBOND ROOF



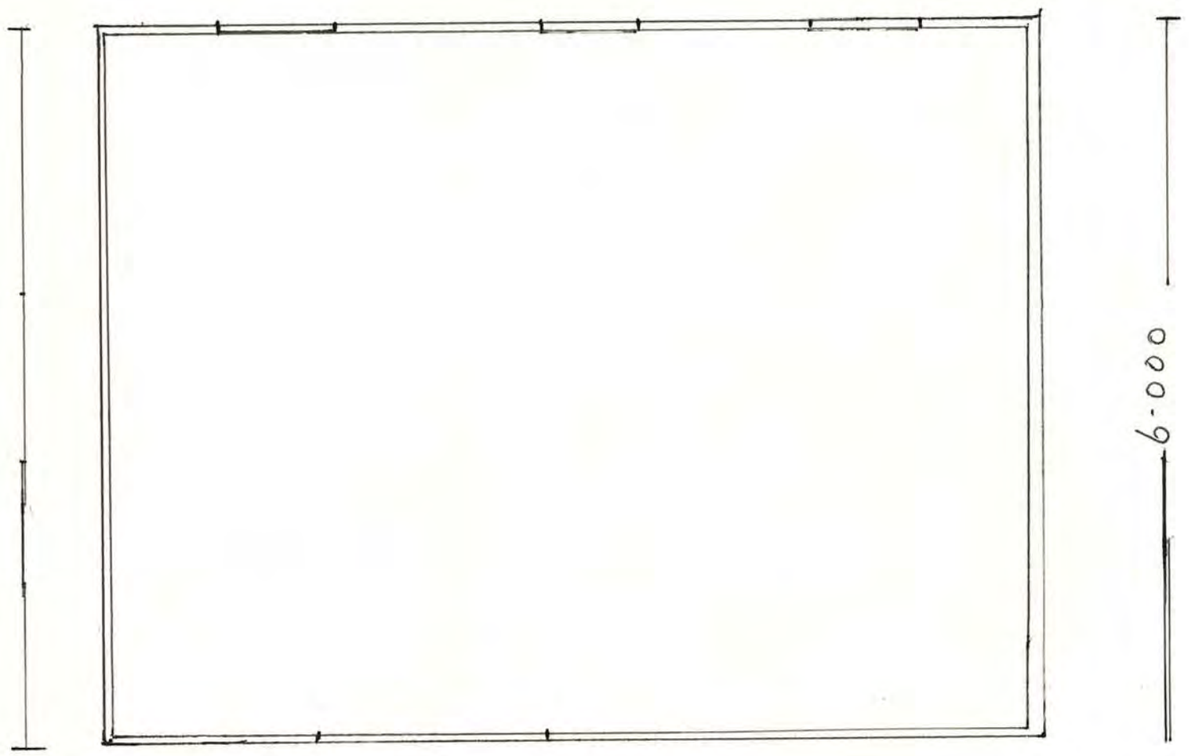
100 7·600 100

FRONT ELEVATION

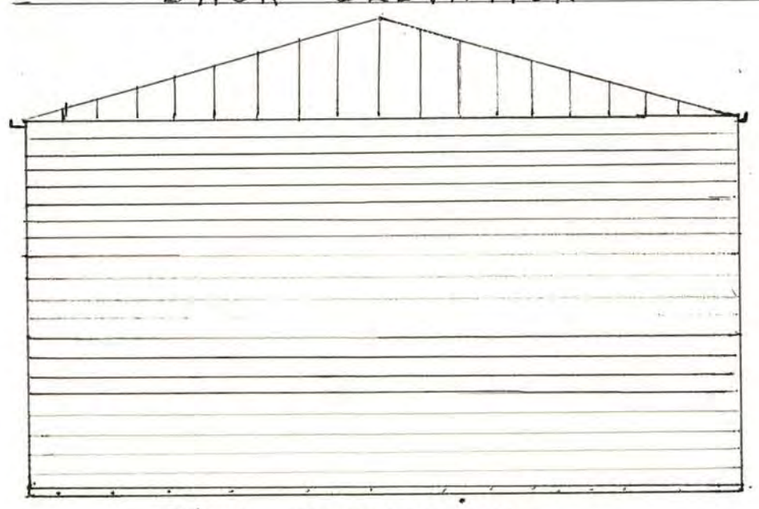
100MM CONCRETE FLOOR
F62 MESH



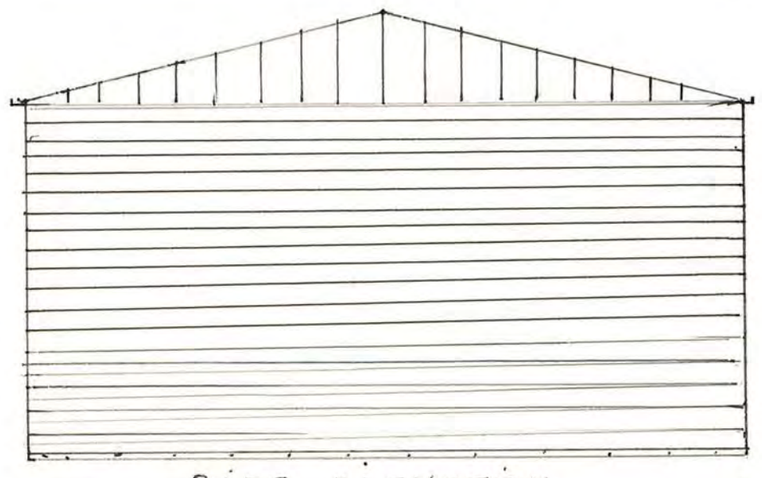
BACK ELEVATION



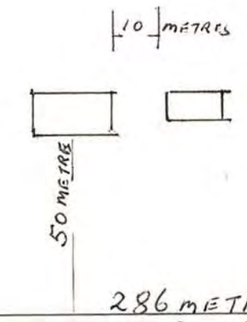
FLOOR PLAN



SIDE ELEVATION



SIDE ELEVATION



SITE PLAN

Application No. 17/86

Shire of Ballina

(Local Government Act, 1919)

Building Application Under Ordinance No. 70

To the Shire Clerk,
Council Chambers, Ballina

Date 30 January 1986

Sir,

Herewith I forward $ 10- being the amount of the necessary fees, and hereby apply for the Council's approval of the plans and specifications, TWO COPIES of which are submitted herewith, of the building proposed to be erected upon the land described below, and in accordance with such plans and specifications. (Plans to be prints, or drawn with ink. Specifications to be typed or written with ink).

This building is intended to be used as MACHINERY SHED WORKSHOP

State if building materials to be used are new or otherwise NEW

DESCRIPTION OF LAND

Lot No. 3 Portion No. 16 TV 74 Section No. 29 F5 D.P. No.

Street Name SKENNARS HEAD RD Street Number

Town or Village BALLINA Frontage 286 METRES Depth 420 METRES

Name of Owner J MACAULAY Phone No.

Address SKIENNARS HEAD RD SKENNARS HEAD

Name of Builder J MACAULAY Phone No. 877430

Address SKENNARS HEAD

Licence No. O/BUILDER

Builder's Contract Price $

or

Estimated Total Value of Building $ 2000

Applicant Signature J Macaulay

Address PO BOX 112 BALLINA

NOTE :— The form below this line is for use of Council only

Report on Application

Building Fee	$ 10	Receipt No.	7427	Date	28.1.86
Deposit on Footpath	$	Receipt No.		Date	
Deposit on Kerb	$	Receipt No.		Date	
Deposit on Crossing	$	Receipt No.		Date	
Builders Sanitary Service	$	Receipt No.		Date	
Water Tapping Fee	$	Receipt No.		Date	
Septic Tank Fee	$	Receipt No.		Date	
Other Charges	$	Receipt No.		Date	
Sewer Plan Fees	$	Receipt No.		Date	
D.A. Fee	$	Receipt No.		Date	
B.L. Insurance	$	Receipt No.		Date	

SEE REVERSE SIDE FOR INSTRUCTION FOR PREPARATION OF PLANS

Shire of Ballina

P.O. BOX No. 450
BALLINA, N.S.W. 2478
TELEPHONE No. 86-4444 (STD 066)

DX 7789 LISMORE

All communications should be Addressed to the Shire Clerk.

IN REPLY PLEASE

B 53

QUOTE THIS NUMBER

ENQUIRIES REFER

Robert Johnson

J. Macaulay,
Lot 3 Skennars Head Road,
BALLINA. 2478

4th February, 1986.

Dear Sir/Madam,

BUILDING APPLICATION

Please find enclosed Building Permit Number 17/86 together with one copy of your plans and specifications for additions to farm shed at lot 3 Skennars Head Road, Ballina
which has been approved subject to the conditions stated on the Permit and twenty-four (24) hours notice being given to this office so that the building may be inspected at the following stages:-

1. When the foundation trenches are open, the steel reinforcement in position before the concrete is poured.

~~2. When the steel is in position before any concrete floor slabs are poured.~~

3. When the drainage pipe lines beneath the building have been laid by the plumber so that a water test can be carried out.

4. When the absorption trenches have been dug before they are backfilled.

5. On the completion of the frame work with external brick walls erected ~~and roof covering in position before the internal walls and ceilings~~ are fixed.

6. On completion of the building before occupation.

Yours faithfully,

G. L. PEARSE
G.L. Pearse,
SHIRE CLERK

THE COUNCIL OF THE SHIRE OF BALLINA

BUILDING PERMIT

Local Government Act, 1919

No. 17/86

THIS IS TO CERTIFY that the plans and specifications numbered 17/86
submitted by J. Macaulay
for additions to farm shed
at lot 3 Skennars Head Road, Ballina
classification of building under Ordinance 70 10
have been approved by the above Council subject to the following special conditions:------

Name of Owner J. Macaulay
Name of Builder as above

This approval shall not extend to and shall not affect the rights of the Council in respect of any matter appearing in or arising out of such plans and specifications which is not in conformity with the Local Government Act, 1919, and the Ordinances thereunder.

This approval shall be void if the building work to which it refers is not substantially commenced within 12 months after the date of the building approval.

Dated 4th February 19 86

G.L. Pearse
SHIRE CLERK

SPECIFACTIONS

STEEL FRAME 50mm PIPE POSTS

10mm POST PLATES

CONCRETE PADS 450X450X300mm.

12MM GAL HOLD DOWN BOLTS

ROOFING COLOURBOND TRIMDECK.

WALL CLADDING. TRIMDECK

RAFTER-PURLINS ⊏ SECTION GALVANIZED

PROPOSED EXTENSION WORKSHOP MACHINERY SHED

FOR J. MACAULAY

LOT 3 PORTION 16 TV 7429 F5

SKENNARS HEAD RD

SKENNARS HEAD

SKENNARS HEAD RD. SKENNARS HEAD

286. METRES

60 METRES

NORTH

SHED

PROPOSED EXTENSION

HOUSE

75m APPROX. | 10 METRES

SITE PLAN

420 METRES

7-600

EXISTING SHED - BUILDING PERMIT 85/82

16/4/82.

CONCRETE FLOOR

6-00

PROPOSED EXTENSION

GRAVEL FLOOR.

DOOR OPENING

9-00

7600

FLOOR PLAN

TRIMDECK ROOF

DOORWAY

EAST ELEVATION - SIDE

SOUTH ELEVATION REAR

SHIRE OF BALLINA

BUILDING PERMIT No. 17/86

APPROVED SUBJECT TO THE PROVISIONS OF PART XI. LOCAL GOVERNMENT ACT, ORDINANCE 70 AND CONDITIONS ATTACHED TO BUILDING PERMIT NUMBER. 17/86

G. L. PEARSE

SHIRE CLERK

1-2-1986 Per

Section 311 Local Government Act, 1919

Council is satisfied that—

☐ a) the amount, if any, payable under Part VI of the Builders Licensing Act, 1971 as an insurance premium has been duly paid;

OR

☑ b) no amount is payable in respect of the building work.

CERTIFIED BY

336

337 Application No. 295/86

Shire of Ballina

(Local Government Act, 1919)

Building Application Under Ordinance No. 70

To the Shire Clerk,

Council Chambers, Ballina

Date 9 October 19 86

Sir,

Herewith I forward $ ....., being the amount of the necessary fees, and hereby apply for the Council's approval of the plans and specifications, TWO COPIES of which are submitted herewith, of the building proposed to be erected upon the land described below, and in accordance with such plans and specifications. (Plans to be prints, or drawn with ink. Specifications to be typed or written with ink).

This building is intended to be used as MACHINERY SHED

State if building materials to be used are new or otherwise .....

DESCRIPTION OF LAND

Lot No. 3 Portion No. ..... Section No. ..... D.P. No. .....

Street Name SKENNARS HEAD RD Street Number .....

Town or Village SKENNARS HEAD Frontage ..... Depth .....

Name of Owner J MACAULAY Phone No. 877430

Address LOT 3 SKENNARS HEAD RD

Name of Builder J MACAULAY Phone No. 877430

Address SKENNARS HEAD

Licence No. .....

Builder's Contract Price ..... $.....

or

Estimated Total Value of Building $ $990.00

Applicant Signature J Macaulay

Address SKENNARS HEAD

NOTE :— The form below this line is for use of Council only

Report on Application .....

Building Fee	$5—	Receipt No.	33193	Date	9/10/86
Deposit on Footpath	$	Receipt No.		Date	
Deposit on Kerb	$	Receipt No.		Date	
Deposit on Crossing	$	Receipt No.		Date	
Builders Sanitary Service	$	Receipt No.		Date	
Water Tapping Fee	$	Receipt No.		Date	
Septic Tank Fee	$	Receipt No.		Date	
Other Charges	$	Receipt No.		Date	
Sewer Plan Fees	$	Receipt No.		Date	
D.A. Fee	$	Receipt No.		Date	
B.L. Insurance	$	Receipt No.		Date	

SEE REVERSE SIDE FOR INSTRUCTION FOR PREPARATION OF PLANS

338

Shire of Ballina

P.O. BOX No. 450
BALLINA, N.S.W. 2478
TELEPHONE No. 86 4444 (STD 066)

DX 7789 LISMORE

All communications should be Addressed to the Shire Clerk.

IN REPLY PLEASE

B53

QUOTE THIS NUMBER

ENQUIRIES REFER

Mr. B. Johnson

14th October, 1986.

J. Macaulay,
Lot 3, Skennars Head Road,
SKENNARS HEAD. N.S.W. 2478

Dear Sir/Madam,

BUILDING APPLICATION

Please find enclosed Building Permit Number **295/86** together with one copy of your plans and specifications for **a farm machinery shed at Lot 3, Skennars Head Road, Lennox Head.** which has been approved subject to the conditions stated on the Permit and twenty-four (24) hours notice being given to this office so that the building may be inspected at the following stages:-

1. When the foundation trenches are open, the steel reinforcement in position before the concrete is poured.
2. When the steel is in position before any concrete floor slabs are poured.
3. When the drainage pipe lines beneath the building have been laid by the plumber so that a water test can be carried out.
4. When the absorption trenches have been dug before they are backfilled.
5. On the completion of the frame work with external brick walls erected and roof covering in position before the internal walls and ceilings are fixed.
6. On completion of the building ~~before occupation~~.

Yours faithfully,

G. L. PEARSE

G.L. Pearse,
SHIRE CLERK

THE COUNCIL OF THE SHIRE OF BALLINA

BUILDING PERMIT

Local Government Act, 1919

No. 295/86

THIS IS TO CERTIFY that the plans and specifications numbered 295/86
submitted by J. Macaulay
for a farm Machinery shed
at Lot 3, Skennars Head Road, Lennox Head.
classification of building under Ordinance 70 Class 10

have been approved by the above Council subject to the following special conditions:------

Name of Owner J. Macaulay
Name of Builder as above

This approval shall not extend to and shall not affect the rights of the Council in respect of any matter appearing in or arising out of such plans and specifications which is not in conformity with the Local Government Act, 1919, and the Ordinances thereunder.

This approval shall be void if the building work to which it refers is not substantially commenced within 12 months after the date of the building approval.

Dated 14th October, 1986

G. L. PEARSE
SHIRE CLERK

SPECIFICATIONS

100X100 TREATED HWD STUMPS

75X40 HWD FRAME

100X40 RAFTERS

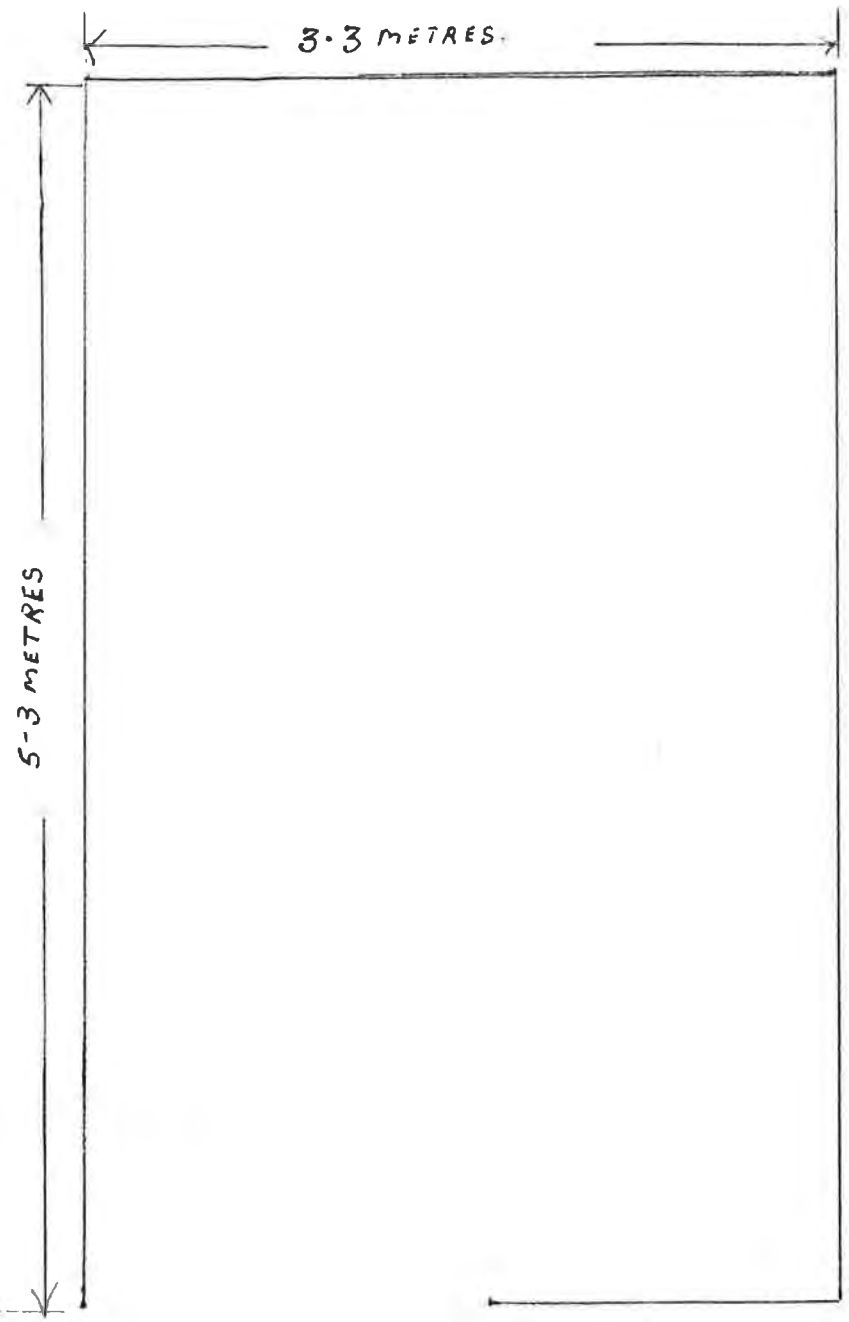
75X40 BATTENS

ROOF CORRAGATED IRON

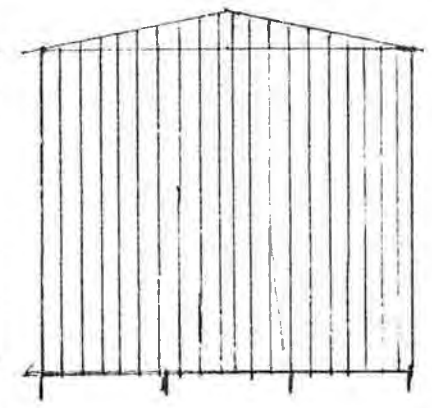
WALLS CORRAGATED IRON

EARTH FLOOR. GRAVELLED

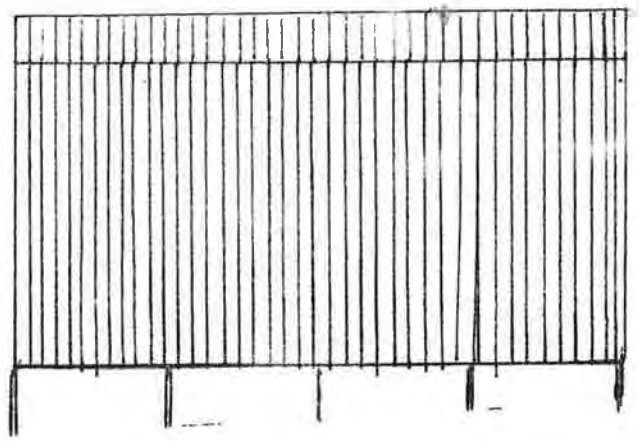
ROOF 10 DEG



FRONT ELEVATION



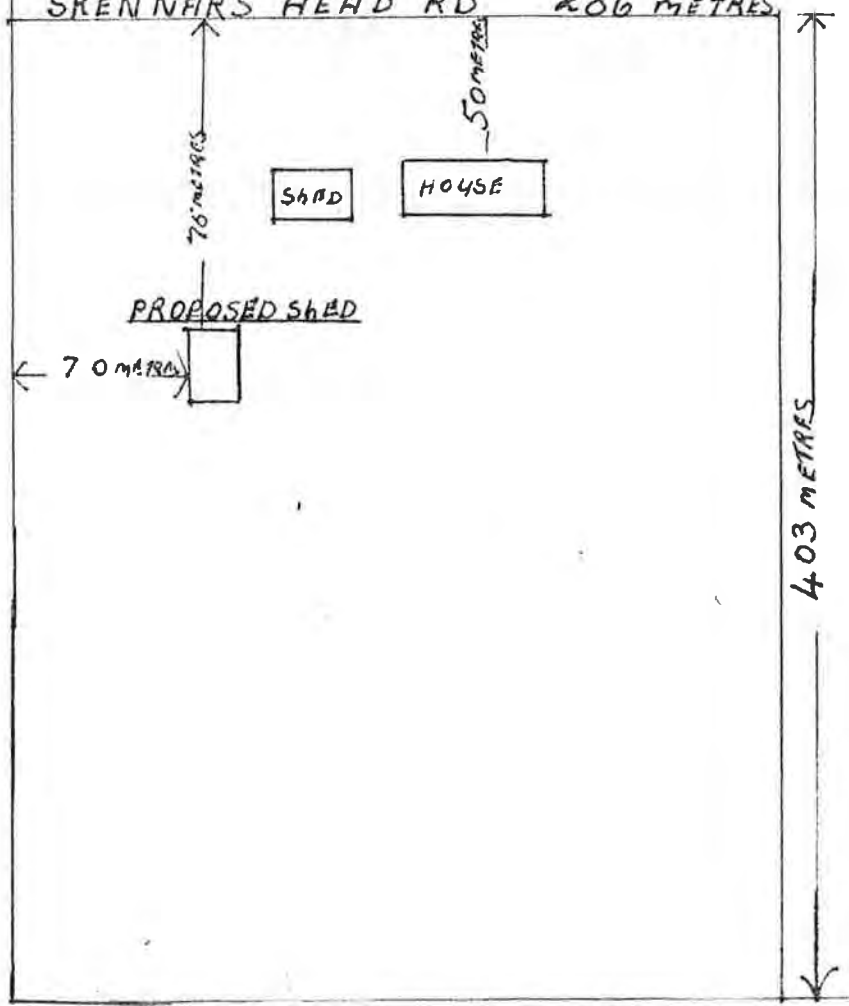
END ELEVATION



SIDE ELEVATION

AREA 17·49 m²

SITE PLAN



PROPOSED TRACTOR SHED FOR J MACAULAY
LOT 3 SKENNARS HEAD RD
SKENNARS HEAD

SHIRE OF BALLINA

BUILDING PERMIT No. 295/86

APPROVED SUBJECT TO THE PROVISIONS OF PART XI. LOCAL GOVERNMENT ACT. ORDINANCE 70 AND CONDITIONS ATTACHED TO BUILDING PERMIT NUMBER 295/86

G. L. PEARSE

SHIRE CLERK

14 - 10 - 19 86 Per

Section 311 Local Government Act, 1919

Council is satisfied that—

☐ a) the amount, if any, payable under Part VI of the Builders Licensing Act, 1971 as an insurance premium has been duly paid;

☑ b) no amount is payable in respect of the building work.

CERTIFIED BY

BALLINA SHIRE COUNCIL

ENGINEERING ASSESSMENT

Application No	**2011-272 Planning Officer: Bob Thornton**
Description	Two lot boundary adjustment
Property	Lot 3 DP 251003, 67 Skennars Head Road & Lot 36 DP 1013547, 40 Isabella Sr, Skennars Head
Reference	Plans by: Michael Hajjar Surveying Dated: 18/05/2011 SEE by: Michael Hajjar Surveying Dated: 22/06/2011

SECTION A of this report contains general information relating to the engineering assessment of the proposed development.

SECTION B of this report provides the Engineering Conditions to be included within the Development Consent.

SECTION A

INTRODUCTION

The proposed development includes a two lot boundary adjustment. Lot 3 DP 251003 will increase from 11.33ha to 11.61ha whilst lot 36 will decrease from 6.44ha to 6.159ha.

ROADS AND TRAFFIC

Local Traffic Committee
NA

Local Development Traffic Committee
NA

External Roads and Traffic
The existing external road network is constructed to a suitable standard to service the proposed development.

Site Access, Internal Driveways and Parking Design
Access to existing lot 36 is via Isabella Drive. The access handle to existing lot 36 from headlands drive is separated by a duck pond. Maintenance access to the handle from existing lot 36 is not practical.

Parking Numbers

FLOODING AND STORMWATER MANAGEMENT

NA

OPEN SPACE/COMMUNITY FACILITES

WATER SUPPLY SERVICING

NA

SEWER SERVICING

NA

EXISTING SERVICES

There is an easement for the potable water supply that extends down the western boundary of the access handle on existing lot 36. The boundary adjustment will incorporate the reticulation main into proposed lot 239. A new easement will be required for the reticulation main over proposed lot 239

The development does not encroach on any easement or the zone of influence of any existing water, sewer or drainage mains.

CONTRIBUTIONS

No extra lots have been created therefore contributions do not apply.

CONCLUSION

The proposed development can be supported subject to the following Engineering Conditions.

SECTION B

ENGINEERING CONDITIONS
DEVELOPMENT APPLICATION NO 2011 / 272

PRIOR TO ISSUE OF A SUBDIVISON CERTIFICATE

- The certification by a Registered Surveyor, prior to issue of a Subdivision Certificate, that all utilities, services, domestic drainage lines and onsite waste water treatment systems are wholly contained within the respective lots or within specified easements. Any existing easements shall be nominated on the new title.

Richard Jerome
Development Engineer **Date: 02/08/2011**

Quotation

Ballina Shire Council
PO Box 450
Ballina NSW 2478

p. (02) 6686 4444
f. (02) 6686 7035

Quote No. : 1,657

Quote Date : 22/11/2012

Expiry Date : 30 June 2013

Officer : cso

Description M Hajjar 67 Skennars Hd Rd & 40 Isabella Drive Skennars Head
Boundary Adjustment Final Plan
DA 2011/272,
Sue B

Fee Code	Fee Description	GST	Amt Inc. GST
401	Subdivision Application Fee - Final Plan		$100.00

Ballina Shire Council
PAID
$ 100-00
DATE: 22/11/12
REC. No 271878
ACCOUNT No.

Please ensure a copy of this quote is enclosed when lodging your Development Application

Quoted figures subject to change
Civil Inspection Fees may apply

Quote Total **$0.00** **$100.00**

Michael G. Hajjar

SURVEYOR

PH. / FAX
02 6686 5562

MOBILE
0402 086 590

1/83 TAMAR STREET
BALLINA N.S.W. 2478.
POSTAL ADDRESS
P.O. BOX 1435
BALLINA N.S.W. 2478.

OUR REF: 239DP
YOUR REF: DA2011/272 (Bob Thornton)

21 November 2012.

The General Manager
Ballina Shire Council
P.O. Box 450
BALLINA N.S.W. 2478.

Dear Sir,

Re: **LOT 3 IN D.P 251003 AND LOT 36 IN D.P. 1013547**
Owner: ROMAN CATHOLIC CHURCH & ESTATE OF CROWLEY
67 SKENNARS HEAD ROAD & 40 ISABELLA DRIVE, SKENNARS HEAD

Please find enclosed final plan of subdivision, copies, letter showing table relating to the applicable right of carriageway and final plan fee.

At his stage the right of carriageway is to be unchanged. Please note that the right of carriageway as shown burdening both Lots exists on both titles though was omitted from DP1013547.

In relation to D.A. condition 2.2 the land being transferred 'the handle of Lot 36' complies. This condition only applies to the land being transferred as discussed at the time of the Development Application.

Would you please sign the copies and inform me of same at your earliest convenience.

Thank you for your time in this matter.

Yours faithfully,

M. Hajjar.

M. G. HAJJAR
Registered Surveyor

Michael G. Hajjar

SURVEYOR

MY REF: 239 stafford roc benefit.doc
YOUR REF: DA: 2011/272

21 NOVEMBER, 2012.

LIST OF LOTS BENEFITTING FROM THE RIGHT OF CARRIAGEWAY OVER THE 'HANDLE' OF EXISTING LOT 36 IN D.P. 1013547 AT SKENNARS HEAD WHICH WILL FORM PART OF PROPOSED LOT 239. INFORMATION PROVIDED BY NAOMI STAFFORD, SOLICITOR OF BALLINA.

Lots benefitted by right of carriage way 7 wide vide DP 251003	**Subdivided:**	**Now known as:**
5/251003	13/584379 Subdivided to become 36/1013547	36/1013547 owned by the Trustees of the Roman Catholic Church for the Diocese of Lismore ("RCC"). RCC will release the right of carriageway as it affects 36/1013547 on registration of the plan of subdivision.
6/251003	14/584379 Subdivided to become 1/826289 Subdivided to become 84/830307 Subdivided to become a pathway 9.945 wide in DP846639. No reference to right of carriageway in this DP presumably because it was no longer required given the construction of Carroll Avenue and Isabella Drive.	Pathway 9.945 wide as shown on DP846639
7/251003	38/830277	Public reserve owned by Ballina Shire Council
8/251003	1/826289 Subdivided to become 84/830307 Subdivided to become 31/846639. No reference to the right of carriageway in this DP presumably because it was no longer required given the construction of Carroll Avenue and Isabella Drive. Subdivided to become Isabella Drive now described as a road of "variable width".	Isabella Drive now described as a road of "variable width".

PLAN FORM 6 (2012) WARNING: Creasing or folding will lead to rejection

DEPOSITED PLAN ADMINISTRATION SHEET

Sheet 1 of 2 sheet(s)

Office Use Only	Office Use Only
Registered: Title System: Purpose:	

PLAN OF SUBDIVISION OF LOT 3 IN D.P. 251003 AND LOT 36 IN D.P. 1013547

LGA: BALLINA

Locality: SKENNARS HEAD

Parish: BALLINA

County: ROUS

Crown Lands NSW/Western Lands Office Approval

I, ... (Authorised Officer) in approving this plan certify that all necessary approvals in regard to the allocation of the land shown herein have been given.

Signature: .....

Date: .....

File Number: .....

Office: .....

Subdivision Certificate

I, ...

*Authorised Person/*General Manager/*Accredited Certifier, certify that the provisions of s.109J of the *Environmental Planning and Assessment Act 1979* have been satisfied in relation to the proposed subdivision, new road or reserve set out herein.

Signature: .....

Accreditation number: .....

Consent Authority: .....

Date of endorsement: .....

Subdivision Certificate number: .....

File number: .....

*Strike through if inapplicable.

Survey Certificate

I, MICHAEL GEORGE HAJJAR

of P.O. BOX 1435 BALLINA NSW 2478

a surveyor registered under the *Surveying and Spatial Information Act 2002*, certify that:

*(a) The land shown in the plan was surveyed in accordance ~~with the~~ *Surveying and Spatial Information Regulation 2012*, is accurate ~~and the survey~~ was completed on .....

*(b) The part of the land shown in the plan (*being/*excluding ^.....) was surveyed in accordance with the *Surveying and Spatial Information Regulation 2012*, is accurate and the survey was completed on, ... the part not surveyed was compiled ~~in~~ accordance with that Regulation.

*(c) The land shown in this plan was compiled in accordance with the *Surveying and Spatial Information Regulation 2012*.

Signature: M. Hajjar Dated: 18 NOV. 2012

Surveyor ID: 1193

~~Datum Line:~~ .....

Type: *Urban/*Rural

The terrain is *Level-Undulating / ~~*Steep-Mountainous.~~

*Strike through if inapplicable.

^Specify the land actually surveyed or specify any land shown in the plan that is not the subject of the survey.

Statements of intention to dedicate public roads, public reserves and drainage reserves.

Plans used in the preparation of ~~survey~~/compilation.

DP554981 DP 584379 DP251003 DP830277 DP846639 DP1013547 DP1146651

If space is insufficient continue on PLAN FORM 6A

Signatures, Seals and Section 88B Statements should appear on PLAN FORM 6A

Surveyor's Reference: 239DP Report File 2011M7100(1790) Comp

PLAN FORM 6A (2012) WARNING: Creasing or folding will lead to rejection

DEPOSITED PLAN ADMINISTRATION SHEET

Sheet 2 of 2 sheet(s)

Office Use Only

Registered:

Office Use Only

PLAN OF SUBDIVISION OF LOT 3 IN DP210003 AND LOT 36 IN DP1013547

This sheet is for the provision of the following information as required:

- A schedule of lots and addresses - See 60(c) *SSI Regulation 2012*
- Statements of intention to create and release affecting interests in accordance with section 88B *Conveyancing Act 1919*
- Signatures and seals- see 195D *Conveyancing Act 1919*
- Any information which cannot fit in the appropriate panel of sheet 1 of the administration sheets.

Subdivision Certificate number: .....

Date of Endorsement: .....

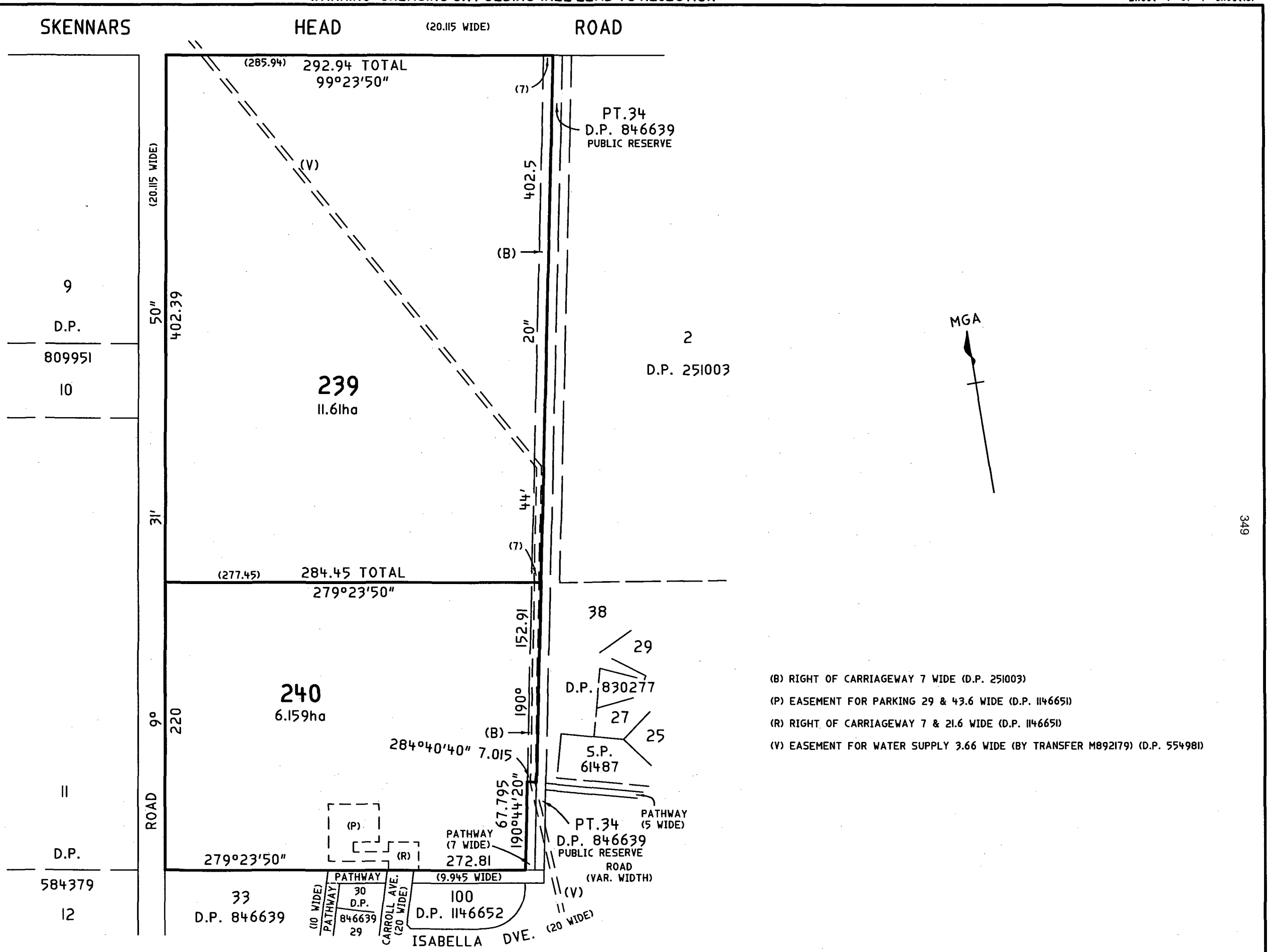
Lot	Street Number	Street Name	Street Type	Locality
239	67	Skennars Head	Road	Skennars Head
240	40	Isabella	Drive	Skennars Head

If space is insufficient use additional annexure sheet

Surveyor's Reference: 239DP Report File 2011M7100(1790) Comp

PLAN FORM 2 (A2)

WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION



(B) RIGHT OF CARRIAGEWAY 7 WIDE (D.P. 251003)

(P) EASEMENT FOR PARKING 29 & 43.6 WIDE (D.P. 1146651)

(R) RIGHT OF CARRIAGEWAY 7 & 21.6 WIDE (D.P. 1146651)

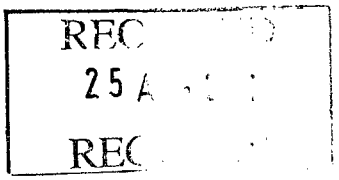
(V) EASEMENT FOR WATER SUPPLY 3.66 WIDE (BY TRANSFER M892179) (D.P. 554981)

Surveyor: MICHAEL GEORGE HAJJAR Date of Survey: 18 NOVEMBER 2012 Surveyor's Ref: 239DP REPORT File 2011M7100(1790) Comp	PLAN OF SUBDIVISION OF LOT 3 IN D.P. 251003 AND LOT 36 IN D.P. 1013547	LGA: BALLINA Locality: SKENNARS HEAD *Subdivision No:* Lengths are in metres. Reduction Ratio 1: 2000	Registered	DP

10 20 30 40 50 60 Table of mm 90 100 110 120 130 140 150

NSW Rural Fire Service
15 Carter St, Lidcombe, NSW, 2141
(Locked Bag 17, GRANVILLE NSW 2142)
Telephone: (02) 8741 5555 Facsimile: (02) 8741 5533
Email: finance@rfs.nsw.gov.au ABN: 25 003 129 221

350



RECEIPT

Date 21.07.2011

Receipt Number	2699
Company code	5000 Rural Fire Service
Cash journal	5000 HEAD OFFICE CHEQUE RECPT

Incoming payment

From	EST OF LATE BARRY PHILLIP CROWLEY
For	2011/272
Transaction	CHEQUE RECEIPTS
Currency	AUD
Cheque number	1097

Net	250.00
Total	250.00

In words TWO HUNDRED FIFTY ZERO

INTEGRATED DEVELOPMENT CHEQUES RECEIVED

APPLICANT: Michael Hajjar

PROPERTY: 40 Isabella & 167 Stevens Hurst **DA NO.:** 2011/272

DEPARTMENT	DATE CHEQUE RECEIVED	DATE POSTED TO DEPT.	SIGNED OUT BY:
NSW Dept. of Planning			
NSW Rural Fire Service	24/6/11	11/7/11	351
Roads & Traffic Authority			
Dept. of Primary Industries (Fisheries, Dept. Ag)			
Dept. Environment & Climate Change			
Dept. of Water & Energy			

Cheques are to be made payable to each relevant agency. Cheques are to be kept in locked box. Cashier to fill in all details on this form. Regulatory staff member retrieves cheque when necessary.

DA No. 2011/272

☑ **SUBDIVISION**

1. **Rates Department**
   Create Rates Memo
   01/12/2012

2. **GIS/Property Section**
   Create Property Files
   10/12/12.

3. **Regulatory Services**
   File

☐ **STRATA PLAN SUBDIVISION**

1. **GIS/Property Section**
   Create Property Files

2. **Regulatory Services**
   File

REGULATORY SERVICES
DEVELOPMENT APPLICATION INTERNAL CHECK SHEET

853

DA NO.: 2011/272 **Assessing Officer:** Bob

Date Received in Reg. Services: 27.6.2011

Register DA: ☑

Development Type:

Local	☐
Regionally Significant Development	☐
Integrated	☑ NSW RFS
Designated	☐

Assumed Concurrence (SEPP 1) - Note in DA Register ☑

Political Donation or Gift Disclosure - Note Register ☐

SEPP (Affordable Housing) 2009 - Note Register ☐

Requirements for Advertising:

Public Newspaper Notice	☐
Adjoining Owners Notification	☐
Exhibition Folder	☐
Sign	☐
N/A (Assessment Officer to determine if any notification required)	☑

Ad Description: _____

_____

_____

Done 27/6/11 WB

Internal Referrals:

Infrastructure Planning Manager	☑	Town Planner	☐
Building Surveyor	☐	Access Reference Group (R Kenk)	☐
Environmental Health Officer	☐	Cultural Development Officer	☐
Trade Waste Officer	☐	Other _____	☐
Environmental Scientist	☐		

External Referrals – Integrated

Drafted 29/6/11 WB

NSW Rural Fire Service (Granville)	☑	I&I NSW (Fisheries Branch - Wollongbar)	☐
DECCW (Murwillumbah)	☐	RTA	☐
DECCW (Grafton)	☐	Other _____	☐

External Referrals

NSW DoP (Grafton)	☐	I&I NSW (Fisheries Branch - Wollongbar)	☐
DECCW (Murwillumbah)	☐	I&I NSW (Agriculture Branch - Orange)	☐
DECCW (Grafton)	☐	NSW Police (CPO - notify via email)	☐
NSW Rural Fire Service (Mullum)	☐	RTA (Grafton)	☐
NSW Maritime Authority	☐	Other _____	☐
NSW Health (Lismore)	☐		

Additional Information:

(Include in acknowledgement letter) 354

Comments:

Signed: _____ **Date:** 27.6.2011
(Manager/Reviewing Officer)

Date Registration Completed and Handed to Assessment Officer:

_____

Signed: _____ **Date:** 28/6/11
(Registration Officer)

DA No: 2011/222

REGULATORY SERVICES GROUP
FINALISATION OF ASSESSMENT AND ISSUE OF DETERMINATION NOTICE

1. *Completion of Assessment and Draft Determination Notice by ASSESSMENT OFFICER:*

BOB THORNTON — Name
4/10/11 — Date

Have draft letters been prepared to all submittors and/or Government Departments notifying of determination?: Yes/NA

Should technical assessment officers sign off on Draft Notice?: Yes/No

Civil Yes/No

EHO Yes/No

Building Yes/No

2. *PLANNER REVIEW/CHECK:* (*NB Review the Assessment form & Sign if ok & review conditions*)

a. No/Minimal Changes ☐ → *Go to Step 5*
(i.e. Planner does not need to review again)

Name — Date

b. Yes Changes ☑ 7 Oct 2011 [signature]
Name — Date

3. *ASSESSMENT OFFICER - Changes Checked:*

Name — Date

4. *PLANNER FINAL CHECK:*

Name — Date

5. *ASSESSMENT OFFICER - Changes made, Initial each page of Consent and Stamp Approved Plans:*

Name — Date

6. *ENDORSED AND SIGNED BY DELEGATED OFFICER:*

[signature]
Name — 13/10/2011. Date

7. *Return to Development Services Mailing Tray for Mailing and Copies*
AND/OR Return to Building Services Typing Tray for Construction Certificate

8. *CONSENT DISPATCHED:* 14/10/11
Date

NB: THIS SLIP TO BE RETAINED ON FILE

DA No. 2011/272

ADMINISTRATION CHECK SHEET
(to be completed after Determination issued)

356

ECM			
o DRAFT to GOCW	Yes ☑	No ☐	N/A ☐
o Check document is attached to DA Number	Yes ☑	No ☐	N/A ☐
o Check document is attached to Public Documents	Yes ☑	No ☐	N/A ☐
o Check document is attached to correct Applicant and/or Owner	Yes ☑	No ☐	N/A ☐
o Register DA Assessment (MEMOW)	Yes ☑	No ☐	N/A ☐
Prepare "Notification of Outcome" letters to submittors/Govt Auth's	Yes ☐	No ☐	N/A ☑
Ensure Copy of Council Report and Minutes are on file	Yes ☐	No ☐	N/A ☑
EXCEL (*Completion of Register*)			
o Complete all applicable columns/fields of data in register (except 101 Ad & SEPP1)	Yes ☑	No ☐	N/A ☐
o Complete "Yes" or "No" in S94 column	Yes ☑	No ☐	N/A ☐
o Copy proposal from ECM consent and paste into "description" field of Register	Yes ☑	No ☐	N/A ☐
o For Swimming Pool DAs ensure Pool Register is updated	Yes ☐	No ☐	N/A ☑
o Write endorsement date of consent on cover of DA File and place tab on copy of Consent	Yes ☑	No ☐	N/A ☐
AUTHORITY			
Main Screen			
o Complete determination field with determination code, date, etc.	Yes ☑	No ☐	N/A ☐
o Complete the DoP "Checklist" screen with determination code, date, etc. *Please fill in all other relevant fields (ie. type of S96, Change of Use, etc.)*	Yes ☑	No ☐	N/A ☐
Additional Details tab			
o Complete expiry date field for DAs	Yes ☑	No ☐	N/A ☐
Proposal tab			
o Check Proposal précis reads the same as on the Notice of Consent	Yes ☑	No ☐	N/A ☐
Tracking tab			
o Ensure all tasks are added and completed (lodgement, notice of receipt, internal referrals , external referrals, determination issued, etc). *Please refer to the peach coloured "Development Application Internal Check Sheet" on file filled out by Development & Building Services Managers.*	Yes ☑	No ☐	N/A ☐

Checklist completed by _____ *Date* 18/10/11.

FINAL Required ☐ Not Required ☐			
Construction Certificate			
o Change Certificate determination code (under Certificates Tab) from 'Pending' to "APPR" with correct approval date	Yes ☐	No ☐	N/A ☐
Occupation Certificate			
o On main screen under 'Additional Details' tab check completion date	Yes ☐	No ☐	N/A ☐
o Check Final Inspection task has been added under Construction Certificate tab and ensure task is completed	Yes ☐	No ☐	N/A ☐
o Ensure kerb & crossing task and BASIX tasks are filled out if applicable under the Occupation Certificates tab	Yes ☐	No ☐	N/A ☐

Checklist completed by _____ *Date* _____

OFFICE USE		
Construction Certificate applied for	Yes ☐	No ☐
Construction Certificate paid	Yes ☐	No ☐
S94 Contributions applicable	Yes ☐	No ☐
S94 Contributions paid	Yes ☐	No ☐

PLAN FORM 6 (2012) WARNING: Creasing or folding will lead to rejection

DEPOSITED PLAN ADMINISTRATION SHEET

357

Office Use Only

Registered:

Title System:

Purpose:

Office Use Only

PLAN OF SUBDIVISION OF LOT 3 IN D.P. 251003 AND LOT 36 IN D.P. 1013547

LGA: BALLINA

Locality: SKENNARS HEAD

Parish: BALLINA

County: ROUS

Crown Lands NSW/Western Lands Office Approval

I, ... (Authorised Officer) in approving this plan certify that all necessary approvals in regard to the allocation of the land shown herein have been given.

Signature: .....

Date: .....

File Number: .....

Office: .....

Subdivision Certificate

I, ANDREW SMITH

Authorised Person/~~General Manager/*Accredited Certifier~~, certify that the provisions of s.109J of the *Environmental Planning and Assessment Act 1979* have been satisfied in relation to the proposed subdivision, new road or reserve set out herein.

Signature: .....

Accreditation number: -

Consent Authority: Ballina Shire Council

Date of endorsement: 5 December 2012

Subdivision Certificate number: 51/2012

File number: DA 2011/272

*Strike through if inapplicable.

Survey Certificate

I, MICHAEL GEORGE HAJJAR

of P.O. BOX 1435 BALLINA NSW 2478

a surveyor registered under the *Surveying and Spatial Information Act 2002*, certify that:

*(a) The land shown in the plan was surveyed in accordance ~~with the~~ *Surveying and Spatial Information Regulation 2012*, is accurate ~~and the~~ survey was completed on .....

*(b) The part of the land shown in the plan (*being/*excluding ^.....) was surveyed in accordance with the *Surveying and Spatial Information Regulation 2012*, is accurate and the survey was completed on, ... the part not surveyed was compiled ~~in~~ accordance with that Regulation.

*(c) The land shown in this plan was compiled in accordance with the *Surveying and Spatial Information Regulation 2012.*

Signature: M Hajjar Dated: 18 NOV. 2012

Surveyor ID: 1193

~~Datum Line:~~ .....

Type: *Urban/*Rural

The terrain is *Level-Undulating / ~~*Steep Mountainous.~~

*Strike through if inapplicable.

^Specify the land actually surveyed or specify any land shown in the plan that is not the subject of the survey.

Statements of intention to dedicate public roads, public reserves and drainage reserves.

Plans used in the preparation of ~~survey~~/compilation.

DP554981 DP 584379 DP251003 DP830277 DP846639 DP1013547 DP1146651

If space is insufficient continue on PLAN FORM 6A

Signatures, Seals and Section 88B Statements should appear on PLAN FORM 6A

Surveyor's Reference:239DP Report File 2011M7100(1790) Comp

PLAN FORM 6A (2012) WARNING: Creasing or folding will lead to rejection

DEPOSITED PLAN ADMINISTRATION SHEET

Sheet 2 of 2 sheet(s)

Office Use Only

Registered:

Office Use Only

PLAN OF SUBDIVISION OF LOT 3 IN DP210003 AND LOT 36 IN DP1013547

This sheet is for the provision of the following information as required:

- A schedule of lots and addresses - See 60(c) *SSI Regulation 2012*
- Statements of intention to create and release affecting interests in accordance with section 88B *Conveyancing Act 1919*
- Signatures and seals- see 195D *Conveyancing Act 1919*
- Any information which cannot fit in the appropriate panel of sheet 1 of the administration sheets.

Subdivision Certificate number: 51/2012

Date of Endorsement: 5 December 2012

Lot	Street Number	Street Name	Street Type	Locality
239	67	Skennars Head	Road	Skennars Head
240	40	Isabella	Drive	Skennars Head

If space is insufficient use additional annexure sheet

Surveyor's Reference: 239DP Report File 2011M7100(1790) Comp

PLAN OF PROPOSED SUBDIVISION OF LOT 3 IN D.P. 251003 & LOT 36 IN D.P. 1013547 &
RELEASE OF RIGHT OF CARRIAGEWAY 7 WIDE THROUGH LOT 36 D.P. 1013547 (SEE D.P.251003)

SKENNARS HEAD ROAD (20.115 WIDE)

(P) EASEMENT FOR PARKING 29 & 43.6 WIDE (D.P. 1146651)
(R) RIGHT OF CARRIAGEWAY 7 & 21.6 WIDE (D.P. 1146651)
(V) EASEMENT FOR WATER SUPPLY 3.66 WIDE (BY TRANSFER M892179) (D.P. 554981)

NO. 85
9
D.P.
809951
10

MGA

(285.94) 292.94 TOTAL 99°23'50"

(7)

PT.34 D.P. 846639

(20.115 WIDE)

402.5

(V)

50" 402.39

239
11.61ha
FARM
NO.67

20"

2
D.P. 251003

BALLINA HEADLANDS LEISURE PARK
NO. 35

44'

(7)

(277.45) 284.45 TOTAL 279°23'50"

38

152.91

29

D.P. 830277

27

25

190°

284°40'40" 7.015

S.P. 61487

67.795

190°44'20"

PATHWAY (5 WIDE)

PT.34 D.P. 846639

ROAD (VAR. WIDTH)

31'

240
6.159ha
HOLY FAMILY CATHOLIC PRIMARY SCHOOL
NO.40

9°

220

ROAD

11

(P)

(R)

PATHWAY (7 WIDE)

272.81

279°23'50"

D.P.
584379
12

33
D.P. 846639

PATHWAY (10 WIDE)

30 D.P. 846639 29

CARROLL AVE. (20 WIDE)

100
D.P. 1146652

(9.945 WIDE)

(V)

(20' WIDE)

ISABELLA DVE

BALLINA SHIRE COUNCIL
Plan of subdivision to which ... relates.
Dated on 7/10/11
GENERAL MANAGER per: ...

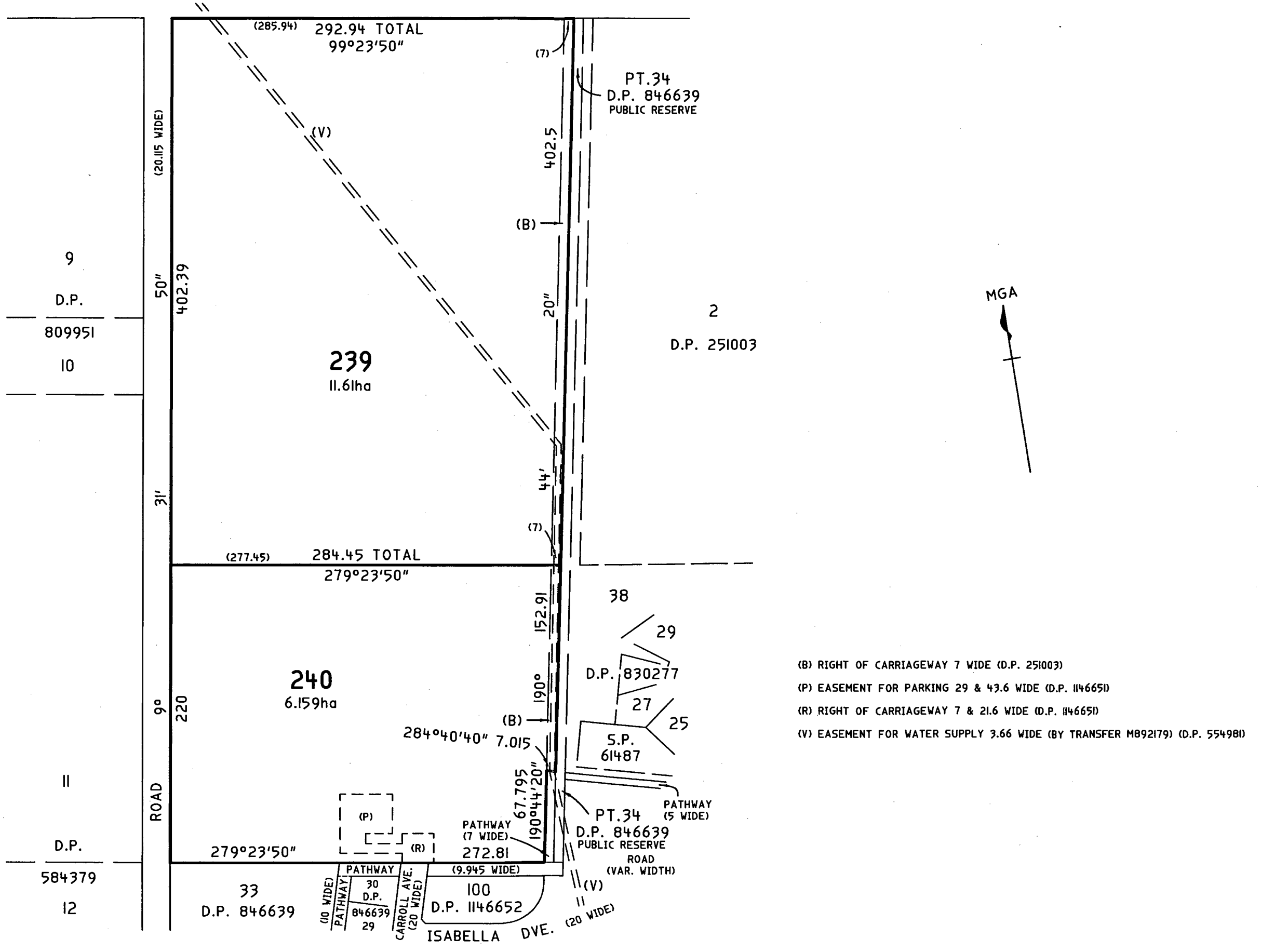
MICHAEL HAJJAR SURVEYING
P.O. BOX 1435 BALLINA
PH. 6686 5562
0402 086 590
18 MAY 2011. REF: 239 DA
R.R. 1:2000 AT A3 SIZE

LGA: BALLINA
LOCALITY: SKENNARS HEAD
PARISH: BALLINA
COUNTY: ROUS

CLIENT: THE TRUSTEES OF THE ROMAN CATHOLIC CHURCH FOR THE DIOCESE OF LISMORE & ESTATE OF THE LATE BARRY PHILIP CROWLEY.

THIS PLAN IS ONLY TO USED BY THE ORIGINAL INSTRUCTOR FOR ITS INITIAL PURPOSE ONLY.

ALL LINES, DIMENSIONS AND AREAS ARE SUBJECT TO APPROVAL AND THE FINAL PLAN OF SURVEY.



(B) RIGHT OF CARRIAGEWAY 7 WIDE (D.P. 251003)

(P) EASEMENT FOR PARKING 29 & 43.6 WIDE (D.P. 1146651)

(R) RIGHT OF CARRIAGEWAY 7 & 21.6 WIDE (D.P. 1146651)

(V) EASEMENT FOR WATER SUPPLY 3.66 WIDE (BY TRANSFER M892179) (D.P. 554981)

Surveyor: MICHAEL GEORGE HAJJAR Date of Survey: 18 NOVEMBER 2012 Surveyor's Ref: 239DP REPORT File 2011M7100(1790) Comp	PLAN OF SUBDIVISION OF LOT 3 IN D.P. 251003 AND LOT 36 IN D.P. 1013547	LGA: BALLINA Locality: SKENNARS HEAD Subdivision No: Lengths are in metres. Reduction Ratio 1: 2000	Registered	DP

10 20 30 40 50 60 Table of mm 90 100 110 120 130 140 150

360

SKENNARS HEAD (20.115 WIDE) ROAD

(285.94) 292.94 TOTAL
99°23'50"

(7)

PT.34
D.P. 846639
PUBLIC RESERVE

(20.115 WIDE)

(V)

402.5

(B)

9

D.P.

809951

10

50"

402.39

20"

2

D.P. 251003

239
11.61ha

MGA

31'

44'

(7)

(277.45) 284.45 TOTAL
279°23'50"

152.91

38

29

D.P. 830277

27

25

S.P.
61487

240
6.159ha

9°

220

(B)

284°40'40" 7.015

190°

67.795

190°44'20"

PATHWAY
(5 WIDE)

PT.34
D.P. 846639
PUBLIC RESERVE

ROAD
(VAR. WIDTH)

(P)

(R)

PATHWAY
(7 WIDE)

272.81

279°23'50"

PATHWAY (9.945 WIDE)

(V)

(20 WIDE)

11

D.P.

584379

12

33
D.P. 846639

(10 WIDE) PATHWAY 30 D.P. 846639 29

CARROLL AVE. (20 WIDE)

100
D.P. 1146652

ISABELLA DVE.

Authorised Officer
Ballina Shire Council

361

(B) RIGHT OF CARRIAGEWAY 7 WIDE (D.P. 251003)

(P) EASEMENT FOR PARKING 29 & 43.6 WIDE (D.P. 1146651)

(R) RIGHT OF CARRIAGEWAY 7 & 21.6 WIDE (D.P. 1146651)

(V) EASEMENT FOR WATER SUPPLY 3.66 WIDE (BY TRANSFER M892179) (D.P. 554981)

Surveyor: MICHAEL GEORGE HAJJAR Date of Survey: 18 NOVEMBER 2012 Surveyor's Ref: 239DP REPORT File 2011M7100(1790) Comp	PLAN OF SUBDIVISION OF LOT 3 IN D.P. 251003 AND LOT 36 IN D.P. 1013547	LGA: BALLINA Locality: SKENNARS HEAD Subdivision No: 51/2012 Lengths are in metres. Reduction Ratio 1: 2000	Registered	DP

10 20 30 40 50 60 Table of mm 90 100 110 120 130 140 150

Refer to :
Bdo Thornton

BALLINA SHIRE COUNCIL

SUBDIVISION CERTIFICATE ASSESSMENT FORM

NB: For all outstanding matters/conditions please phone the Surveyor/applicant for the Subdivision Certificate

Development Application No.: DA 2011/272 **Date Received:** 22/11/12

Property Description: Lot 3 DP 251003, 67 Skennars Head Rd & Lot 36 DP 1013547, 40 Isabella Dr; Skennars Head.

Details of Subdivision (eg Torrens/Strata Title; staged etc): 2 x Lot Boundary Adjustment Subdivision

Civil Services Assessment: I am satisfied that relevant engineering conditions of development consent have been complied with (check off on attached notice of consent) and authorise the grant of the Subdivision Certificate/release of the Final Plan of Subdivision. A security/bond in an amount of $..... has been retained for performance/maintenance of works associated with the subdivision involving:

.....(Complete only if applicable)

(Signed)..... (Date) 4/12/12

Development Engineer

Building Services Assessment: I am satisfied that relevant conditions of development consent have been complied with (check off on attached notice of consent) and authorise the grant of the Subdivision Certificate/release of the Final Plan of Subdivision.

N/A

(Signed).....(Date).....

Building Surveyor

Development Services Assessment: I am satisfied that relevant conditions of development consent have been complied with (check off on attached notice of consent) and authorise the grant of the Subdivision Certificate/release of the Final Plan of Subdivision.

Developer Contributions paid ?
YES / NOT APPLICABLE

(Signed)..... (Date) 4/14/12

Town Planner

Authorised Officer's Determination:
The Subdivision Certificate/Final Plan of Subdivision has been checked and released.

Phoned applicant - Left message "plans ready for collection".
LMB 5/12/12.

(Signed)..... (Date) 5.12.12

Authorised Officer

Subdivision Certificate No.: 51/2012

Preparation for Checking	*Preparation of Certificate*
Card in Compactus for DA File ☑	Mark off in Excel Register when returned ☑
Copies of Plan, Letter & Fees placed on file ☑	Update tracking on Authority Subdivision Certificate (**COMP**lete) ☑
Attach copies of consent & S96 behind yellow Assess Form and place on file ☑	Write on copy of Linen Plans noting DA reference & Certificate No. (DO NOT STAMP ORIGINAL LINEN PLANS) and accompanying Deposited Plan Administration Sheet ☑
Attach yellow "Linen Plan Process form & "Pink slip" to front of DA file ☑	Add template in Authority to create Subdivision Certificate (this will automatically add the task) and register in ECM ☑
Original Linen/extra copies put in Linen's Awaiting box ☑	Forward to Relevant officer for Signing ☑
Enter in Excel Register ☑ N/A	Change in ECM from DRAFT to GOCW ☑
Add Subdivision Certificate in Authority (update applicant name and enter PCA details) ☑	Update Authority Subdivision Certificates tracking (**COMP**leted) ☑
Add Tracking onto Subdivision Certificate in Authority ☑	Phone applicant Certificate ready. Note on sheet if pick up/posted ☑

NSW EPA Notices Search

Healthy Environment, Healthy Community, Healthy Business

365

Home Contaminated land Record of notices

Search results

Your search for:LGA: Ballina Shire Council

Matched 6 notices relating to 3 sites.

Search Again

Refine Search

Suburb	Address	Site Name	Notices related to this site
LENNOX HEAD	13 Fig Tree Hill DRIVE	Spoors Dip	1 former
MCLEANS RIDGES	McLeans Ridges ROAD	Dip 5157 Ridges	1 former
WEST BALLINA	Pacific HIGHWAY	Caltex Big Prawn Service Station	4 former

Page 1 of 1

20 June 2016

Groundwater Bore Search

Department of Primary Industries
Office of Water

Home | About us | Water Management | Water Licensing | Urban Water

Real-time data

home · help · login
customise

All Groundwater
find a site
- All Groundwater Map
  - North Coast Region
    - Tweed River Basin
    - Brunswick River Basi
    - Richmond River Ba
    - Clarence River Basin
    - Bellinger River Basin
    - Macleay River Basin
    - Hastings River Basin
    - Manning River Basin
  - Hunter Region
  - Greater Sydney Region
  - South Coast Region
  - Northwest Region
  - Central West Region
  - Southwest Region
  - Far West Region
  - Great Artesian Basin
  - Coal Basins

bandwidth ◉ high ○ low
glossary and metadata

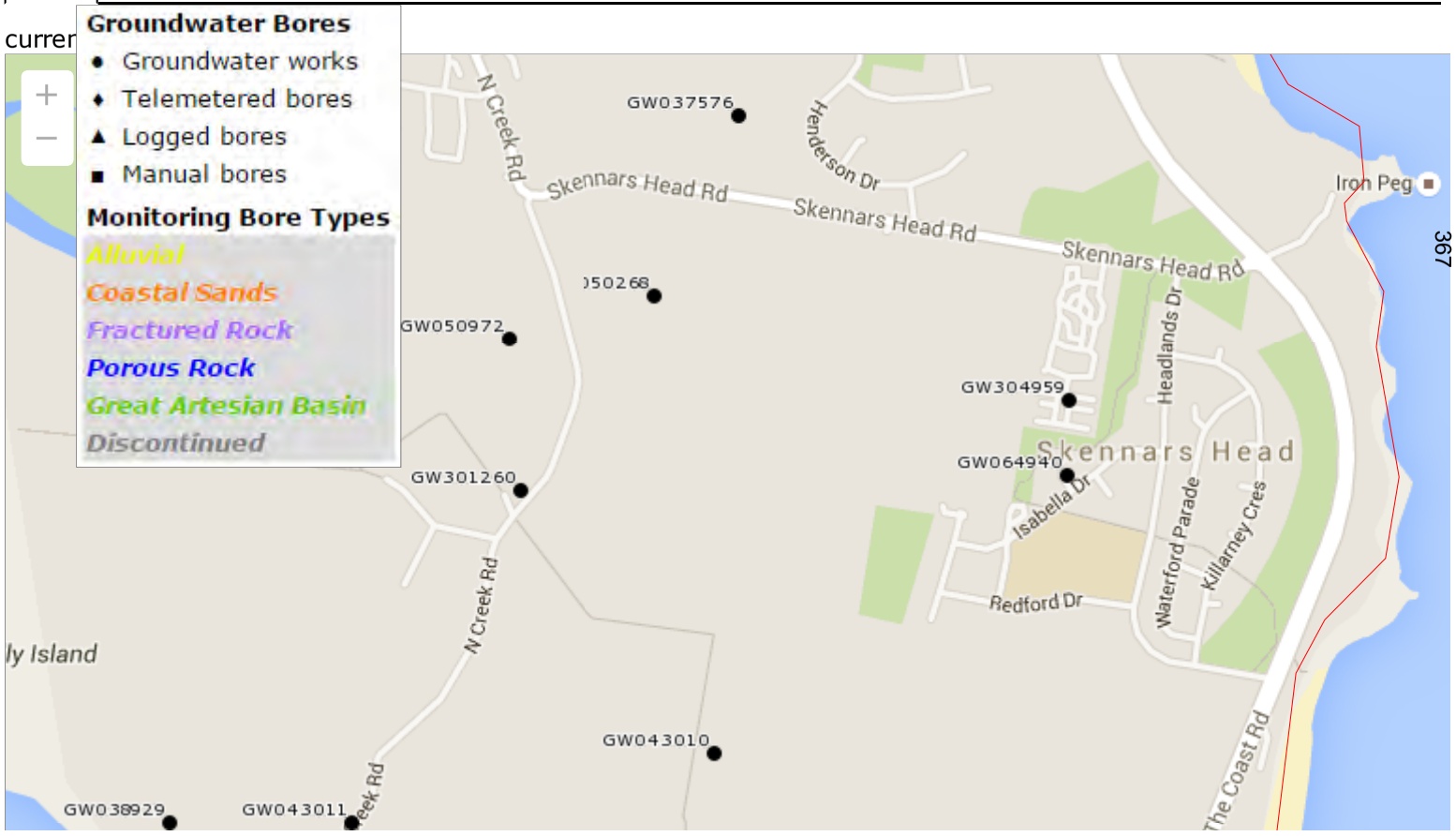
bookmark this page
go back to referring page

Richmond River Basin

All data times are Eastern Standard Time

Map

curren



NSW Office of Water
Work Summary

GW037576

Licence: 30BL101040 Licence Status: ACTIVE

Authorised Purpose(s): STOCK
Intended Purpose(s): STOCK

Work Type: Well
Work Status:
Construct.Method:
Owner Type: Private

Commenced Date:
Completion Date:

Final Depth: 1.50 m
Drilled Depth: 1.50 m

Contractor Name:
Driller:
Assistant Driller:

Property: N/A
GWMA: -
GW Zone: -

Standing Water Level (m):
Salinity Description: Potable
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	ROUS	ROUS.002	64
Licensed:	ROUS	BALLINA	Whole Lot //

Region: 30 - North Coast
River Basin: 203 - RICHMOND RIVER
Area/District:

CMA Map: 9640-3N
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: (Unknown)

Northing: 6811712.0
Easting: 557805.0

Latitude: 28°49'15.3"S
Longitude: 153°35'32.8"E

GS Map: -

MGA Zone: 0

Coordinate Source: GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1	1	Casing	Nil	0.00	0.00	1219			

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
1.20	1.50	0.30	Fractured			0.13			

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	1.52	1.52	Clay Nominal	Clay	
0.00	1.52	1.52	Basalt Broken Nominal Water Supply	Basalt	

Remarks

369

*** End of GW037576 ***

NSW Office of Water
Work Summary

GW043010

Licence: 30BL101423
Licence Status: ACTIVE

Authorised Purpose(s): STOCK
Intended Purpose(s): STOCK

Work Type: Well
Work Status:
Construct.Method:
Owner Type: Private

Commenced Date:
Completion Date:
Final Depth: 1.50 m
Drilled Depth:

Contractor Name:
Driller:
Assistant Driller:

Property: N/A
GWMA: -
GW Zone: -
Standing Water Level (m):
Salinity Description: Good
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	ROUS	ROUS.002	303
Licensed:	ROUS	BALLINA	Whole Lot //

Region: 30 - North Coast
River Basin: 203 - RICHMOND RIVER
Area/District:
CMA Map: 9640-3N
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: (Unknown)
Northing: 6810296.0
Easting: 557743.0
Latitude: 28°50'01.3"S
Longitude: 153°35'30.8"E

GS Map: -
MGA Zone: 0
Coordinate Source: GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1	1	Casing	Timber	0.00	0.00	1219			

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
1.20	1.50	0.30	(Unknown)	0.30		0.25			

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

371

*** End of GW043010 ***

NSW Office of Water
Work Summary

GW050268

Licence: 30BL111674
Licence Status: ACTIVE

Authorised Purpose(s): STOCK,DOMESTIC
Intended Purpose(s): NOT KNOWN

Work Type: Excavation
Work Status: Supply Obtained
Construct.Method: < 100 sq.m.
Owner Type: Private

Commenced Date:
Completion Date: 01/01/1980
Final Depth: 4.00 m
Drilled Depth:

Contractor Name:
Driller:
Assistant Driller:

Property: N/A
GWMA: -
GW Zone: -
Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	ROUS	ROUS.002	L5 DP251633 (385)
Licensed:	ROUS	BALLINA	Whole Lot //

Region: 30 - North Coast
River Basin: 203 - RICHMOND RIVER
Area/District:
CMA Map:
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: (Unknown)
Northing: 6811313.0
Easting: 557613.0
Latitude: 28°49'28.3"S
Longitude: 153°35'25.8"E

GS Map: -
MGA Zone: 0
Coordinate Source: GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1	1	Casing	Nil	0.00	0.00	4000			

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

373

*** End of GW050268 ***

NSW Office of Water
Work Summary

GW064940

Licence: 30BL135557
Licence Status: CANCELLED

Authorised Purpose(s): FARMING
Intended Purpose(s): NOT KNOWN

Work Type: Excavation
Work Status:
Construct.Method:
Owner Type: Private

Commenced Date:
Completion Date: 01/01/1986
Final Depth:
Drilled Depth:

Contractor Name:
Driller:
Assistant Driller:

Property: N/A NSW
GWMA: -
GW Zone: -
Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	ROUS	ROUS.002	LOT 38 DP830277
Licensed:	ROUS	BALLINA	Whole Lot //

Region: 30 - North Coast
River Basin: 203 - RICHMOND RIVER
Area/District:
CMA Map: 9640-3N
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6810908.0
Easting: 558532.0
Latitude: 28°49'41.3"S
Longitude: 153°35'59.8"E

GS Map: -
MGA Zone: 0
Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

375

*** End of GW064940 ***

NSW Office of Water
Work Summary

GW304959

Licence: 30BL181650
Licence Status: ACTIVE

Authorised Purpose(s): COMMERCIAL
Intended Purpose(s): COMMERCIAL

Work Type: Bore
Work Status: Supply Obtained
Construct.Method:
Owner Type: Private

Commenced Date:
Completion Date:
Final Depth: 5.00 m
Drilled Depth: 5.00 m

Contractor Name: LEE ION ROTHWELL
Driller:
Assistant Driller:

Property: BALLINA HEADLAND LEISURE PARK LOT 2 SKENNARS HEAD ROAD BALLINA 2478
GWMA: -
GW Zone: -
Standing Water Level:
Salinity:
Yield:

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	ROUS	ROUS.2	2 251003
Licensed:	ROUS	BALLINA	Whole Lot 2//251003

Region: 30 - North Coast
River Basin: - Unknown
Area/District:
CMA Map:
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6811076.0
Easting: 558537.0
Latitude: 28°49'35.8"S
Longitude: 153°35'60.0"E

GS Map: -
MGA Zone: 0
Coordinate Source: GPS - Global Positioning System

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	5.00	0			Unknown

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

21/01/2005: Form A Remarks:

Owner advised - High iron content, doesn't taste salty. pH slightly below neutral.
07/12/2009: Reviewed data - nothing to update.

377

*** End of GW304959 ***

Safework NSW Dangerous Goods Search

NSW GOVERNMENT | WorkCover

Site search for Schedule 11 hazardous chemicals on premises

This application must be accompanied with:

- A letter of authorisation from the owner of the land to be searched
- A clear map showing the actual location of the land to be searched

Lodgement instructions

Email (preferred): operations@workcover.nsw.gov.au (credit card payments only)

Fax: (02) 9287 5500 (credit card payments only)

Post: Customer Service Centre – Operations, WorkCover NSW, Locked Bag 2906, Lisarow, NSW, 2252 (credit card, cheque or money order).

Hotline: 13 10 50 At any WorkCover NSW office. Visit the website **workcover.nsw.gov.au** to find your nearest office.

Email, fax or post the application – do not send more than once.

SECTION 1: BUSINESS NAME OR INDIVIDUAL APPLYING FOR SITE SEARCH

COFFEY SERVICES AUSTRALIA PTY LTD

SECTION 2: POSTAL ADDRESS OF THE APPLICANT

Unit number/Street number/Property number (include Lot or DP/PO Box/GPO Box/Private Bag/Locked Bag)

UNIT 1 NUMBER 5

Street name

BUGDEN AVENUE

Suburb

ALSTONVILLE

State: NSW

Postcode: 2477

SECTION 3: CONTACT FOR SITE SEARCH ENQUIRY

Names

RIAN VLEGGAAR

Daytime contact number: 0266283224

Mobile number: 0431545745

Fax number:

Email

RV@COFFEY.COM

SECTION 4: STREET ADDRESS OF SITE TO BE SEARCHED

Unit number/Street number/Property number (include Lot or DP number if applicable)

67 LOT 239//DP1201225

Street name

SKENNARS HEAD ROAD

Suburb

SKENNARS HEAD

State: NSW

Postcode: 2478

Nearest cross street

THE COAST ROAD

WORK SAFE HOME SAFE

SECTION 5: CURRENT SITE OCCUPIER'S NAME/PREVIOUS OCCUPIER'S NAME (and trading name if applicable)

Current

GREENLIFE PROPERTIES PTY LTD

Previous

SECTION 6: LODGEMENT FEES

Refer to the WorkCover current fees schedule or call **13 10 50**.

NOTE: Completion and lodgement of a separate application is required for each site to be searched. The application fee includes GST.

☐ Pay by cheque. Enclose a cheque made payable to WorkCover

☐ Pay by money order. Enclose a money order made payable to WorkCover

☑ Pay by credit card. Please charge $ 0284.95 to my: ☑ MasterCard ☐ Visa

A payment processing fee of 0.44% applies to credit card payments (MasterCard and Visa).

Card number

Cardholder name (please print name as displayed on credit card)

Applicant's signature

20/06/2016

SECTION 7: NAME OF APPLICANT

Name

RIAN VLEGGAAR

Applicant's signature

Date (DD/MM/YYYY)

20/06/2016

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Locked Bag 2906, Lisarow, NSW, 2252 |
Customer Service Centre **13 10 50**
licensing@safework.nsw.gov.au | www.safework.nsw.gov.au

Our Ref: D16/617569
Your Ref: Rian Vleggaar

29 June 2016

Attention: Rian Vleggaar
Coffey Services Australia Pty Ltd
Unit 1 / 5 Bugden Avenue
ALSTONVILLE NSW 2477

Dear Mr Vleggaar

RE SITE: 67 Skennars head Road, Skennars Head NSW 2478

I refer to your site search request received by SafeWork NSW on 21 June 2016 requesting information on Storage of Hazardous Chemicals for the above site.

A search of the records held by SafeWork NSW has not located any records pertaining to the above mentioned premises.

For further information or if you have any questions, please call our Customer Service Centre on 13 10 50 or email licensing@safework.nsw.gov.au

Yours sincerely,

Sally Anderson obo Brent Jones
Customer Service Officer
Customer Service Centre - Operations
SafeWork NSW

Interviews

SITE HISTORY QUESTIONS

Coffey: How long have you owned or been involved with the site?

Greenlife Properties Pty Ltd: Since mid 2015

Coffey:What activities have been carried out on site and where were they located

Greenlife Properties Pty Ltd: None – home on site is rented

Coffey:Where any chemicals used in any of the activities, what were the chemicals and how were they applied?

Greenlife Properties Pty Ltd: Nil

Coffey:Where were chemicals stored?

Greenlife Properties Pty Ltd: No chemicals stored

Coffey:Where was waste stored and disposed?

Greenlife Properties Pty Ltd: Nil

Coffey:Were there any fueling facilities or fuel storage areas on site?

Greenlife Properties Pty Ltd: No fueling facilities or storage

Coffey:Who owned the site beforehand?

Greenlife Properties Pty Ltd: Patrick James Kearney And Anthony Thomas Kearney As Executors Of The Estate Of Barry Philip Crowley Deceased

Coffey:What was the site used for beforehand?

Greenlife Properties Pty Ltd: I do not know but the previous owner was holding the land for redevelopment

Coffey:What was the surrounding land used for?

Greenlife Properties Pty Ltd: No response

Coffey:Is there anything else that you think may have affected the site in the past?
Greenlife Properties Pty Ltd: I do not know

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TECHNICAL REPORT 6A

Mosquito Assessment

GemLife Lennox Head
67 Skennars Head Road
Skennars Head
DA 2016/524

Integrated Mosquito Management Plan

22 May 2018

Prepared by

Darryl McGinn
Director and Medical Entomologist

Mosquito Consulting Services Pty Ltd
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Mobile: 0404043867
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ABN: 16 095 739 067

1.0 Background

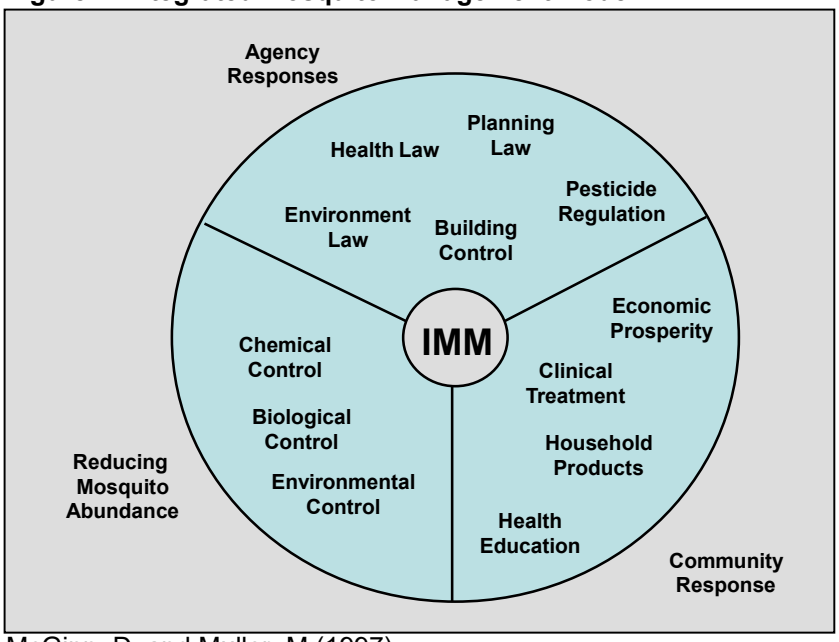
This report is a consolidation of several previous strategies designed to demonstrate compliance with Ballina Shire Council's Development Control Plan in relation to Mosquito Management. It has developed from a need to meet acceptable mosquito management outcomes without causing conflict with other conditions of approval including vegetation rehabilitation. The previous mosquito management strategies were presented as stand-alone solutions in response to the evolution of the development's master planning phases, an evolving vegetation management plan and, responding to information requests by Ballina Shire Council. This mosquito management plan is therefore designed as a unique solution to the challenges encountered in this specific Development Application. The specifics of this management plan are not intended to be a formula to be applied to other developments. The process of integrated pest management (Integrated Mosquito Management - IMM in this case) has however been used for many years in large scale and complex problem solving. It has been used as a process to develop this specific program of mosquito management for this Development Application.

2.0 Principles of Integrated Mosquito Management (IMM)

Integrated mosquito management (IMM) is a direct analogy for the more general Integrated Pest Management model for developing multiple overlapping control strategies aimed at a specific pest management issue. The development of IMM has been in response to developing effective mosquito control practices subject to a wide variation in target mosquito species biology and ecology and how environmental, biological and approved control agents may best be deployed to reduce exposure of people to mosquitoes; Government Agency stakeholder responsibilities including Local Government public health obligations and environmental protection responsibilities; Community Stakeholder expectations including future resident expectations for the reasonable enjoyment of their home life and understanding some mosquito activity is to be expected.

At the conceptual schematic level, IMM can be represented by the following figure (1.) with (some) example management elements listed. This model has been widely adopted as a fair representation of typical management responsibilities and methods. The Victorian Department of Sustainability and Environment adopted this model for its Framework for Mosquito Management in Victoria (2004).

Figure 1: Integrated Mosquito Management Model



McGinn, D. and Muller, M (1997)

3.0 GemLife Integrated Mosquito Management Plan

In the context of GemLife Lennox Head, the mosquito control strategies that have been presented in previous reports, and are now consolidated into an Integrated Mosquito Management Plan. In summary form they include:

Community Response

- **Body Corporate and Management**
  - Residential Community information on the nature of mosquito activity and its control at this development is possible as an organised service delivered through the body corporate.
  - Maintenance of (any) active mosquito control measures would be via the body corporate responding to advice from residents about mosquito activity.
  - The body corporate would engage 3rd party licenced Pest Management Technicians for application of any active control measures.
  - The cost of any such active measures will be borne by the residents through their body corporate and management fees and as such will be self-regulating to be only activated when mosquito abundance is sufficient to be required.

Agency Response

- **Pesticide Regulation**
  - The Federal Government has responsibility for regulation of pesticides used within Australia. The Australian Pesticide and Veterinary Medicines Authority (APVMA) is a statutory authority that oversees the registration of pesticides in Australia. In considering a given product for registration, the APVMA assesses its efficacy and human safety, environmental safety and suitability for the intended use.
  - The APVMA approves the directions for use of any registered pesticide that legally directs how the registered product may be used.
  - The use of a registered pesticide product, within the scope of its approved directions for use, is legally permissible and is therefore a legal right of use by persons or organisations on land over which they have authority.
  - In New South Wales, the EPA has responsibility for administration of pesticide use via the Pesticide Act 1999 and the Pesticide Regulation 2017.
  - Commercial pesticide application in New South Wales is regulated by the Pesticide Regulation 2017 requiring applicators be licenced.

- **Building Controls**
  - A physical control measure is the fitting of mosquito proof screening to external windows and doors of residential units. The Ballina Shire Council can condition Building Applications to include mandatory fitting of mosquito proof screens as it sees fit.

Reducing Mosquito Abundance

- **Environmental controls reducing mosquito abundance**:
  - Mosquito buffers providing near continuous open space separation between natural and revegetation areas to the west and south of proposed residential allotments,
  - Engineering of the existing natural drainage line to positively direct flows through an engineered free flowing low flow swale with a wider graded high flow zone that will fully drain within 48 hrs after inflows cease.
  - Stormwater detention basins designed to be fully drained within 48 hrs after inflows cease.
  - Removal of declared weeds from retained tree understory vegetation will reduce potential harbourage of adult mosquitoes within the retained copse.
  - Fitting of mosquito proof screening to external windows and doors of residential dwellings and community use buildings.

- **Biological control reducing mosquito abundance**:
  - The southern stormwater drain is currently populated by large numbers of fish providing predatory control of mosquito larvae that may be breeding there.
  - Populations of mosquito predatory fish will also be present in the general areas of storm water discharges.

- **Selected barrier treatment** with APVMA approved and registered (for that specific purpose) residual insecticide will control mosquitoes traversing the mosquito buffer zone at the places tree copse and their understory vegetation have been retained. Such treatments are only provided as required and during peak seasonal mosquito activity.

From the initial mosquito impact assessment of this development site in 2016, it was identified that there was a reasonably high exposure to mosquitoes of public health and nuisance biting significance. At the time, a simple development master plan was provided with an adequate buffer zone that in that context was considered appropriate. The master plan has undergone several major revisions and is now significantly more complex with additional issues to include in consideration of mosquito management for each revision. If taken individually, any single control measure is unlikely to provide effective management of the human exposure to mosquitoes. Due consideration should however now be given to this Integrated Mosquito Management Plan.

4.0 Elements of the GemLife Integrated Mosquito Management Program

Reducing Mosquito Abundance

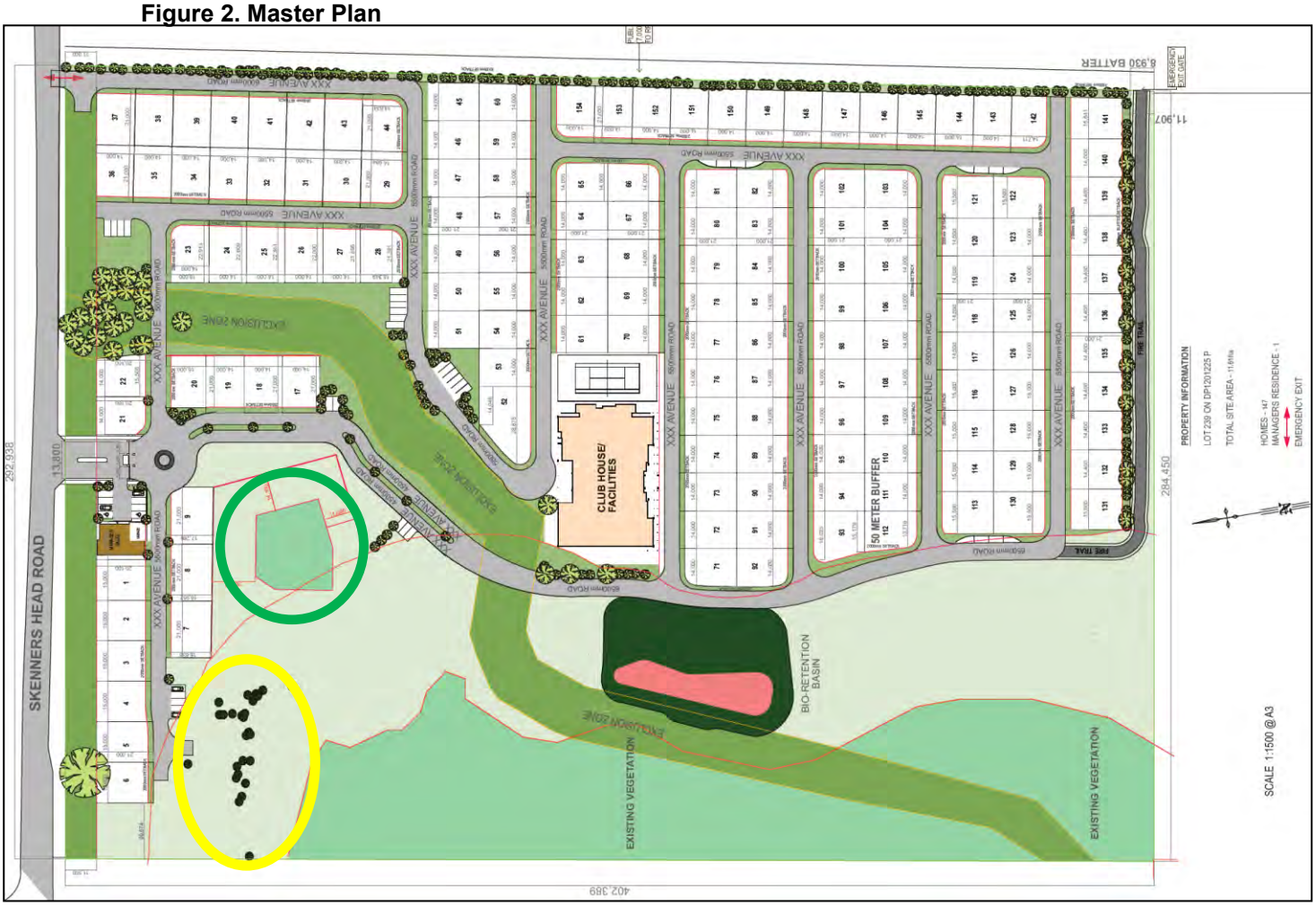
4.1 Mosquito Buffers

The master plan (Fig 2) shows the alignment (inner red line) of the proposed open space that will serve as both the asset protection zone and mosquito buffer zone. As such, it provides almost continuous open space between the heavily vegetated SEPP 14 boundary and residential allotments. At the narrowest dimension between residential allotment boundary and (restored) vegetation at the south west portion of the site, more than 34 meters of open space has been provided. At the north west portion, more than 50 m has been provided. Retained tree copse within the APZ/Mosquito Buffer zone (identified by yellow oval) reduce mosquito buffer effectiveness only at that point. The more central retained tree copse (identified by green circle) is itself protected from recruitment of adult mosquitoes by the mosquito buffer and should not be a source of any significant mosquito activity.

Requirements to retain understory vegetation for the retained copse does provide some opportunity for adult mosquitoes to “bridge” across the mosquito buffer at that point. It is understood that some clearing of declared weed species within

the understory will be conducted but it is expected that retained understory vegetation will eventually replace those.

Figure 2. Master Plan



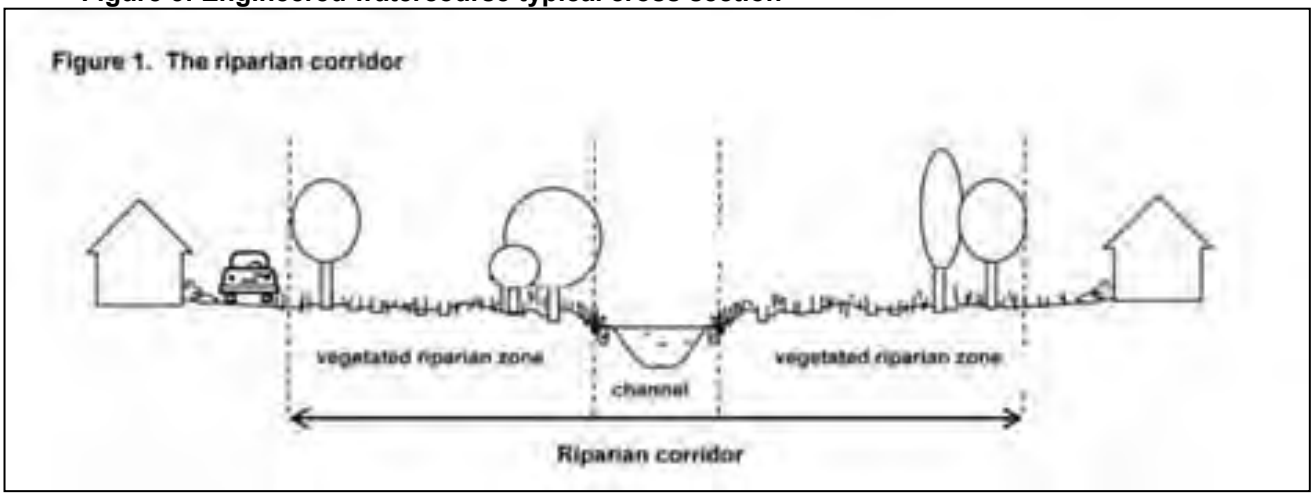
4.2 Engineered Watercourse

The advice MCS received from the applicant in relation to the watercourse engineering is as follows:

> *The proposed revegetation works shall be undertaken in accordance with DPI Office of Water's Guidelines for riparian corridors on waterfront land. Illustrated below (Figure 3.) is the typical section of the proposed watercourse illustrating mainly grassland vegetation that will be kept mown and sparsely treed to best manage mosquitos. The proposed retained watercourse is to be regraded and shaped to assist in the conveyance of water through the site (as recommended in previous Mosquito Consulting Services Pty Ltd reports) and to prevent water ponding and acting as a breeding site for mosquitoes.*

In the opinion of the author, an engineered low flow channel will minimise the opportunity for mosquito breeding within the watercourse and is regarded as an acceptable solution.

Figure 3: Engineered watercourse typical cross section



4.3 Stormwater Detention Basin

According to advice received by the applicant, the proposed stormwater detention basin has been designed to drain completely within 48hrs after cessation of inflows. The basin is located within the APZ/Mosquito Buffer zone and does not impact on the functionality of the buffer in terms of minimising passage of mosquitoes. The designed detention duration will prevent completion of mosquito breeding. Long term maintenance will be required to ensure the detention basin continues to function as designed.

4.4 Barrier Treatments to Selected Retained Understory Vegetation

In previous reports addressing Council's information requests, there is apparent conflict between the general mosquito management advice regarding provision of open space buffers with limited retention of several tree copses (within the proposed 25m mosquito buffer zone). The conflict arises between the mosquito management preferred removal of copse understory vegetation and Council's Environmental Scientist's preferred retention of the understory. The same conflict exists in relation to retained trees with or without understory vegetation adjacent to Skennars Head Road and on the southern boundary of the development site.

The previous recommendations regarding mosquito buffer arrangements (retention of copse – removal of understory vegetation) were predicated on a purely passive approach without a requirement for further works other than ongoing maintenance of the mosquito buffer and copes understory. There is however a supplementary methodology or more active mosquito control measures that can resolve the existing conflicting mosquito management and environmental considerations over the copse understory vegetation.

The solution, in the context of this Integrated Mosquito Management Plan, is to recommend use of “on-demand” application of residual insecticide to the coops understory vegetation to control harbouring mosquitoes and prevent their continued passage into the residential portions of the development. It is not a new technique, but it has not previously been recommended for residential developments within the Ballina Shire area as use of only passive measures have previously been adequate to meet mosquito management outcomes.

Regulatory Status of Barrier Treatments

The Federal Government has responsibility for regulation of pesticides used within Australia. The Australian Pesticide and Veterinary Medicines Authority (APVMA) is a statutory authority that oversees the registration of pesticides in Australia. In considering a given product for registration, the APVMA assesses its efficacy and human safety, environmental safety and suitability for the intended use.

The APVMA approves the directions for use of any registered pesticide that are a legally enforceable document on how the registered product may be used. The use of a registered pesticide product, within the scope of its approved directions for use, is therefore legally permissible and persons or organisations have the legal right to use such products on land over which they have authority.

In New South Wales, the EPA has responsibility for administration and enforcement matters for pesticide use via the Pesticide Act 1999 and the Pesticide Regulation 2017. Commercial pesticide application in New South Wales is regulated by the Pesticide Regulation 2017 requiring applicators be specifically licenced as Pest Management Technicians.

Residual Insecticide Barrier Treatment Methodology

A very important distinction between residual barrier treatments and older traditional aerosol-based insecticide “fogging” should be understood from the outset. Barrier treatments uses very strategic application of residual insecticide to vegetated mosquito harbourage located adjacent to residential allotments. In the context of the GemLife development, it is proposed to provide very limited treatment of the retained understory vegetation under copse within the mosquito buffer zone and adjoining Skennars Head Road and the southern boundary to prevent mosquitos utilising it as a migration “bridge” into residential allotments. The technique of outdoor residual barrier treatments for biting insect management has been well established having been first researched in 2003 (Standfast et al.) in Harvey Bay, Qld.

Traditional “fogging” uses small airborne contact insecticide droplets drifting over a relatively wide area to kill mosquitoes while on the wing. While fogging is still

used for mosquito management in some locations, it is not recommended in the context of the GemLife development.

4.4.1 Background to Barrier Treatment

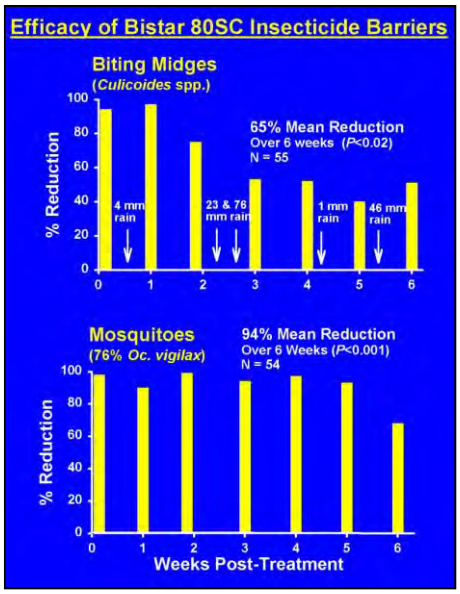
The concept of barrier treatment is an adaptation of Indoor Residual Spraying (IRS) that has been the cornerstone of controlling *Anopheles spp* mosquito vectors of Malaria in much of the effected locations of the world since the 1940s. The availability of new molecules of synthetic pyrethrin based insecticide designed as horticultural pest management tools in crop production provided opportunity to reconsider their use for vector control in outdoor applications. The basic premise of barrier treatments is to make deliberate use of strategically located landscape or natural vegetation, used by biting insects as harbourage adjacent to sensitive human receptors (in this context residential allotments), as a medium for residual insecticide application. When residual insecticide is applied to the harbourage foliage, it kills resting mosquitoes on contact.

Research into the efficacy of barrier treatments was first published by Standfast (2003) into the results of controlled experiments using the synthetic pyrethrin, Bifenthrin, to treat replicate pair (4x treated and 4x untreated) residential yard vegetation of premises located in River Heads, Harvey Bay, Qld. A 0.1% active ingredient (AI) formulation of the horticultural pest control product called “Bistar” was applied using motorised backpack blower to available garden shrubs of the treatment premises. Light trap collections pre-treatment and post treatment collected mosquitoes and biting midge over a 6-week period. Figure 4 shows the application method.

Figure 4: Application of barrier treatment in domestic yard

The results of the efficacy evaluation demonstrated a mean reduction of biting insect abundance within the treated premises of 65% for biting midge and 94% for mosquitoes over a 6 week duration. Figure 5 shows those results graphically.

Figure 5: Standfast et al. 2003 results



The initial successful experiment to assess efficacy of barrier treatments has been repeated on numerous occasions with similarly good levels of protection from mosquitoes. Its application has also been extended to include protection of deployed military personnel particularly those of the United States where this technique has been adopted with the US Deployed War-fighter Protection Program.

The results from the 2003 experiments and other follow-up evaluations were submitted to the Australian Pesticide and Veterinary Medicines Authority for registration of “Bistar Environmental Health Insecticide”. Since then there have been several re-formulations of this product and several generic brands of formulations containing Bifenthrin labelled for use as barrier treatments for mosquito management. As relatively local examples, this form of mosquito control has been used over the past several years at the Byron at Byron resort and more recently at Elements of Byron Resort each within Byron Bay shire.

The formulation of Byfenthrin in these products is designed for outdoor application. It is known as a Suspension Concentrate (SC) formulation with microscopic solid particles of insecticide in a water-based liquid suspension. The formulation is suitable of outside use because of several useful properties that include:

- It is UV stable,
- It has high adhesion to treated surfaces after drying,

- It has very low solubility and is resistant to washing off or leaching due to rain,
- It bio-degrades by microbial action over several weeks,
- It provides good control of mosquitoes for up to 6-8 weeks,
- It is low irritant with very little odour as there are no solvents,
- It does not repel mosquitoes and therefore ensures good contact by mosquitoes resting on treated surfaces.
- It is not phytotoxic – being designed initially for crop protection.

A number of application recommendations exist for the effective treatment of vegetation for barrier treatments. These include:

- Barrier treatments are applied seasonally during periods of heightened adult mosquito activity only,
- During winter and dry summer conditions with little mosquito activity, treatments are not required,
- Applications must be made by suitably licenced pest management technicians,
- A motorised back-pack blower sprayer is strongly recommended to provide air movement of vegetation foliage for even treatment into the harbourage,
- Applications should not be performed if rain is expected within 2-3 hours of treatment.
- Flowering shrubs are to be avoided to minimise impact on pollinating insects,
- Treatments should be limited between ground level and 2m above ground,
- Follow label directions for use.

4.4.2.1 Suitability for barrier treatments at GemLife

The Integrated Mosquito Management Program recommended for GemLife at Lennox Head are primarily based on an open space buffer reducing dispersal of mosquitoes into residential allotments. The development included the retention of several copes of trees located within the buffer and trees adjacent to Skennars Head Road that has created a conflict between a mosquito management preferred removal of the retained trees understory vegetation and environmental considerations for understory retention. To resolve the conflict, it is proposed that very limited barrier treatment applications of residual insecticide be used only on the retained understory vegetation that was otherwise recommended for removal in the Mosquito Consulting Services Pty Ltd report and response (23 May 2017) to information request.

The GemLife development will have a management structure that provides for maintenance including gardening and continued work on environmental rehabilitation to be undertaken. While barrier treatments must be provided by a licenced pest management technician, the GemLife management would be able to make suitable arrangements with a provider (e.g. the same as providing such

services in Byron Shire). As a single management structure, a single point of procurement would provide an efficient method of management of barrier treatments to the benefit of all future residents of the development. The barrier treatment method would not be recommended in the context of a development of freehold residential allotments where a coordinated approach is not possible.

5.0 Conclusions

The use of the Integrated Mosquito Management model for consolidating each of the separate control strategies provides a logical method for understanding how the control program would be implemented for GemLife Lennox Head. It is a unique program designed specifically for this development and is not intended as a generic approach applicable for any other location. Each of the elements of the IMM uses well established technologies and processes and makes best use of resources.

The complex issue of deconflicting the functional need for a mosquito buffer without harbourage vegetation and the required retention of copse understory vegetation within the mosquito buffer is managed by implementation of the Integrated Mosquito Management Program. The use of active residual insecticide treatments to very selected locations and only when required is sound technology and is permissible within the scope of APVMA registered products labelled for that purpose and applied in compliance with NSW Legislation.

The implementation of the Integrated Mosquito Management Program will effectively reduce the risk of residents being unreasonably exposed to mosquitoes within the proposed development.

Darryl McGinn
Mosquito Consulting Services Pty Ltd

References:

McGinn, D. and Muller, M (1997) Saltmarsh Mosquito Control – towards best practice*. Arbovirus Research in Australia.* 7:194-197

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TECHNICAL REPORT 6B

Mosquito Assessment

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Mosquito Management Plan

PROPOSED SENIORS LIVING DEVELOPMENT

67 Skennars Head Road

Skennars Head NSW

14 May 2018

Foreword

This mosquito management plan (MMP) has been prepared to address the known or potential risk of mosquito nuisance and/or mosquito-borne disease on the proposed development site at 67 Skennars Head Road, Skennars Head.

This document is designed to support the Planning Application (DA 2016/524) previously submitted to the Ballina Shire Council by Planners North on behalf of the GemLife Group.

This is a new development on a “green field” site containing up to 147 free standing retirement villas and substantial on-site communal recreational facilities.

The potential for mosquito problems (nuisance and/or disease risk) for the residents of the estate is acknowledged and this management plan has been formulated to mitigate the mosquito risk using a proven management system which does not rely on chemical insecticides or separation barriers.

The MMP supersedes those previously submitted by Darryl McGinn from Mosquito Consulting Services Pty Ltd.

Contents

1. Introduction/executive summary

Mosquitoes are a concern for a residential community not only due to their potential to carry debilitating diseases but also due to their nuisance value which can impact on the ability of residents to enjoy the amenities and facilities within the estate.

In contradiction to this, while they may be pests, mosquitoes are an important component of the local ecosystem, providing food for birds, bats, amphibians, fish and insects.

The challenge is creating a balance between these factors and implementing a program that has little impact on the environment but reduces the risk of the residential community being exposed to mosquito borne diseases and nuisance.

This challenge can be met through an effective mosquito management program incorporating “best practice” control options. Such an approach needs to consider the statutory obligations, policies, guidelines, current practices, the community and the environment. By having such an approach to mosquito management, it creates an effective and environmentally sensitive solution that is sustainable.

The GemLIfe approach relies substantially on the deployment of commercial mosquito killing stations/traps to decimate the female mosquito without the need for recurrent application of insecticides and the elimination of vegetative pathway habitats.

There are no significant or permanent mosquito breeding sites on the site however the management system proposed herein provides continuous and full time control of the mosquito nuisance, whether the mosquitos originate on our site or adjoining sites.

2. Aim/objectives

The objectives governing this MMP are:

- to identify mosquito breeding areas and pathways.
- to deploy a control strategy which disrupts the breeding cycle.
- to eliminate the use of insecticides.
- to provide an easy access document to convey information to on site management staff;
- to inform, guide and assist the development owner, residents and council officers of the mosquito management actions and guidelines;
- to strategically guide the financial direction of mosquito management.

3. Strategic implications

Our MISSION is to make the GemLife Lennox Head retirement village an attractive place to live and recreate without the adverse concern for mosquito nuisance.

4. Statutory management/legislation

This MMP has been formulated with reference to the Ballina Shire Council’s Development Control Plan 2012 Chapter 2 – General and Environmental Considerations, Part 3.6 Mosquito Management.

5. Mosquitoes

Mosquitoes go through four development stages - egg, wriggler (larva), tumbler (pupa) and finally adult. This whole cycle from hatching egg to flying adult can take as little as 5-7 days in summer. During colder months the life cycle may take several weeks. Mosquitoes can breed in any type of standing water. Different species of mosquitoes will breed in different environments, from natural and man-made water bodies to a variety of water-holding containers, and from fresh to brackish or even saltwater.

Mosquitoes do not breed in vegetation. The **female** mosquito is the one that **bites** (males feed on flower nectar). She requires blood to produce eggs and a water body to lay those eggs.

Some species of adult mosquitoes are known to travel **3km** or more from a breeding site in search of a blood meal. As a result, residents living at a distance from the breeding sites (as well as those close by) may be affected.

6. Breeding sites – land ownership/responsibility

The responsibility for the maintenance and governance of the developed site (including mosquito management) will remain with the GemLife Group during the life and operational phase of the project.

The GemLife Group's on-site management team will also be responsible for the enduring management of the site, including mosquito control, however expectations are that mosquito breeding habitats immediately adjoining the development will be managed by the respective land owners; including the Ballina Shire Council.

Although the site adjoins a SEPP 14 wetland to the west, the vegetation types on the subject site are primarily Melaleuca and Casuarina within a seasonal wetland. The site is self-draining with no permanent or significant mosquito breeding habitats within the development boundaries.

A freshwater flooded drainage channel which adjoins the southern boundary of the site contains emergent vegetation suitable for the production of several species of mosquito including *Coquilletidia* and *Mansonia* but collection results show a low population of these mosquitoes, possibly due to the high population of fish in the drain.

Survey results indicate that the development site is generally exposed to typical background abundance of transient adult mosquito activity.

7. Nuisance/disease risk

As well as being a potential disease risk (Ross River virus and Barmah Forest virus) mosquitoes can also be a considerable nuisance.

Some mosquito species in the Shire are known to be aggressive biters, causing discomfort and pain which affect residents and can impact significantly on their lifestyle. One species, Aedes *vigilax* (15% Spp), is not only a vicious biter, but will attack at any time during the day or night and can travel tens of kilometres from their breeding sites. This can cause a significant nuisance to residents and visitors, severely impacting their outdoor amenity.

Other dominant species on the site (17%Spp), the *Culex annulirostris* (common banded mosquito) is considered an effective carrier of Ross River and Barmah Forest virus.

It is to be noted with some significance that the **female** mosquito is the one that **bites** – male mosquitoes feed only on flower nectar.

8. Mosquito management – baseline survey/existing data [1]

The abundance of mosquitos on this site was determined by trapping in representative locations on four separate occasions between 15 and 24 April 2016. Over 16 trap nights, 3451 mosquitos from 24 species and 7 genera were collected. Five species represented around 78% of the collection.

The abundance of the mosquitoes collected is considered relatively low compared with other coastal locations in northern NSW and in south east Queensland.

Traps were baited with carbon dioxide and Octenol. Mosquitos attracted to the site were preserved in 70% ethanol and laboratory identified.

The major mosquito populations were:

- Verralline funera 39%
- Culex annulirostris 17%
- Aedes vigilax 15%
- Aedus multiplex 6.5%

[1] Darryl McGinn – Mosquito Impact Assessment Proposed Serviced Self – Care Housing Estate, 67 Skennars Head Road, Skennars Head. 22 August 2016

9. Mosquito management – control strategy

There are five (5) approaches to mosquito management that could be considered in the development of an integrated mosquito management plan.

These include Cultural, Physical, Electronic, Biological and Chemical control of mosquitoes and their breeding habitats. All are important when developing a successful approach to manage mosquitoes, depending on the scale of the nuisance and site specific environmental considerations.

This integrated Mosquito Management Action Plan has been developed incorporating the methods detailed below:

Physical Control

Physical control methods will be used to reduce the potential for mosquito breeding and harbourage by modifying the natural environment.

1. No opportunity will be provided for permanent breeding sites to be established.
2. The natural water course through the site, currently consisting of a grass choked paddock drain, will be reprofiled and landscaped as a low flow drainage swale with no permanent water.
3. Declared weeds will be removed from the vegetation copse.
4. All dwellings and habitable buildings will be fitted with insect screening to windows and external doors.
5. No water tanks will be installed.

Electronic Trapping/Killing

A “state-of-the-art” trapping/killing regime consisting of at least seven (7) stations will be established around the site. The devices are manufactured by Bantix Worldwide Pty Ltd and rely on a combination of pulsed carbon dioxide, UV light spectrums, heaters and food attractants. The “Mosquito Slayer” traps have a drawing radius of up to 300m and target the female mosquito to break the breeding cycle.

These traps operate continuously over 24hrs a day and use CO^2 gas and 12v power to sustain operations. The traps do not use chemicals and do not attract non- target insects.

The emphasis with this strategy is to kill the female (biting) mosquito and disrupt the breeding cycle. No females = no biting = no new populations = no nuisance.

Biological Control

The flooded stormwater drains located at the south eastern boundary of the site contains a healthy and abundant population of fish, most probably *Gambusia.* Due to the very low count of mosquitos in this area it is assumed that the fish are providing adequate control within the stormwater drains.

This natural control measure will not be interfered with.

Public Education & Awareness

The resident population are also vital stakeholders for this MMP to be effective and have a responsibility in any integrated program to manage mosquitoes on their own properties. It is important that educational programs are ongoing to ensure information is received by all residents.

10. Consistency with Development Control Plan

Mosquito management for applicable developments is prescribed within the Ballina Development Control Plan 2012, Chapter 2 – General and Environmental Considerations, Section 3.6- Mosquito Management. This proposed development is located within the designated Coastal Plains and Lowlands as described by the DCP's associated mapping as being of "higher mosquito risk". A such, the DCP prescribes general controls intended to provide physical separation between residential allotments and the source of mosquito breeding.

The DCP further states that recommendations for mosquito management that equals or improves on the DCP's objectives of minimising nuisance and health risk associated with mosquitoes may be proposed by a suitably qualified and experienced person.

This MMP has been developed in conjunction with Andrew Coventry, the designer of the BANTIX system which has been successfully deployed over a 17 year period on 74 countries.

11. Mosquito management – ongoing monitoring and surveillance

Traditionally, mosquito monitoring commences from September through to late March. Mosquito population spikes can occur throughout the season; due to summer rainfall events, environmental conditions, nutrient availability and/or numbers of natural predators. It should also be noted that certain environmental conditions are more conducive to increased populations of specific species.

As the proposed "Mosquito Slayer" electronic CO^2 traps will be permanently installed on the site, ongoing monitoring and surveillance is an easy task. If a localised complaint is received, an additional trap can be set at the area of concern.

In all cases, environmental conditions such as predicted wind speed/direction and rainfall will be considered prior to setting the traps.

Ongoing monitoring and surveillance is vital to ensure the correct placement of trap deployment and to assess the effectiveness of the control program.

Over time, this will enhance the mosquito knowledge within the area, providing a deeper understanding of the way populations change in response to environmental variables. This information can then be incorporated into updated versions of the MMP during the review process.

12. Internal stakeholder obligations

As mosquitoes breeding externally to the site can potentially travel at least 3km from their breeding sites, the GemLife site management team will undertake all measures to prevent potential on-site breeding sites becoming established by:

- Assessing locations of trap deployment to ensure effective eradication of female mosquitos.
- Eliminate standing water bodies.
- Removal of declared weeds as necessary.
- Maintenance of vegetated drainage swales
- Maintenance of detention basins – no water detained after 48hrs.

13. Budget and resource requirements

Operating and implementing the proposed "Mosquito Slayer" mosquito management program is not a costly exercise; as opposed to the application of chemical insecticides on a regular basis.

No specialised equipment is required, no special training is required to establish and monitor the system and no vast quantities of chemicals are required.

The cost of establishing the equipment for the program will be covered within the project development costs and the operational costs covered in the project operations budget.

The management of the system will be part of the weekly tasks assigned to the full-time site manager.

14. Conclusion and recommendations

The facts are:

i. It has been determined that the GemLife development site is not a recognised breeding site for mosquitoes.
ii. Although several mosquito species have been captured and identified on the site, there is no evidence to suggest that the site is their breeding habitat, although vegetation on the site is acknowledged to be a mosquito pathway.
iii. There is a known mosquito breeding site near the southern boundary of the site, but this appears to be self-managed by the population of freshwater fish in the water body.
iv. GemLife has no obligation to control mosquito breeding sites beyond the development site boundaries.
v. Council have conveyed their aversion to the use of insecticides, residual chemical barriers and vegetation removal to control mosquito populations, indicating however a preference for a 25m buffer from vegetation.
vi. Mosquitoes can travel several kilometres, even without the assistance of wind.
vii. The female mosquito is the nuisance – male mosquitoes do not bite.
viii. The Ballina DCP may require a physical separation between residential allotments and the source of mosquito breeding; or a relaxation of this, if a control measure can be shown to be equal to or better than conventional and DCP prescribed methods.

The GemLife Solution is:

The GemLife solution to control transient populations of mosquitoes is based on a non-chemical strategy which has been implement and proven in 74 countries in the world over a period of 17 years; including DEFAT, Australian Embassies, major mining companies, UN Peace Keeping Forces, Australian Defence Force, zoos, island resorts and schools.

The BANTIX trapping device has been tested by the University of South Australia and the results are included in **Appendix B.**

The GemLife solution is based on the deployment of low maintenance electronic trapping/killing stations which targets the female mosquito only (the male mosquito does not bite or cause a nuisance) and decimates the breeding cycle. The system operates on a 24/7 basis - is not affected by wet weather, does not rely on insecticides, does not adversely affect non-target invertebrates.

In summary, the GemLife Mosquito Management Plan provides a solution which:

i. Does not employ the use of insecticides.
ii. Does not require native vegetation removal.
iii. Does not depend on a 25m buffer from vegetation as mosquitoes are capable of flying (or being carried by wind) several kilometres.
iv. Complies with the Ballina Shire Council DCP which requires a separation from mosquito breeding sites. Closest known but controlled breeding site is the fresh water drainage channel approximately 30m from the closest dwelling.
v. Targets only the female biting and breeding mosquitoes.
vi. Does not require “qualified characterisation and recommendations” from an Entomologist as no breeding sites are within the development boundaries.
vii. Is cost efficient and environmentally friendly.

The proposed deployment strategy is illustrated on the Mosquito Management Site Plan contained in **Appendix A**.

The system deployment will be initiated at least nine (9) months prior to the first dwelling is occupied, providing ample time for the breeding cycle to be disrupted and female populations reduced.

15. Review

Due to the nature of mosquito management, there will be an ongoing need to review and refine this document. This will allow the site management team to accommodate new and/or changing mosquito breeding sites which may be identified from year to year depending on rainfall, tidal influence and human activity.

Furthermore, alternative approaches and new innovations to mosquito management may become available or desirable for the site. It is also necessary to periodically review achievements and results from consecutive seasons to identify emerging trends.

16. SUMMARY

The GemLife mosquito management strategy, based on electronic trapping/killing stations, is the only realistic solution for this development.

As other possible solutions are either discounted by the Ballina Shire Council or are practically ineffective (separation buffers); the options are not abundant. As no significant breeding sites have been identified on the development site and the closest site is biologically controlled, there can be no reason to adopt anything other the proposed BANTIX system supplemented by common-sense insect screening on all dwelling and community facilities.

It must be remembered that only female mosquitoes bite and they require blood and water to breed. Vegetation may provide a habitat for resting mosquitoes but ultimately if the mosquito breeding cycle is disrupted, the mosquito populations must diminish.

Appendix A


SKENNERS HEAD ROAD
CLUB HOUSE/ FACILITIES
BIO-RETENTION BASIN
EXISTING VEGETATION
EXISTING VEGETATION
50 METER BUFFER
A
B
C
E
F
G
SCALE 1:1500 @ A3
GENERAL NOTES
AMENDMENTS: DATE/ ISSUE
PLEASE READ CAREFULLY
CLIENT:
GemLife
SITE:
67 SKENNARS HEAD ROAD
LENNOX HEAD
MODEL:
JOB NO.:
LH-02
ISSUE DATE:
21/05/18
DRAWN:
SHT NO.:
1 OF 3
ISSUE:
0
GemLife
LENNOX HEAD

Appendix B

A report on the testing for effectiveness of the three models of Mosquito Slayer for mosquito capture by:

Craig R Williams, Harry L S Roberts & Michael J Kokkinn

Mosquito Research Laboratory
School of Pharmaceutical, Molecular & Biomedical Sciences
University of South Australia
North Terrace, Adelaide 5001

February 2001

I. Introduction

In the scientific literature, standard insect traps, such as light traps are not often used in studies of mosquito populations. Mosquito-specific traps, directed at the physical, visual and air-borne cues used by mosquitoes to detect host animals, are employed.

There are increasing numbers of commercially available insect traps for use by the general public. The designs of such traps are beginning to incorporate the scientific understanding of what attracts mosquitoes. Of the traps tested over time, the two Mosquito Slayers designed by Bantix Pty Ltd incorporate such knowledge and are specifically directed at mosquitoes. If such traps are able to trap significant numbers of mosquitoes, thereby removing them from local populations, it is possible that such devices could form part of an integrated pest management approach to mosquito control.

II. Aims and scope of this test

This test seeks to answer two main questions:

i) What is the ability of the Mosquito Slayer to capture mosquitoes?

ii) What is the ability of the Mosquito Slayer to reduce the size of local mosquito populations over time in a localised area?

In addressing these two questions, the three trap models were tested and compared for their ability to capture mosquitoes in both natural and contrived situations. In addition, they were trialed to determine whether they could reduce the number of biting mosquitoes in a localised area.

III. Materials and Methods

A. The traps tested in this test.

1. Mosquito Slayer master and satellite model with carbon dioxide

This traps works by attracting mosquitoes to a light source, at which point they are blown into an aqueous solution and are killed. Attraction to the light source is facilitated by the following lures:

· carbon-dioxide gas released in pulses,
· a weak lactic acid solution (also acting as the aqueous killing solution),
· a heating element in the top and front of the unit,
· a 1-octen-3-ol (octenol) releasing strip,
· a sound-emitting unit (specifically for attracting females),
· the lights themselves, which emit wavelengths considered attractive to mosquitoes.

Carbon dioxide gas is supplied to the unit from a pressurised cylinder. The trap tested actually comprises a programmable master unit, and a satellite unit, which receives power and carbon dioxide via the master. The satellite trap can be operated up to 40 metres from the master.

2. Mosquito Slayer - Non Gas trap

This trap differs in that no carbon dioxide gas is used.

B. Insect trapping ability of the different models tested

i) Mosquito trapping efficacy

The traps were tested in a coastal suburb (Globe Derby Park) 15km north of the Central Business District of Adelaide, South Australia (34055'S, 138033'E). The suburb lies adjacent to several hectares of samphire swamp and mangrove forest and is known for seasonally high numbers of the mosquitoes Aedes camptorhynchus (Thomson) and Aedes vigilax (Skuse). Both species are aggressive biters by day and night, and are vectors of arboviruses of local importance (eg. Ross River virus).

Five trapping sites were used. These were all located on private property, near the homes of local residents. Each of the traps was tested at each site twice, with the rotation of the traps conducted in a random, albeit balanced design. This design allowed a statistical comparison of the total mosquito catch between traps, as well as site and date of trapping effects to be accounted for. Trapping was conducted from December 5th - December 22nd, 2000.

Traps were set in the late afternoon and allowed to run overnight. They were set in shaded locations near dwellings, particularly amongst vegetation. Mosquitoes are known to gather in vegetated areas to rest during the day, thereby avoiding potentially desiccating conditions.

Catches were placed in sample jars and transported to the laboratory, where they were stored in 70% ethanol. Mosquitoes were removed, counted and identified.

ii) Specificity for mosquitoes over non-target invertebrates

Invertebrates other than mosquitoes were sorted roughly by order or class before more thorough identification and counting was performed.

iii) Ability to capture other pestiferous invertebrates

Where possible, other insects of potential pest significance were identified. Of particular focus were other haematophagous Diptera such as stable fly (Muscidae), gad flies (Tabanidae) and flesh flies (Sarcophagidae).

C. Mosquito control using the Mosquito Slayer

i) Trap-down studies

To determine whether such insect traps could be used to reduce the number of mosquitoes biting in an area, such as around a dwelling, traps were operated daily over a one month period. The traps were programmed to switch on at 20.00h (30-45 minutes prior to sunset), and switch off at 08.00h (2 to 2.5 hrs after sunrise). The traps were maintained (ie trap solution reservoirs were kept full) by the residents whose properties were chosen for this study.

The number of mosquitoes in the area was assayed every two weeks using human-biting catch and by EVS traps. Mosquito populations were assayed both at the site where the trap was operating, and at a control site, approximately 500 metres away. Human biting catch was conducted for 10 minutes immediately after sunset at the treatment site, then for 10 minutes at the control site. This was done by aspirating biting mosquitoes from the lower limbs and body, depositing the catch into a collection cup, then counting and identifying specimens in the laboratory. EVS traps were set at the treatment and control sites approximately 30 minutes before sunset and were retrieved the following morning. The traps were tested in this manner:

Mosquito Slayer Master and Satellite trap with carbon dioxide

Test location - adjacent to horse stables behind house at 107 Globe Derby Drive, Globe Derby Park. Master and satellite traps were set 10 metres apart amongst general large inorganic refuse (old sheet metal, play equipment etc.) and a small copse of Eucalypt trees with understorey next to the stables. An EVS trap was set every two weeks at the same location as the Mosquito Slayer. Human biting catch was conducted 10 metres downwind of the location.

The trap was operated from December 31, 2000 to February 5, 2001.

Control location - at 93 Globe Derby Drive, Globe Derby Park. This site is approximately 500 metres east of 107 Globe Derby Drive. A straight line joining the two locations lies roughly perpendicular to the south-westerly winds common there. Major mosquito breeding sites are thought to be approximately 1 km upwind of the treatment and control sites.

Mosquito Slayer Non Gas Trap

Test location - near the main house at Buckland Park Estate, near Port Gawler, South Australia, approximately 34 km north of the Adelaide Central Business District. An EVS trap set every two weeks at the same site as the Mosquito Slayer. Biting catch was performed 10 metres from the trap.

The trap was operated from January 1, 2001 to January 31, 2001.

Control location - 500 metres to the north, also on Buckland Park estate, in a copse of Eucalypt trees.

ii) Close system mosquito trapping efficiency

To determine the ability of the traps to capture a known number of mosquitoes in a given time, a closed system containing female mosquitoes and a test trap was established. The closed system consisted of a screen-house; namely a 3.8m wide x 3.8m wide x 2.1m high tent with a poly-vinyl floor and roof, but with only insect-proof mesh for walls. This was located in a backyard in suburban Adelaide, on a partially shaded lawn.

100 adult female Ae.vigilax mosquitoes, captured by EVS trap, were introduced into the screen house the day before a trap was trialed. Mosquitoes were provided with humid refugia in the form of a large potted plant in one corner of the screen-house. 15% sucrose solution dispensed by a cotton wick from a reservoir was also provided.

The two traps were tested in the closed system for three nights each. The number of mosquitoes captured in the traps was counted and replaced in the screen house to ensure a constant number of 100 Ae.vigilax mosquitoes at all times.

IV. Results

A. Mosquito trapping efficacy

The Mosquito Slayer Master and Satellite traps with carbon dioxide displayed the greatest mosquito capturing efficacy by catching an average of over 100 mosquitoes per night. The Mosquito Slayer Non Gas trap was also successful in mosquito capture. Both traps captured less than one male mosquito per night. In terms of the percentage of the catch comprised of males, this was less than 1% for the Mosquito Slayer Master and Satellite trap. Respective mosquito numbers in the Mosquito Slayer Master and Satellite traps were counted separately on six occasions. In general, the Master trap caught slightly more than the Satellite, although there was no statistically significant difference between them. Aedes vigilax was the most common mosquito captured. Given the proximity of trapping locations to coastal samphire and mangrove swamp, this was expected. Aedes camptorhynchus, Aedes notoscriptus, and various Culex species were also captured.

B. Specificity for mosquitoes over non-target invertebrates

Both traps captured less than 250 other invertebrates on average per night. When the number of other invertebrates is compared against the number of mosquitoes captured per night, it is clear that the Mosquito Slayer Master and Satellite traps have the greatest specificity for mosquitoes. A mean ratio of nearly 0.8:1 (mosquitoes : non-mosquitoes) was obtained for this trap.

C. Trap-down studies

The Mosquito Slayer Master and Satellite traps were promising in effectively reducing the numbers of biting mosquitoes. Mosquito numbers at the treatment and control sites were similar prior to the operation of the trap. Following the installation of the trap, the numbers of mosquitoes captured at the site using the Mosquito Slayer Master and Satellite traps were less than half the number that were caught at the control site (no trap). The human biting catch results were also promising, as the number of biting mosquitoes at the treatment site (using Mosquito Slayer Master and Satellite traps) was always lower than at the control site (no trap).

The Mosquito Slayer Non Gas trap did not appear to be successful in reducing mosquito numbers substantially. While it could be argued that mosquito numbers did not increase as sharply at the treatment site compared with the control site. The human catch data reveals little difference between the treatment and control sites after a month of operation. However, as mosquito numbers in the entire area appeared to have risen over the test period, it may be interpreted that the Mosquito Slayer Non Gas Traps prevented an even larger increase in human biting catch.

D. Closed system mosquito trapping efficiency

The screen house functioned well in retaining the mosquitoes placed in it, and provided a suitable environment for mosquito host-seeking. The latter was evidenced by aggressive human biting when the screen house was entered to service the traps within.

Although it was an artificially enclosed environment, the screen house was outdoors, and so was subject to local weather conditions. Temperature varied from 24oC to 31.6oC and relative humidity from 22% - 38% over the nights that testing took place. Overall, weather conditions were warm and dry, with very little wind.
Both models of traps captured Ae.vigilax mosquitoes from within the screen-house. The Mosquito Slayer Master and Satellite traps were the most successful at this, capturing a mean of 24.5 (+10.5) and 30.5 (+14.5) out of 100 Ae.vigilax per night respectively. The Mosquito Slayer Non Gas trap was not as impressive in this regard, only capturing a mean of 1.5 (+1.5) out of 100 mosquitoes per night.

V. Discussion

A. Comparison of the different models

The Mosquito Slayer Master and Satellite traps were clearly the most efficacious for mosquito capture. Miniature light traps baited with carbon dioxide (such as the EVS) have been reported as capturing up to 260,000 mosquitoes per night (C Johansen, Queensland Health, pers. comm.) and are renowned for their efficacy. It is therefore of interest that the Mosquito Slayer Master and Satellite trap performed better than the EVS trap in a comparison test.

In terms of catching female mosquitoes, the Mosquito Slayer Master and Satellite trap was clearly the most specific for females as opposed to males. This suggests that the technology in the Mosquito Slayer Master and Satellite traps used to specifically attract females, ie the sound emitting units, was successful. This may be related to the mosquito species locally available, and the trap may catch males of other species in greater numbers.

Specificity for mosquitoes relative to other invertebrates is a desirable quality in any purposebuilt mosquito trap. Similarly, avoiding the capture of potentially beneficial or otherwise benign invertebrates should be a priority of any environmentally-conscious trap manufacturer. With this in mind, it should be pointed out that the Mosquito Slayers have less impact on the non-mosquito fauna than other traps tested over time.

In a comparison between the Master and the Satellite of the Mosquito Slayer, no detectable difference in mosquito numbers was detected. This demonstrates that both traps are of equal value.

B. Usefulness of the traps for mosquito nuisance reduction

Of the traps tested over time, only the Mosquito Slayer Master and Satellite traps appeared to cause some significant reduction in mosquito numbers. This was evident from lower EVS trap results and consistently lower human biting catch at the site where this trap was operated. The Mosquito Slayer Non Gas trap did not effectively reduce mosquito numbers in this instance. However, they may be more effective in other situations.

It is likely that if the Mosquito Slayer Master and Satellite traps were tested in a different situation, such as a relatively closed-in urban garden with an Aedes notoscriptus problem (domestic container and tree-hole breeding species), then even more convincing results may be obtained. Major Ae.notoscriptus problems may arise from as few as 100 mosquitoes in a backyard. The data presented in this report suggests that such a problem would be well within the abilities of the Mosquito Slayer Gas trap to control.

In terms of the different traps tested over time, it is clear that the Mosquito Slayer with carbondioxide is the most efficacious mosquito trap.

For the purposes of mosquito control, Mosquito Slayer with carbon dioxide represents the best option from the traps tested over time. However, effective control of very large numbers of mosquitoes migrating at high rates into an area cannot be expected of such a device.

These traps provide an inexpensive alternative or augmentation to existing control programs in small, well-defined areas.

An earlier version of the Mosquito Slayer was the Megacatch. The Megacatch site provides full details of the technology used in this scientifically tested unit. The Mosquito Slayer has enhancements such as a new light spectrum, sound emissions and the removal of the gas regulator which reduces the overall costs.

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TECHNICAL REPORT 7

Bushfire Assessment

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BCA Check Pty Ltd trading as Bushfire Certifiers

ADDENDUM TO BUSHFIRE THREAT ASSESSMENT REPORT

Special Fire Protection Purpose (SFPP)

Lot 239 DP 1201225

67 SKENNARS HEAD ROAD SKENNARS HEAD

SENIORS LIVING DEVELOPMENT

Prepared for: Living Gems Pty Ltd

Prepared by:
Peter Thornton
BPAD-L3 ACCREDITED PRACTITIONER

28th May 2018

Ref: 16/044

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DOCUMENT CONTROL

Revision No.	Date	Description	Prepared	Checked	Authorised
A	10.05.2018	Addendum A	Peter Thornton	SJT	Peter Thornton
B	28.05.2018	Addendum A (amended)	Peter Thornton	SJT	Peter Thornton

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

The applicant is proposing to amend the allotment and road configuration of the application for a Seniors Living development on Lot 239 DP 1201225, 67 Skennars Head Road Skennars Head. The re-configuration has resulted in a reduction in the overall number of sites with 147 sites now proposed.

The NSW RFS has issued a current Bush Fire Safety Authority (BFSA) (***attached***) for the proposal considering the bushfire report prepared by this office Ref: 16/044, dated 5th June 2017 Revision C.

This addendum report provides two additional performance solutions relating to –

1. The western perimeter road complying with Table 4.1 PBP2006 with a roll top kerb and no obstructions for a distance of 1.5m from the western kerb with no parking permitted on the western side of the perimeter road.

2. A fire trail in accordance with s4.1.3(3) PBP2006 is proposed adjacent to the southern boundary in lieu of a perimeter road in recognition of the minimal bushfire hazard to the south of the subject property. The fire trail will link to the Council road adjacent to the east boundary of the subject property.

The amendments will not significantly alter the original assessment outcomes apart from those in relation to the above performance solutions. It is recommended that the current Bush Fire Safety Authority be re-issued subject to the following amendments –

1. *Replace Condition No. 1 to – The development proposal is to comply with the layout identified on the drawing titled Site Plan, Job No. LH-01 issued 21/5/2018 issue O, Drawn by FJ.*

2. *Amend Condition No. 2 to reflect the reduced lot numbers to – At the commencement of the development and in perpetuity, the entire property to the north and east of the Littoral rainforest establishment area shown on the diagram identified as Figure 5 in the Addendum to the Bushfire Threat Assessment Report dated 28th May 2018 prepared by Bushfire Certifiers (ref:16/044, Revision B) shall be managed as an inner protection area (IPA) as outlined within section 4.1.3 and Appendix 5 of 'Planning for Bush Fire Protection 2006' and the NSW Rural Fire Service's document 'Standards for asset protection zones', except for the following:*

    - *The area of remnant rainforest trees in the north-west portion of the site – ground cover and elevated fuel shall be managed in accordance with*

Appendix 5 of PBP and a minimum 11 metre separation shall be maintained between the canopy of the rainforest remnant and the adjacent Littoral rainforest establishment area;

- *The area of unmanaged rainforest located centrally between Sites 7 – 9 and the broad leaf paperbark remnant north of Sites 61, 1-6, 21, 22, 36 and 37.*

3. *Delete Condition No. 3.*

Reason: *The proposed allotments adjacent to the southern boundary will comply with the 10m SFPP requirement of Planning for Bushfire Protection 2006. The fence is considered to be a potential hindrance to NSW RFS intervention and access to the hazard if staging is required in the location of the proposed fire trail.*

4. *Additional and amended dot points to Condition No. 6 being –*
   - *Replace dot point No. 1 - The western perimeter road is to have a roll top kerb and no obstructions for a distance of 1.5m on the western side of the formed road with no parking permitted on the western side of the perimeter road.*
   - *Delete dot point No. 2 given location of the fire trail.*
   - *Additional dot point - The Council owned road to the east, being used as a secondary emergency egress must comply with Table 4.1 PBP2006 except the road will not require sealing. Confirmation is required the maintenance and management will be legally undertaken for the life of the proposed development. Details of any upgrading works to comply with Table 4.1 PBP2006 shall be submitted to the consent authority for approval.*
   - *Additional dot point – The fire trail proposed adjacent to the south boundary between lots 131 – 141 is to comply with s4.1.3(3) of PBP2006. Hydrants are to be provided on the hazard side of the fire trail in accordance with the coverage requirements of AS 2419-2005.*
   - *Additional Internal reversing bays at the end of Road No. 2 and 4 must be 8m deep x 6m wide with 6m inner radius curves.*

Reason: *To reflect the amended design proposal.*

5. *Addition to Condition No. 5 – A fire hydrant must be provided adjacent to the proposed fire trail in accordance with s4.1.3 PBP2006.*

6. *Amend Condition No. 8 – ''The construction of any structures (including a Manager's residence and the County Club) on sites within 100 metres of the northern and/or eastern edge of the Littoral rainforest establishment area shown on the diagram identified as Figure 5 in the Addendum to the Bushfire Threat Assessment Report*

dated 28th May 2018 prepared by Bushfire Certifiers (ref:16/044, Revision B) shall comply with Sections 3 and 5 (BAL 12.5) Australian Standard AS 3959-2009 'Construction of buildings in bush fire-prone areas' or NASH Standard (1.7.14 updated) 'National Standard Steel Framed Construction in Bushfire Areas – 2014' as appropriate and section A3.7 Addendum Appendix 3 of Planning for Bushfire Protection 2006, except sites 131-134 (see separate condition).

7. *Amend Condition No. 9 by replacing the reference to sites 155, 156 and 157 with Sites 131–134.*

Reason: *To reflect the amended design proposal.*

8. *Additional wording to Condition No. 10 in recognition of the bio-basin location and the proposed APZ being –*
    - *The proposed bio-basin located partially within the hazard and the asset protection zone is to be landscaped in accordance with the ''Bio Basin Concept Plan Rev B dated 5.05 – IR Submission."*

Reason: *In recognition that the bio-basin is location both within the revegetation area (hazard) and the asset protection zone (APZ). The section of bio-basin within the APZ must be managed lawn.*

2.0 INTRODUCTION

This addendum report will address the variations to the development primarily relating to allotment arrangement, reduced site number and amended internal road network. The current Bush Fire Safety Authority for the site was issued by the NSW RFS on the 31st August 2017 considering the bushfire threat assessment report prepared by this office (ref: 16/044, Revision C, dated 5 June 2017). In this regard all asset protection zones will be as per the report relating to this addendum with exception to the asset protection zones previously required for Lots 158 – 163 to the east and south given these allotments are no longer proposed.

The report provides an updated site plan for reference in a Bush Fire Safety Authority with the reference of the plan substituting the references in the previous BFSA.

The addendum includes two performance solution to address the amended design being:

1. The western perimeter road complying with Table 4.1 PBP2006 with a roll top kerb and no obstructions for a distance of 1.5m from the western kerb with no parking permitted on the western side of the perimeter road.

2. A fire trail in accordance with s4.1.3(3) PBP2006 is proposed adjacent to the southern boundary in lieu of a perimeter road in recognition of the minimal bushfire hazard to the south of the subject property. The fire trail will link to the Council road adjacent to the east boundary of the subject property.

The addendum report will also acknowledge in the recommended BFSA conditions, the use of the Council access road adjacent to the east boundary of the subject property which will now be used as part of an emergency egress/access road.

The report will also recommend the removal of the required 1.8m metal fence along the part of the south boundary of the subject property in recognition of potential access requirements for fire-brigade intervention from the proposed fire trail adjacent to the southern boundary and in recognition of the hazard in this location.

3.0 PROPOSED AMENDED DEVELOPMENT

It is understood the amended development will be a seniors living development involving a reduction in the number of sites to 147 seniors serviced self-care housing dwellings, clubhouse, recreational facilities, roads, utility services, environmental management and environmental protection works.

The full Statement of Environmental Effects (SEE) should be considered when assessing this bushfire report. The amended site plan is provided in Figure 1 and a larger plan ***attached*** to this report.

The proposal is amended as a result of Ballina Shire Council's requested for further information and more detailed design assessment. The proposed primary access is from Skennars Head Road with the secondary egress linking to the Council road adjacent to the east boundary of the subject property.

Figure 1: Proposed site plan relating to the bushfire addendum report.

4.0 ACCESS

4.1 GENERAL

The current Bush Fire Safety Authority for the site was issued by the NSW RFS on the 31st August 2017 considering the bushfire threat assessment report prepared by this office. The access condition No. 6 of the Bush Fire Safety Authority current for the subject property is –

''Internal roads shall comply with section 4.2.7 of 'Planning for Bush Fire Protection 2006' and the following requirements:

- *The perimeter road along the southern and eastern boundary stall comply with Table 4.1 in Planning for Bushfire Protection 2006,*
- *Internal roads (Road No. 2 to 9 inclusive) shall provide a minimum 6.5 metre width clear of any obstructions and shall incorporate roll-top kerb;*
- *Road No. 1 shall provide hydrants on the western side of the road, roll top kerb and no parking to be permitted (except in designated parking bays);*
- *Internal roundabouts shall provide for circulation of fire-fighting appliances in accordance with section 4.2.7 of Planning for Bushfire Protection 2006; and*

- *Any locked gate at the emergency access points onto Skennars Head Road shall be provided with a key/lock system authorised by the local NSW Rural Fire Service. A key is also to be held by the on-site manager.*

This addendum report provides two additional performance solution relating to –

1. The western perimeter road complying with Table 4.1 PBP2006 with a roll top kerb and no obstructions for a distance of 1.5m from the western kerb with no parking permitted on the western side of the perimeter road.

2. A fire trail in accordance with s4.1.3(3) PBP2006 is proposed adjacent to the southern boundary in lieu of a perimeter road in recognition of the minimal bushfire hazard to the south of the subject property. The fire trail will link to the Council road adjacent to the east boundary of the subject property.

In this regard the recommended amendment to Condition No. 6 is provided in the conclusion of this performance solution and the executive summary of the addendum report to reflect the amended references to the internal roads and additional measures in conclusion of the performance solution.

4.2 PERFORMANCE SOLUTION

The performance solution relates to the perimeter road requirements of s4.2.7 of Planning for Bushfire Protection 2006. All other performance solutions and bushfire measures are provided in the bushfire report which was subject to the current Bush Fire Safety Authority.

The performance solution and addendum report recommendations in conjunction with the bushfire protection measures outlined in the current BFSA will demonstrate compliance with the performance criteria and the Aim and Objectives of PBP2006 as follows -

Aim and Objectives of PBP2006
The aim of PBP is to use the NSW development assessment system to provide for the protection of human life (including firefighters) and to minimise impacts on property from the threat of bushfire, while having due regard to development potential, on site amenity and protection of the environment.

More specifically, the objectives are to:

i. Afford occupants of any building adequate protection from exposure to a bush fire;
ii. Provide for a defendable space to be located around buildings;

iii. *Provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent direct flame contact and material ignition;*
iv. *Ensure that safe operational access and egress for emergency service personnel and residents is available.*
v. *Provide for ongoing management and maintenance of bush fire protection measures, including fuel loads in the asset protection zone (APZ); and*
vi. *Ensure that utility services are adequate to meet the needs of firefighters (and others assisting in bushfire fighting)*

The following acceptable solution will not be fully complied –

Acceptable Solution s4.2.7 PBP2006
Internal Perimeter roads are provided with at least two traffic lane widths (carriageway 8 metres minimum kerb to kerb) and shoulders on each side, allowing traffic to pass in the opposite directions

The following acceptable solution is the subject of the following performance solution -

Performance Criteria s4.2.7 PBP2006
Internal road widths and design enable safe access for emergency services and allow crews to work with equipment about the vehicle.

4.3 PERFORMANCE SOLUTION - ACCESS

The performance solution will address the following items relating to the aforementioned non-compliance with the acceptable solution of s4.2.7 PBP2006.

1. The western perimeter road will not have an 8m wide carriageway when measured from kerb to kerb. The western perimeter road will however comply with Table 4.1 PBP2006 with a roll-top kerb and no obstructions for a distance of 1.5m from the western kerb with no parking permitted on the western side of the perimeter road as shown in Figure 2 below.

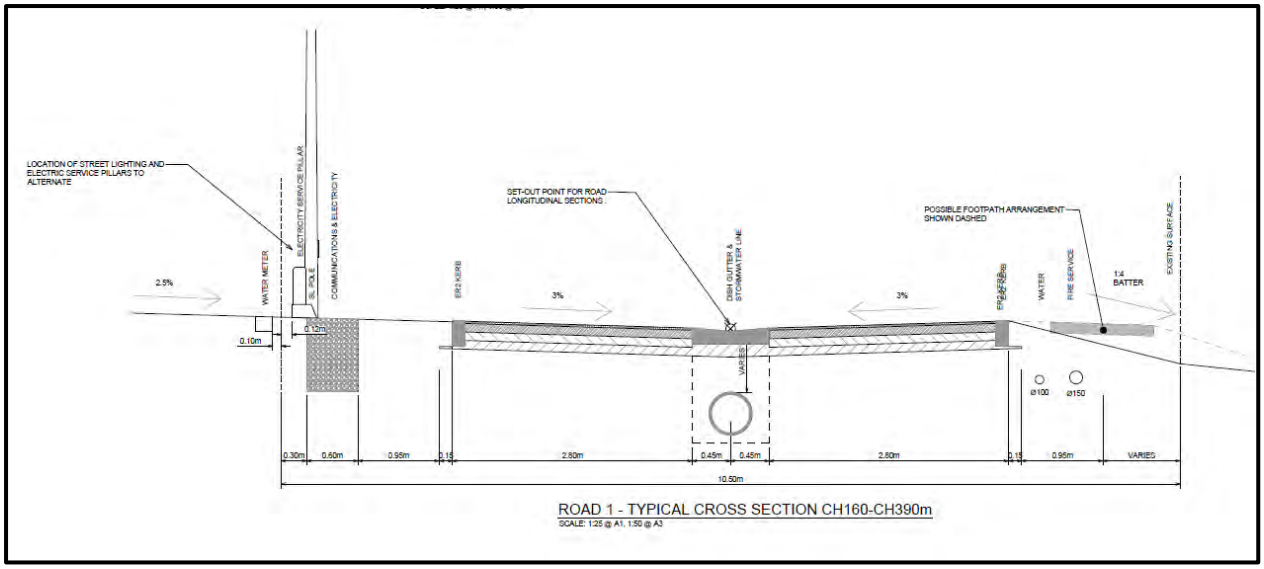


Figure 2: Cross section of the western perimeter road.

The western perimeter road will comply with Table 4.1 of Planning for Bushfire Protection 2006 with exception to the requirement for an 8m wide sealed perimeter road width.

The applicant however is proposing to have a roll-top kerb on the western side of the road with no further obstructions for a minimum 1.5m from the back of the western kerb. This will allow a fire fighting appliance to stage partially off the sealed road but within the carriage way. The 1.5m is to be construction to be capable of supporting a fully laden fire-fighting appliance (15 tonnes).

This proposal will be equivalent to an 8m wide sealed perimeter road in the surface is accessible for a fire fighting appliance and will provide an equivalent bearing capacity.

2. A perimeter road will not be provided between the development and the south boundary. In recognition of the bushfire threat from the south, a fire trail in accordance with s4.1.3(3) PBP2006 is proposed adjacent to the southern boundary in lieu of a perimeter road. The fire trail will link to the Council road adjacent to the east boundary of the subject property as shown in Figure 3.

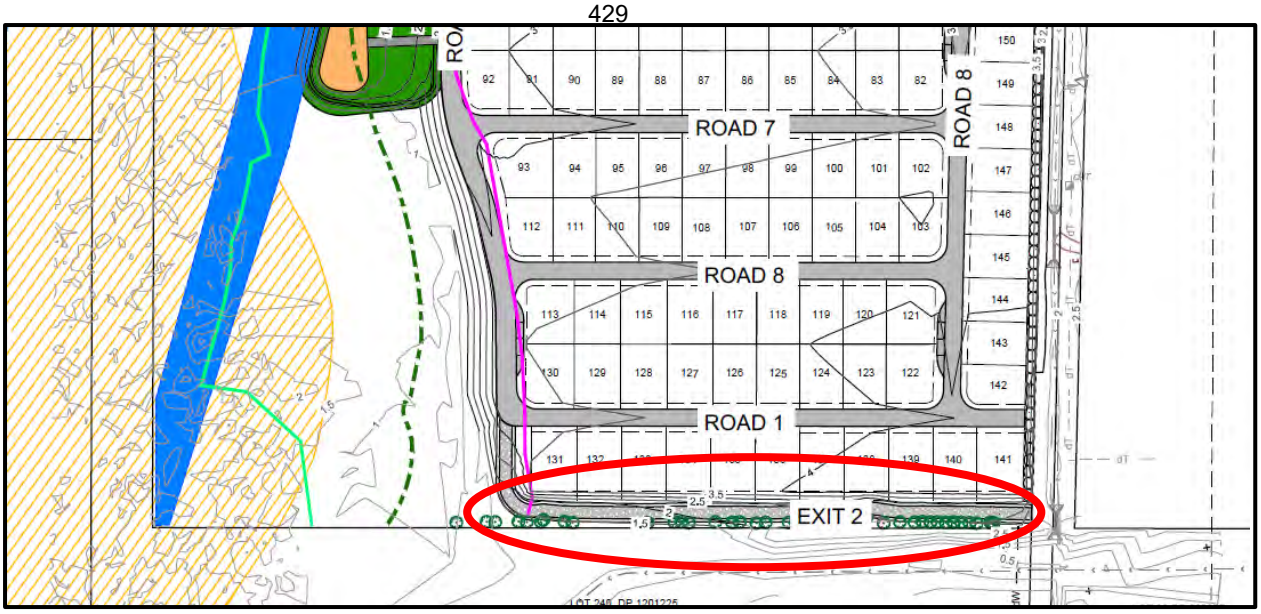


Figure 3: Location of the proposed fire trail linking to the road to the east.

Fire Trail in lieu of Perimeter Roads

The amended design as shown previously in Figure 1 and 3 shows the location of the proposed fire trail adjacent to part of the southern boundary of the subject property and linking to the Council road to the east.

As outlined in s4.1.3 PBP2006 a fire trail in lieu of a perimeter road is generally only considered acceptable in exceptional circumstances and where the performance criteria and objectives can be satisfied. Further, the 'Aim' of PBP2006 is to minimise the impacts on property and people from the threat of bushfire, "while having due regard to development potential, on-site amenity and protection of the environment".

The purpose of the public road system is to:

- Provide fire-fighters with easier access to structures, allowing more efficient use of fire-fighting resources;
- Provide a safe retreat for fire-fighters; and
- Provide a clear control line from which to conduct hazard reduction or back burning.

It is considered that the proposed fire trails in these locations will be at least equivalent to providing a public perimeter road in a bushfire event. The assessment provides a comparative analysis as outlined in BCA A0.5(c) against the objectives and performance criteria identified within this report.

Aim and Objectives of PBP2006

The aim of PBP is to use the NSW development assessment system to provide for the protection of human life (including firefighters) and to minimise impacts on property from the threat of bushfire, while having due regard to development potential, on site amenity and protection of the environment.

Comment

All asset protection zone requirements, water supply, utilities and internal road specification except where addressed by this report will need to be fully compliant with Planning for Bushfire Protection 2006 whilst having regard to the development potential.

More specifically, the objectives are to:

Afford occupants of any building adequate protection from exposure to a bush fire;

Comment

The use of a fire trail specifically for emergency services to operate will provide sufficient area for fire-fighters whilst forming part of a compliant asset protection zone that will meet the minimum requirements of PBP2006 and NSW RFS Fast Facts.

The use of the fire trail will also ensure that future occupants in relation to the hazard to the south will not be exiting the dwelling toward the hazard but away from the hazard via the internal public road network. Similarly, occupants of the development in relation to the hazard to the south using the internal road network not be directly exposed to the hazard with the proposed fire trail option.

Conversely, the perimeter road option will potentially have occupants evacuating toward the hazard and within the 'flame zone' whereas occupants exiting to the internal road from the hazard will be exiting where the radiant heat will be less than 10kW/m^2 calculated without the reduction of shielding from the dwellings factored in which would further decrease radiant heat levels.

It is therefore considered that this design is a better outcome for occupants of the buildings in a bushfire event.

Provide for a defendable space to be located around buildings;

Comment

Defendable space will be provided in combination of the fire trails and surrounds and the asset protection zones once the fire front has passed allowing occupants to undertake

property protection. As the asset protection zones will be fully compliant with the requirements of Planning for Bushfire Protection 2006, this will be compliant.
Provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent direct flame contact and material ignition;

Comment
As the asset protection zones will be fully compliant with the requirements of Planning for Bushfire Protection 2006 as demonstrated with the issuing of the current Bush Fire Safety Authority. Dwellings will be required to be constructed to AS 3959-2009 and Addendum to Appendix 3 PBP2006.

Ensure that safe operational access and egress for emergency service personnel and residents is available.

Comment
The fire trail shall be fully compliant with s4.1.3(3) PBP2006 which will provide adequate access for fire-fighters for APZ maintenance and fire control lines. To comply with s4.1.3(3) PBP2006 the fire trail will be connected to the Council road to the east.

The fire trail will be utilised by fire-fighters predominantly and therefore unlike with a perimeter road fire-fighters can operate without the direct impact of occupants passing by during evacuation and/or the scenario where fire fighters are operating within an 8m wide perimeter road with occupants evacuating in one directions and other emergency services or the like passing in the same space in the opposite direction. In this regard it can be considered that at the least, equivalence has been demonstrated.

Provide for ongoing management and maintenance of bush fire protection measures, including fuel loads in the asset protection zone (APZ);

Comment
The fire trail will be managed by the property owners or managers and can be included in the fire safety schedule if required to ensure maintenance is undertaken for the time the proposed use exists.

Ensure that utility services are adequate to meet the needs of firefighters (and others assisting in bushfire fighting).

Comment
The perimeter road design solution would have fire hydrants for fire-fighters to use at the hazard interface and in this regard, in order to demonstrate equivalence, it is recommended

that fire hydrants be placed along the fire trail in accordance with s4.1.3 PBP2006 as would be the case for a perimeter road. Design details will need to provided and submitted to the Consent Authority for approval prior to installation.

The aforementioned comments also demonstrate compliance with the following performance criteria -

Internal road widths and design enable safe access for emergency services and allow crews to work with equipment about the vehicle.

In addition to the above, consideration has been given to the bushfire risk from the south. It is noted a drainage channel to the south, which is understood to be based on previous hydraulic and ecological studies, generally always contains water. In addition, the bushfire behaviour from this direction will be predominantly a grassfire with a burn out time of 10 - 15 seconds at the vegetation interface with little remaining heat yield once the fire front has passed. The effectiveness of a perimeter road in this location is negligible with a fire trail being capable of satisfying the performance criteria.

The proposed fire trail and the secondary egress/access route to the east will also satisfy the NSW RFS concern raised following the initial bushfire engineering brief which resulted with the issue of a BFSA. The RFS comment was as follows –

> *''However, of concern is the proposed road system design and layout. It appears that all traffic movements to enter and exit the property will be at the closest point to the BF hazard. Indeed, the main proposed vehicle thoroughfare will be located close to the BF hazard interface. As such, with this current design, the BF assessment report will need to model flame length and radiant heat exposure to ensure the performance criteria and intent of the access provisions of PBP can be achieved. Also the assessment should look at traffic volumes and smoke visibility impacts.*
>
> *Alternatively, the development could be redesigned to have the main internal access road on the eastern side of the development, possibly incorporating the existing access road on the adjoining lot 34 DP 846639.*
>
> *Some justification of the design layout will need to be forthcoming to justify compliance with the access specifications in PBP.''*

This report addresses the amendments to the development layout which has occurred due to the information request from Ballina Council's and further design development.

Figure 4: Amended design layout (larger image attached)

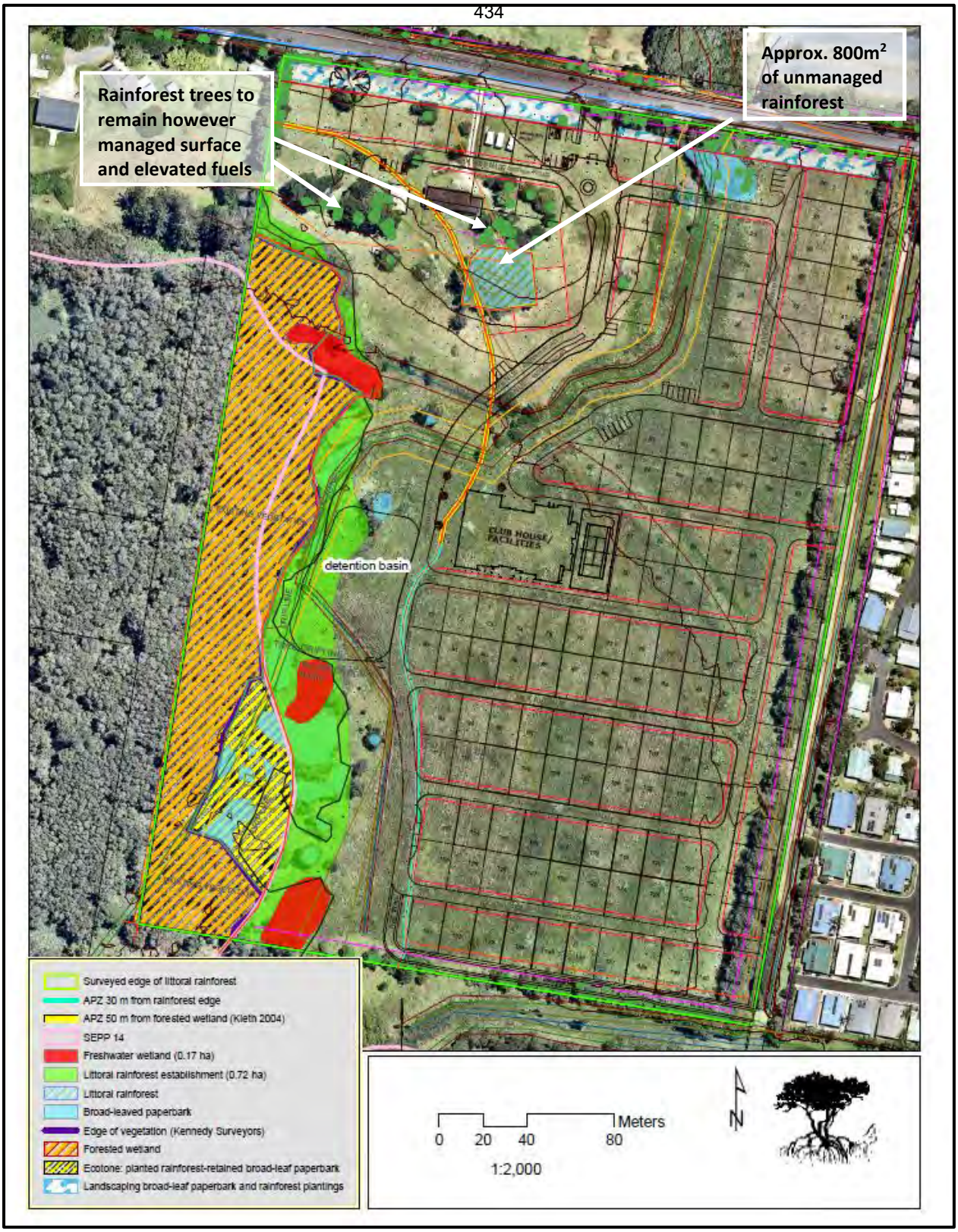


Figure 5: Unshaded areas shall be managed as asset protection zones (APZs)

5.0 WATER AND UTILITY SERVICES

5.1 WATER SERVICES

The proposed development is to be serviced by fire hydrants in accordance with Australian Standard 2419.1-2005 located on the subject property. Sizing, pressure and flows for the fire hydrant system will require design, installation and commissioning certification as required by the Local Authority.

Access to the hydrant system is available for fire brigade intervention and shall comply with NSW RFS and Ballina Shire Council requirements. An additional fire hydrant is to be provided adjacent to the proposed fire trail.

6.0 CONCLUSION

This report has addressed all matters required by clause 44 of the *Rural Fires Regulation* for an application for a Bush Fire Safety Authority. The report has established that:

- The proposed buildings are capable of being constructed to AS 3959-2009 and Planning for Bushfire Protection 2006.
- The performance criteria of Section 4.2.7 of PBP2006 are satisfied with regard to asset protection zones, access and utilities.
- The intent of Planning for Bushfire Protection is satisfied.

DISCLAIMER

This report was prepared for the purposes and exclusive use of the stated client to accompany an addendum to the application to Ballina Shire Council for a proposed seniors living development and is not to be used for any other purpose or by any other person or Corporation. Any future alterations or addition to the building will require a re-assessment of the entire building. BCA Check Pty Ltd accepts no responsibility for any loss or damage suffered howsoever arising to any person or Corporation who may use or rely on this report in contravention of the terms of this clause.

Reporting has been based on the relevant Council and Rural Fire Service Guidelines, however, recommendations given in this report are based on our site investigation at the time of reporting. In some cases site conditions may change dramatically within a few years due to rapid vegetation re-growth and invading weed species.

The report has been established to reduce the risk of ignition to the building and to promote occupant safety and this is dependent on the property and structure being maintained in perpetuity to the recommendations in this report and the standards of Planning for Bushfire Protection 2006. It is noted however that the report and the recommendations within cannot and do not propose that the building or occupants will not be adversely impacted upon given that bushfire is a natural phenomenon and cannot fully be predicted as can occupant behaviour.

REFERENCES

NSW Rural Fire Service and Planning NSW (2006), *Planning for bushfire protection, A guide for councils planners fire authorities developers and homeowners.* Rural Fire Service NSW Australia.
Standards Australia, (2009), AS3959 *Construction of buildings in bushfire prone areas,* Australian Standards, Sydney.

LEGISLATION

Environmental Planning and Assessment Act 1979 and Regulations 2000. *New South Wales.* Parliamentary Counsel's Office, NSW Government Information Service.
Rural Fires Act 1997. *New South Wales.* Parliamentary Counsel's Office, NSW Government Information Service.
Rural Fires Regulation. *New South Wales.* Parliamentary Counsel's Office, NSW Government Information Service.

ATTACHMENTS

- **Bush Fire Safety Authority – NSW Rural Fire Service, dated 31.08.2017**
- **Architectural plans – Planit**
  - **J107 - 0001 INDEX AND LOCALITY PLAN REV L**
  - **J107 - 0002 NOTES AND LEGEND REV E**
  - **J107 - 0003 EXISTING CONDITIONS LAYOUT PLAN REV F**
  - **J107 - 0004 DEMOLITION/CLEARING LAYOUT PLAN REV H**
  - **J107 - 0005 OVERALL LAYOUT PLAN REV L**
  - **J107 - 0006 ROADWORKS LAYOUT PLAN SHEET 1 OF 2 REV H**
  - **J107 - 0007 ROADWORKS LAYOUT PLAN SHEET 2 OF 2 REV H**
  - **J107 - 0008 ROADWORKS TYPICAL CROSS SECTION SHEET 1 OF 3 REV F**
  - **J107 - 0009 ROADWORKS TYPICAL CROSS SECTION SHEET 2 OF 3 REV F**
  - **J107 - 0010 ROADWORKS LONG SECTION SHEET 1 OF 5 REV G**
  - **J107 - 0011 ROADWORKS LONG SECTION SHEET 2 OF 5 REV G**
  - **J107 - 0012 ROADWORKS LONG SECTION SHEET 3 OF 5 REV G**
  - **J107 - 0013 ROADWORKS LONG SECTION SHEET 4 OF 5 REV G**
  - **J107 - 0014 DELETED DRAWING REV G**
  - **J107 - 0015 EARTHWORKS CUT/FILL PLAN REV G**
  - **J107 - 0016 STORMWATER LAYOUT PLAN SHEET 1 OF 2 REV H**
  - **J107 - 0017 STORMWATER LAYOUT PLAN SHEET 2 OF 2 REV G**
  - **J107 - 0018 BIORETENTION BASIN TYPICAL DETAILS REV G**
  - **J107 - 0019 SEWER AND WATER LAYOUT PLAN SHEET 1 OF 2 REV G**
  - **J107 - 0020 SEWER AND WATER LAYOUT PLAN SHEET 2 OF 2 REV G**
  - **J107 - 0021 EROSION AND SEDIMENT CONTROL LAYOUT PLAN REV H**
  - **J107 - 0022 EROSION AND SEDIMENT NOTES REV C**
  - **J107 - 0023 ROADWORKS TYPICAL CROSS SECTION SHEET 3 OF 3 REV B**
  - **J107 - 0024 HILL SECTIONS REV A**

- **Master Plan (revised) – 21.05.2018**
- **Ecology Plan**

NSW RURAL FIRE SERVICE

NSW GOVERNMENT

General Manager
Ballina Shire Council
PO Box 450
BALLINA NSW 2478

Your Ref: DA 2016/524
Our Ref: D16/3509
DA16102104335 PC

ATTENTION: Anthony Peters

31 August 2017

Dear Mr Peters,

Integrated Development – Lot 239 DP 1201225, 67 Skennars Head Road, Skennars Head

I refer to your letter dated 24 July 2017 seeking general terms of approval for the above integrated development in accordance with section 91 of the 'Environmental Planning and Assessment Act, 1979'.

This response is to be deemed a bush fire safety authority as required under section 100B of the 'Rural Fires Act, 1997' and is issued subject to the following numbered conditions:

1. The development proposal is to comply with the layout identified on the drawing titled 'Ste Plan' prepared by GemLife (Ref: LH-01, Revision I), dated 14 July 2017, except as modified by the following conditions.

Asset Protection Zones
The intent of measures is to provide sufficient space for fire fighters and other emergency services personnel, ensuring radiant heat levels permit operations under critical conditions of radiant heat, smoke and embers, while supporting or evacuating occupants. To achieve this, the following conditions shall apply:

2. At the commencement of the development and in perpetuity, the entire property to the north and east of the Littoral rainforest establishment area shown on the diagram identified as Figure 2 in the Bushfire Threat Assessment Report prepared by Bushfire Certifiers (ref: 16/044, Revision C, dated 5 June 2017) shall be managed as an inner protection area (IPA) as outlined within section 4.1.3 and Appendix 5 of 'Planning for Bush Fire Protection 2006' and the NSW Rural Fire Service's document 'Standards for asset protection zones', except for the following:

Postal address
Records
NSW Rural Fire Service
Locked Bag 17
GRANVILLE NSW 2142

Street address
NSW Rural Fire Service
Planning and Environment Services (North)
Suite 1, 129 West High Street
COFFS HARBOUR NSW 2450

T (02) 6691 0400
F (02) 6691 0499
www.rfs.nsw.gov.au
Email: pes@rfs.nsw.gov.au

- the area of remnant rainforest trees in the north-west portion of the site - ground cover and elevated fuel shall be managed in accordance with Appendix 5 of PBP and a minimum 11 metre separation shall be maintained between the canopy of the rainforest remnant and the adjacent Littoral rainforest establishment area;
- the area of unmanaged rainforest located centrally between Sites 158 to 170 and the broad-leaved paperbark remnant north of Site 60.

3. A minimum 1.8 metres high radiant heat shield made of non-combustible materials shall be constructed along the southern boundary from a point opposite the eastern boundary of Site 155 to a point 10m to the west of the western perimeter road. All posts and rails shall be constructed of steel. The bottom of the fence is to be in direct contact with the finished ground level or plinth.

4. A bush fire management plan is to be prepared that addresses the following requirements:
   - contact person and details; and
   - schedule and description of works for the construction of asset protection zones and their continued maintenance.

   A copy shall be provided to the consent authority prior to the commencement of the development.

Water and Utilities
The intent of measures is to provide adequate services of water for the protection of buildings during and after the passage of a bush fire, and to locate gas and electricity so as not to contribute to the risk of fire to a building. To achieve this, the following conditions shall apply:

5. Water, electricity and gas are to comply with sections 4.1.3 and 4.2.7 of 'Planning for Bush Fire Protection 2006'.

Access
The intent of measures for internal roads is to provide safe operational access for emergency services personnel in suppressing a bush fire, while residents are accessing or egressing an area. To achieve this, the following conditions shall apply:

6. Internal roads shall comply with section 4.2.7 of 'Planning for Bush Fire Protection 2006' and the following requirements:
   - the perimeter road along the southern and eastern boundary shall comply with Table 4.1 in 'Planning for Bush Fire Protection 2006';
   - internal roads (Road No. 2 to 9 inclusive) shall provide a minimum 6.5 metre width clear of any obstructions and shall incorporate roll-top kerb;
   - Road No. 1 shall provide hydrants on the western side of the road, roll-top kerb and no parking to be permitted (except in designated parking bays);
   - internal roundabouts shall provide for circulation of fire fighting appliances in accordance with section 4.2.7 of 'Planning for Bush Fire Protection 2006'; and
   - any locked gate at the emergency access points onto Skennars Head Road shall be provided with a key / lock system authorised by the local NSW Rural Fire Service. A key is also to be held by the on-site manager.

Evacuation and Emergency Management
The intent of measures is to provide suitable emergency and evacuation (and relocation) arrangements for occupants of special fire protection purpose developments. To achieve this, the following conditions shall apply:

7. Arrangements for emergency and evacuation are to comply with section 4.2.7 of 'Planning for Bush Fire Protection 2006', including the preparation of an emergency / evacuation

plan consistent with the NSW RFS document titled 'A guide to developing a bush fire emergency management and evacuation plan'. A copy of the plan shall be provided to all occupants of the development, the consent authority and the local Bush Fire Management Committee prior to occupation of the development.

Design and Construction
The intent of measures is that buildings are designed and constructed to withstand the potential impacts of bush fire attack. To achieve this, the following conditions shall apply:

8. The construction of any structures (including a Manager's residence and the Country Club) on Sites within 100 metres of the northern and/or eastern edge of the Littoral rainforest establishment area shown on the diagram identified as Figure 2 in the Bushfire Threat Assessment Report prepared by Bushfire Certifiers (ref: 16/044, Revision C dated 5 June 2017) shall comply with Sections 3 and 5 (BAL 12.5) Australian Standard AS3959-2009 'Construction of buildings in bush fire-prone areas' or NASH Standard (1.7.14 updated) 'National Standard Steel Framed Construction in Bushfire Areas – 2014' as appropriate and section A3.7 Addendum Appendix 3 of 'Planning for Bush Fire Protection 2006', except Sites 155, 156 and 157 (see separate condition).

9. The construction of any structures on Sites 155, 156 and 157 shall comply with section 3 and section 7 (BAL 29) Australian Standard AS3959-2009 'Construction of buildings in bush fire-prone areas' or NASH Standard (1.7.14 updated) 'National Standard Steel Framed Construction in Bushfire Areas – 2014' as appropriate and section A3.7 Addendum Appendix 3 of 'Planning for Bush Fire Protection' 2006'.

Landscaping
10. Landscaping to the site is to comply with the principles of Appendix 5 of 'Planning for Bush Fire Protection 2006'.

For any queries regarding this correspondence please contact Paul Creenaune on 1300 NSW RFS.

Yours sincerely,

Alan Bawden
Team Leader – Development Assessment & Planning

The RFS has made getting information easier. For general information on 'Planning for Bush Fire Protection, 2006', visit the RFS web page at www.rfs.nsw.gov.au and search under 'Planning for Bush Fire Protection, 2006'.

100mm AT ORIGINAL SIZE

LIVING GEMS C/- PLANNERS NORTH

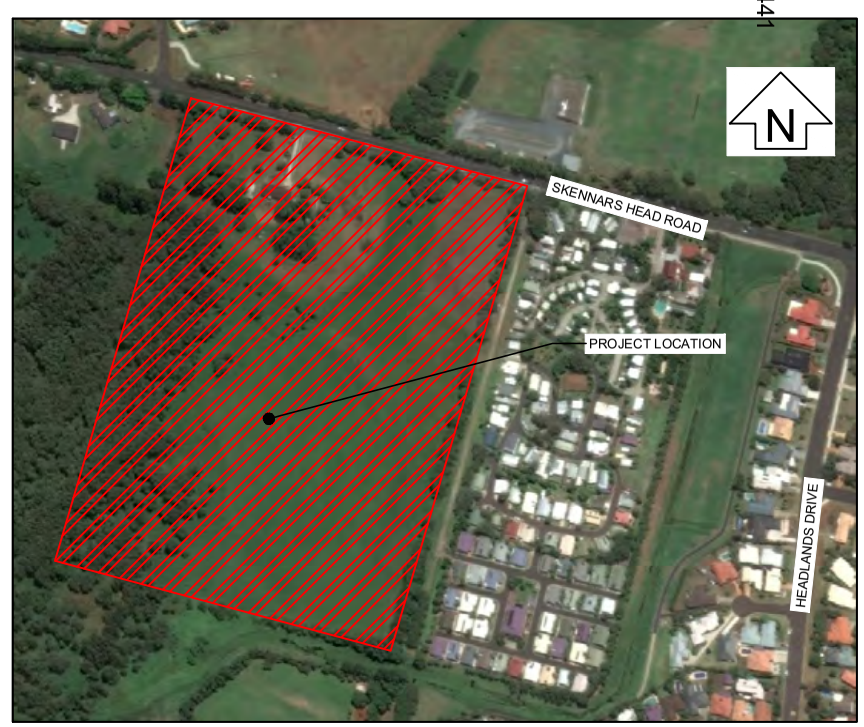
67 SKENNARS HEAD ROAD

SKENNARS HEAD, NSW, 2478

ISSUED FOR DEVELOPMENT APPLICATION

DRAWING NUMBER	TITLE	REVISON
J107 - 0001	INDEX AND LOCALITY PLAN	L
J107 - 0002	NOTES AND LEGEND	E
J107 - 0003	EXISTING CONDITIONS LAYOUT PLAN	F
J107 - 0004	DEMOLITION/CLEARING LAYOUT PLAN	H
J107 - 0005	OVERALL LAYOUT PLAN	L
J107 - 0006	ROADWORKS LAYOUT PLAN SHEET 1 OF 2	H
J107 - 0007	ROADWORKS LAYOUT PLAN SHEET 2 OF 2	H
J107 - 0008	ROADWORKS TYPICAL CROSS SECTION SHEET 1 OF 3	F
J107 - 0009	ROADWORKS TYPICAL CROSS SECTION SHEET 2 OF 3	F
J107 - 0010	ROADWORKS LONG SECTION SHEET 1 OF 5	G
J107 - 0011	ROADWORKS LONG SECTION SHEET 2 OF 5	G
J107 - 0012	ROADWORKS LONG SECTION SHEET 3 OF 5	G
J107 - 0013	ROADWORKS LONG SECTION SHEET 4 OF 5	G
J107 - 0014	DELETED DRAWING	G
J107 - 0015	EARTHWORKS CUT/FILL PLAN	G
J107 - 0016	STORMWATER LAYOUT PLAN SHEET 1 OF 2	H
J107 - 0017	STORMWATER LAYOUT PLAN SHEET 2 OF 2	G
J107 - 0018	BIORETENTION BASIN TYPICAL DETAILS	G
J107 - 0019	SEWER AND WATER LAYOUT PLAN SHEET 1 OF 2	G
J107 - 0020	SEWER AND WATER LAYOUT PLAN SHEET 2 OF 2	G
J107 - 0021	EROSION AND SEDIMENT CONTROL LAYOUT PLAN	H
J107 - 0022	EROSION AND SEDIMENT NOTES	C
J107 - 0023	ROADWORKS TYPICAL CROSS SECTION SHEET 3 OF 3	B
J107 - 0024	HILL SECTIONS	A

441



LOCALITY PLAN
SCALE: N.T.S

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
F	AMENDED TO COUNCIL COMMENTS	24/02/17	SA	SA	AW	AW
G	BASIN CAPACITY INCREASED	14/06/17	SA	SA	AW	AW
H	ENTRANCE AMENDED & LOT LAYOUT UPDATE	14/07/17	SA	SA	AW	AW
I	INTERNAL CHECK	21/08/17	SA	SA	AW	AW
J	SITE ENTRANCE RELOCATED	22/11/17	SA	SA	AW	AW
K	ENTRY LANES SHOWN	06/12/17	SA	SA	AW	AW
L	LOT LAYOUT AMENDED TO COUNCIL COMMENTS	23/05/18	SA	SA	AW	AW

SCALES:

DO NOT SCALE FROM DRAWING

DRAWN BY: S.ADAM
DESIGN BY: S.ADAM
APPROVED BY:
DATE:
THIS DRAWING MUST NOT BE USED FOR CONSTRUCTION UNLESS SIGNED AS APPROVED

PLANIT ENGINEERING
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CLIENT: LIVING GEMS
C/- PLANNERS NORTH
3/ 69 CENTENNIAL CIRCUIT
BYRON BAY, NSW, 4281

LOCAL GOVERNMENT AUTHORITY: BALLINA SHIRE COUNCIL

PROJECT: 67 SKENNARS HEAD ROAD
DRAWING TITLE: INDEX & LOCALITY PLAN

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	0001	L

CAD FILE: T:\J107 - 67 SKENNARS HEAD ROAD - DA\6 - CAD\J107-0001.DWG PLOTTED BY: STEPHENA PLOT DATE: 23/05/2018 12:46:27 PM

100mm AT ORIGINAL SIZE

GENERAL

1. THESE DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE FOLLOWING DOCUMENTS:
   - OTHER PROVIDED ENGINEERING DRAWINGS;
   - TECHNICAL SPECIFICATIONS;
   - SUPPLEMENTARY SPECIFICATIONS;
   - WRITTEN INSTRUCTIONS.
2. ALL CONSTRUCTION MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE RELEVANT SPECIFICATION FOR THE WORKS TOGETHER WITH THE REQUIREMENTS OF ALL THE RELEVANT CODES OF PRACTICE REFERRED TO THEREIN AND THE REQUIREMENTS OF NORTHERN RIVERS LOCAL GOVERNMENT STANDARDS AND SPECIFICATIONS.
3. THE CONTRACTOR IS RESPONSIBLE FOR THE DESIGN AND PROVISION OF ANY TEMPORARY BRACING, PROPPING ETC. TO DRAINAGE PIPES DURING CONSTRUCTION. STRUCTURES SHALL BE MAINTAINED IN A STABLE POSITION AND NO PART SHALL BE OVERSTRESSED.
4. ALL LOCATIONS, ORIENTATION AND LEVELS SHALL BE VERIFIED ON SITE BEFORE COMMENCING ANY WORK. DISCREPANCIES SHALL BE REFERRED TO THE SITE SUPERINTENDENT.
5. DO NOT OBTAIN DIMENSIONS FROM SCALING.
6. NATURAL SURFACE LEVELS ON THE DRAWINGS ARE INDICATIVE ONLY.
7. ANY PERMITS AND APPROVALS REQUIRED FOR CONSTRUCTION OF PERMANENT OR TEMPORARY WORKS SHALL BE OBTAINED BY THE CONTRACTOR.
8. NORTHERN RIVERS LOCAL GOVERNMENT STANDARD DETAILS ARE TO BE ADOPTED UNLESS STATED OTHERWISE.

ROADWORKS

1. NOTWITHSTANDING THE DETAILS SHOWN ON THE DRAWINGS ALL WORKS SHALL BE CONSTRUCTED IN ACCORDANCE WITH NORTHERN RIVERS LOCAL GOVERNMENT STANDARD SPECIFICATIONS AND DRAWINGS.
2. SUB-SURFACE DRAINAGE SHALL BE CONSTRUCTED UNDER ALL NEW KERBS AS SPECIFIED WITHIN THESE DRAWINGS AND AS DIRECTED BY THE SUPERINTENDENT. DRAINS TO BE INSTALLED IN ACCORDANCE WITH THE CITY OF GOLD COAST'S STANDARD DRAWING 05-02-103 INSTEAD OF NORTHERN RIVERS STANDARD DRAWING R09B.
3. FLUSHING POINTS SHALL BE PROVIDED FOR SIDE DRAINS AT THE REQUIRED SPACING IN ACCORDANCE WITH NORTHERN RIVERS LOCAL GOVERNMENT STANDARD DRAWINGS AND SPECIFICATIONS.
4. GEOTECHNICAL TEST RESULTS ARE TO BE FORWARDED TO THE SUPERINTENDENT PRIOR TO FINAL BOXING. TESTS SHALL INCLUDE SOAKED CBR AND/OR OTHER TESTS AS REQUESTED BY THE SUPERINTENDENT. THESE TESTS SHALL BE USED TO CONFIRM THE PAVEMENT DESIGN SHOW ON THESE DRAWINGS.
5. THE PAVEMENT DESIGN ON THE DRAWINGS IS NOT FOR CONSTRUCTION UNTIL FINAL CBR TESTS ARE REVIEWED AND APPROVED BY THE SITE SUPERINTENDENT. CONSTRUCTION OF THE PAVEMENT TO THE DESIGN SHOWN ON THE DRAWINGS PRIOR TO RECEIPT OF THE FINAL CBR TEST SHALL BE UNDERTAKEN AT THE CONTRACTOR'S OWN RISK.
6. THE CONTRACTOR SHALL OBTAIN THE LOCATION OF ALL SERVICES AND PROTECT THESE SERVICES PRIOR TO WORKING IN THE VICINITY. ANY DAMAGE WILL BE REPAIRED AT THE CONTRACTOR'S EXPENSE.
7. WORK TO ANY SERVICES SHOULD BE DONE IN CONSULTATION WITH THE APPROPRIATE SERVICE PROVIDER.
8. EXISTING DRIVEWAYS WITHIN THE LIMITS OF THE CONSTRUCTION WORKS SHALL BE PROTECTED FROM DAMAGE. ANY DAMAGE TO DRIVEWAYS SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE.
9. ENTRY INTO EXISTING PROPERTIES SHALL BE MAINTAINED AT ALL TIMES.
10. TEMPORARY WARNING SIGNS TO BE ERECTED AS PER RMS SPECIFICATION G10, CURRENT EDITION.
11. SEAL TO BE A.C. SURFACING - AS SPECIFIED.
12. KERB ADAPTERS ARE TO BE INSTALLED FOR ALL LOTS THAT FALL TO THE ROAD.

PAVEMENTS

1. GRANULAR PAVEMENT MATERIAL TO BE IN ACCORDANCE WITH NORTHERN RIVERS LOCAL GOVERNMENT CONSTRUCTION SPECIFICATIONS AND ALL DOCUMENTS REFERENCED WITHIN.
2. THE PAVEMENT SEAL IS TO BE IN ACCORDANCE WITH RMS CONSTRUCTION SPECIFICATIONS AND ALL DOCUMENTS REFERENCED WITHIN THESE SPECIFICATIONS.
3. GEOTECHNICAL TESTING UNDERNEATH PAVEMENTS IS TO BE UNDERTAKEN TO LEVEL 1 TESTING REQUIREMENTS AT THE COMPLETION OF THE BULK EARTHWORKS.
4. SAMPLING SHALL BE CARRIED OUT IN ACCORDANCE WITH NORTHERN RIVERS LOCAL GOVERNMENT GUIDELINES.
5. FINAL PAVEMENT DESIGN IS SUBJECT TO RECEIPT OF THE GEOTECHNICAL TEST RESULTS AND MAY RESULT IN AN AMENDMENT TO THE PAVEMENT DESIGN SHOWN ON THIS DRAWING.
6. PAVEMENT DESIGN IS BASED ON NORTHERN RIVERS LOCAL GOVERNMENT GUIDELINES.

SEWERAGE

1. NOTWITHSTANDING THE DETAILS SHOWN ON THE DRAWINGS ALL WORKS SHALL BE CONSTRUCTED IN ACCORDANCE WITH NORTHERN RIVERS LOCAL GOVERNMENT STANDARD SPECIFICATIONS AND DRAWINGS.
2. ALL PIPES SHALL BE Ø150 uPVC CLASS 'SN8' OR APPROVED EQUIVALENT U.N.O.
3. EACH LOT SHALL BE SERVICED BY A Ø100 HOUSE CONNECTION IN ACCORDANCE WITH NORTHERN RIVERS LOCAL GOVERNMENT STANDARD SPECIFICATIONS AND DRAWINGS. HOUSE CONNECTIONS SHALL BE LOCATED 0.5m UPSTREAM OF ALLOTMENT BOUNDARIES.
4. CONTRACTOR SHALL VERIFY FINISHED SURFACE LEVELS ON SITE BEFORE CONSTRUCTION OF SEWERS AND HOUSE CONNECTION BRANCHES.
5. THE CONTRACTOR SHALL HAVE PROPERTY BOUNDARIES PEGGED AND THE LOCATION OF HOUSE CONNECTIONS CONFIRMED PRIOR TO COMMENCING CONSTRUCTION OF HOUSE CONNECTION BRANCHES.
6. FINISHED SURFACE LEVELS SHOWN ON LONGITUDINAL SECTIONS ARE INDICATIVE ONLY AND MANHOLE LIDS SHALL FINISH TO THE GRADE OF THE FOOTPATH IN ROADWAYS AND 75mm ABOVE THE SURROUNDING LEVELS IN THE ALLOTMENTS.
7. ANY WORK ASSOCIATED WITH LIVE SEWERS AND MANHOLES MAY BE CARRIED OUT BY THE CONTRACTOR UNDER SUPERVISION BY NORTHERN RIVERS LOCAL GOVERNMENT. FEES & EXPENSES FOR THESE EXPENSES ARE THE RESPONSIBILITY OF THE CONTRACTOR.
8. THE CONTRACTOR SHALL OBTAIN THE LOCATION OF ALL SERVICES AND PROTECT THESE SERVICES PRIOR TO WORKING IN THE VICINITY. ANY DAMAGE WILL BE REPAIRED AT THE CONTRACTOR'S EXPENSE.
9. THE CONTRACTOR SHALL ADVICE THE SUPERINTENDENT IMMEDIATELY IF MIN. & MAX. DEPTHS AS DEFINED BY NORTHERN RIVERS LOCAL GOVERNMENT ARE EXCEEDED DURING CONSTRUCTION.
10. ALL TRENCH BACK FILL MATERIAL UNDER ROAD PAVEMENT SHALL BE CBR 15 OR APPROVED EQUIVALENT.
11. THE BEDDING MATERIALS USED IN TRENCHS SHALL FOLLOW THE GUIDELINES OF AS2566.2, AND SHOULD BE ONE OF THE FOLLOWING:
    - 11.1. SAND OR SOIL, FREE FROM ROCKS GREATER THAN 15MM IN SIZE.
    - 11.2. CRUSHED ROCK, GRAVEL, OR GRADED MATERIAL OF EVEN GRADING WITH A MAXIMUM SIZE OF 15MM.
    - 11.3. EXCAVATED MATERIAL FREE FROM ROCKS OR ORGANIC MATERIAL OR VEGETABLE MATTER THAT WILL AFFECT EMBEDMENT MATERIAL PERFORMANCE.
    - 11.4. CONTROLLED LOW STRENGTH MATERIALS.
12. SEWER HOUSE CONNECTIONS SHALL BE A MAXIMUM DEPTH OF 1.5m MEASURED FROM THE DESIGN SURFACE AT A POINT 1m INSIDE THE ALLOTMENT.
13. THE CONTRACTOR SHALL CHECK ALL HOUSE CONNECTIONS PRIOR TO CONSTRUCTION AND SEEK INSTRUCTIONS FROM THE SUPERINTENDENT FOR ANY HOUSE CONNECTIONS OUTSIDE THE ALLOWABLE DEPTH.
14. THE CONTRACTOR SHALL BE RESPONSIBLE FOR RECTIFICATION OF HOUSE CONNECTIONS DEEPER THAN 1.5m IF THE SUPERINTENDENT HAD NOT BEEN CONSULTED PRIOR TO CONSTRUCTION.

DRAINAGE

1. ALL DRAINAGE STRUCTURES ARE TO BE INSTALLED IN ACCORDANCE WITH THE FOLLOWING DOCUMENTS:
   - NORTHERN RIVERS LOCAL GOVERNMENT DRAWINGS AND SPECIFICATIONS;
   - ANY MANUFACTURER'S STANDARD DRAWINGS AND SPECIFICATIONS.
2. ALL CONSTRUCTION MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE RELEVANT SPECIFICATION FOR THE WORKS TOGETHER WITH THE REQUIREMENTS OF ALL THE RELEVANT CODES OF PRACTICE REFERRED TO THEREIN AND THE REQUIREMENTS OF THE STATUTORY AUTHORITIES WHERE APPLICABLE.
3. STRUCTURES HAVE BEEN DESIGNED FOR OPERATIONAL LOADS ONLY. THE CONTRACTOR IS RESPONSIBLE FOR THE ASSESSMENT OF CONSTRUCTION LOADS AND PROVISIONS OF ANY TEMPORARY BRACING, PROPPING ETC. REQUIRED DURING CONSTRUCTION. STRUCTURES SHALL BE MAINTAINED IN A STABLE CONDITION AND NO PART SHALL BE OVERSTRESSED.
4. PRECAST REINFORCEMENT CONCRETE PIPES ARE TO BE MANUFACTURED IN ACCORDANCE WITH AS 4058 AND AS 1992.
5. ALL STORMWATER PIPES SHALL BE CLASS '3' RCP. U.N.O.
6. ALL PIPES UP TO AND INCLUDING Ø600 ARE TO BE RUBBER RING JOINTED. ALL PIPES ABOVE Ø600 ARE TO BE FLUSH JOINTED U.N.O.
7. HEADWALL END STRUCTURES TO BE TYPE A, CAST IN SITU CONCRETE WITH CONCRETE APRONS (INCLUDING CUT OFF WALLS) U.N.O. REFER TO NORTHERN RIVERS LOCAL GOVERNMENT STANDARD DRAWINGS FOR DETAILS.
8. PRECAST END STRUCTURES MAY BE USED ON CULVERTS LESS THAN OR EQUAL TO 15° SKEW, SUBJECT TO THE APPROVAL OF THE SUPERINTENDENT. PRECAST END STRUCTURES SHALL BE CONSTRUCTED WITH A REINFORCED CONCRETE CUT OFF WALL AS DETAILED FOR TYPE 3 APRONS BY NORTHERN RIVERS LOCAL GOVERNMENT.
9. EXISTING STORMWATER DRAINAGE PIPES AND MANHOLES WITHIN THE LIMIT OF WORK SHALL BE PROTECTED, REMOVED OR MODIFIED AS SPECIFIED.
10. WHERE A CONNECTION IS MADE TO AN EXISTING DRAINAGE PIPE OR PIT, THE LEVEL OF THAT ELEMENT MUST BE SURVEYED PRIOR TO CONSTRUCTION. THE SURVEYED LEVELS SHALL BE PROVIDED TO THE SITE SUPERINTENDENT TO CONFIRM THE CONNECTION AND LEVELS PRIOR TO CONSTRUCTION.
11. BACKFILL AND BEDDING TO PIPE TO BE IN ACCORDANCE WITH NORTHERN RIVERS LOCAL GOVERNMENT STANDARD DRAWINGS AND SPECIFICATIONS.
12. UNSUITABLE FOUNDING MATERIAL FOR PIPES AND STRUCTURES SHALL BE REMOVED OR IMPROVED IN ACCORDANCE WITH NORTHERN RIVERS LOCAL GOVERNMENT SPECIFICATIONS.
13. ALL TRENCH BACK FILL MATERIAL UNDER THE PAVEMENT SHALL BE CBR 15 OR APPROVED EQUIVALENT.
14. STEEL GRATES AND FRAMES ARE TO BE FABRICATED FROM MILD STEEL AND HOT DIP GALVANISED. ALL GRATES ARE TO BE CLASS D U.N.O. AND BICYCLE SAFE IN ACCORDANCE WITH AS 3996 U.N.O.
15. GRATE SUPPORT TO BE CONSTRUCTED LEVEL TO ENSURE THAT THE GRATE DOES NOT ROCK AFTER INSTALLATION.
16. ALL LEVELS ARE APPROXIMATE ONLY AND ARE SUBJECT TO FULL DETAIL SURVEY OF THE EXISTING STRUCTURE.
17. THE THICKNESS OF THE RIP-RAP PROTECTION SHALL BE TWICE THE D50 STONE SIZE SPECIFIED ON THE DRAWINGS.
    - 17.1. THE STONE SHALL BE REASONABLY WELL GRADED THROUGHOUT THE RIP-RAP LAYER. STONE SIZE SHALL BE DEPENDENT ON THE D50 VALUE SPECIFIED ON THE DRAWINGS. D10 SHALL BE 0.5xD50 AND D90 SHALL BE 1.35xD50. STONES SMALLER THAN THE SPECIFIED D10 ARE NOT TO EXCEED 20% BY WEIGHT OF EACH LOAD.
    - 17.2. ROCK IS TO BE HARD, DENSE, DURABLE, RESISTANT TO WEATHERING AND ANGULAR IN SHAPE. IT SHALL BE FREE FROM OVERBURDEN, SPOIL SHALE AND ORGANIC MATTER. ROCK THAT IS LAMINATED, FRACTURED, POROUS OF OTHERWISE PHYSICALLY WEAK SHALL NOT BE USED.
    - 17.3. AS AN APPROXIMATE GUIDE TO STONE SHAPE: THE BREADTH OR THICKNESS OF A SINGLE STONE SHOULD NOT BE LESS THAN ONE-THIRD ITS LENGTH. ROUND MATERIAL CAN BE USED AS RIP-RAP, PROVIDED IT IS NOT PLACED ON SLOPES GREATER THAN 1:3.

WATER

1. NOTWITHSTANDING THE DETAILS SHOWN ON THE DRAWINGS, ALL WORKS SHALL BE CONSTRUCTED IN ACCORDANCE WITH NORTHERN RIVERS LOCAL GOVERNMENT STANDARD SPECIFICATIONS AND DRAWINGS.
2. ALL FITTINGS SHALL BE D.I.C.L. CLASS K9 RUBBER RING JOINTED SPIGOT AND SOCKET TO AS 2280-1986.
3. ANCHOR BLOCKS SHALL BE INSTALLED AT ALL BENDS, JUNCTIONS AND DEAD ENDS.
4. THE CONTRACTOR SHALL OBTAIN THE LOCATION OF ALL SERVICES AND PROTECT THESE SERVICES PRIOR TO WORKING IN THE VICINITY. ANY DAMAGE WILL BE REPAIRED AT THE CONTRACTOR'S EXPENSE.
5. OFFSET FROM BOUNDARY TO WATER MAIN 1.4m U.N.O.
6. PROVIDE WATER SERVICE TO ALL LOTS TO NORTHERN RIVERS LOCAL GOVERNMENT STANDARD DRAWINGS.
7. ALL TRENCH BACK FILL MATERIAL UNDER ROAD PAVEMENT SHALL BE CBR 15 OR APPROVED EQUIVALENT.
8. ANY WORKS ASSOCIATED WITH LIVE WATER CONNECTIONS MAY BE CARRIED OUT BY THE CONTRACTOR UNDER SUPERVISION BY NORTHERN RIVERS LOCAL GOVERNMENT. FEES & EXPENSES FOR THESE EXPENSES ARE THE RESPONSIBILITY OF THE CONTRACTOR.

SIGNAGE

1. FINAL SIGN LOCATIONS TO BE DETERMINED ON SITE BY THE SUPERINTENDENT.
2. ALL TRAFFIC SIGNS TO BE SIZE 'A' U.N.O.
3. FOR GUIDE POST INSTALLATION AND DETAILS, REFER RMS SPECIFICATIONS.
4. FOR TRAFFIC SIGN SUPPORT DETAILS, REFER RMS STANDARD DRAWINGS.
5. ALL SIGN MATERIAL TO BE CLASS 1.

ALL SIGNAGE, LINE MARKING & RRPMs ARE TO BE PREPARED IN ACCORDANCE WITH RMS SPECIFICATIONS.

CONCRETE

1. COMPLY WITH AS 3600.
2. DESIGN AND CONSTRUCT FORMWORK IN ACCORDANCE WITH AS 3610.
3. PROVIDE QUALITY OF FINISHES OF FORMED SURFACES IN ACCORDANCE WITH AS 3610 AND AS FOLLOWS U.N.O. ON DRAWINGS:
   - EXPOSED SURFACES - CLASS 3;
   - CONCEALED SURFACES - CLASS 4;
   - IN CONTACT WITH GROUND - CLASS 5.
4. THE LISTED SIZES OF CONCRETE ELEMENTS DO NOT INCLUDE THICKNESS OF APPLIED FINISHES. PROVIDE CHAMFERS, FILLETS, REGLETS AND DRIP GROOVES AS SHOWN ON THE STRUCTURAL DRAWINGS.
5. DO NOT MAKE ANY PENETRATIONS OR CHASES OR EMBED ANY ITEMS OTHER THAN THOSE SHOWN IN THE STRUCTURAL DRAWINGS WITHOUT APPROVAL OF THE ENGINEER.
6. FORM CONSTRUCTION JOINTS ONLY WHERE APPROVED BY THE ENGINEER.
7. REINFORCEMENT SYMBOLS:
   - "S" DENOTES GRADE 250S HOT ROLLED DEFORMED BAR TO AS 1302;
   - "Y" DENOTES GRADE 400Y HOT ROLLED DEFORMED BAR TO AS 1302;
   - "R" DENOTES GRADE 250R HOT ROLLED PLAIN BAR TO AS 1303;
   - "W" DENOTES HARD-DRAWN PLAIN WIRE TO AS 1303;
   - "RF" & "L" DENOTES HARD DRAWN RIBBED WIRE FABRIC TO AS 1304;
   - "N" DENOTES GRADE 500N HOT ROLLED DEFORMED BAR TO AS 1302.

   THE NUMBER FOLLOWING THE BAR SYMBOL IS THE BAR DIAMETER IN mm.
8. PROVIDE COVER TO REINFORCEMENT AS FOLLOWS:

ELEMENT	COVER
PAVEMENTS	40mm TOP
CONCRETE IN CONTACT WITH GROUND	65mm

9. SUPPORT REINFORCEMENT IN ITS CORRECT POSITION DURING CONCRETING BY APPROVED BAR CHAIRS, SPACERS OR SUPPORT BARS SUITABLE FOR THE EXPOSURE CONDITIONS.
10. LAP BAR REINFORCEMENT AS FOLLOWS U.N.O. ON DRAWINGS:
    - N12 550mm
    - N16 750mm
    - N20 950mm
    - N24 1100mm
    - N28 1300mm
    - N32 1500mm
    - N36 1700mm
    - N42 1900mm
11. BARS WITH MORE THAN 300mm OF CONCRETE UNDER THEM SHALL HAVE LAPS 1.25 TIMES THESE LENGTHS.
12. LAP MESH REINFORCEMENT BY ONE COMPLETE MESH.
13. DO NOT WELD OR SITE BEND REINFORCEMENT UNLESS SHOWN IN THE DRAWINGS OR OTHERWISE SPECIFIED BY THE ENGINEER.
14. REINFORCEMENT IS REPRESENTED DIAGRAMMATICALLY AND IS NOT NECESSARILY SHOWN IN TRUE PROJECTION.
15. PROVIDE PREMIX CONCRETE FOR EACH ELEMENT AS FOLLOWS:

ELEMENT	GRADE	MAX AG	SLUMP
PAVEMENTS	N32	20mm	80mm
MASS CONCRETE	N20	20mm	80mm

16. SAMPLE TEST AND ASSESS CONCRETE COMPLIANCE IN ACCORDANCE WITH PROJECT ASSESSMENT OF STRENGTH GRADE TO SECTION 20 OF AS 3600.
17. THE CONCRETE SHALL BE COMPACTED USING HIGH-FREQUENCY VIBRATORS.
18. ALL SLABS SHALL BE PLACED AT THE SAME TIME AS BEAMS OF WHICH THEY FORM PART.
19. TRIM ALL PENETRATIONS LESS THAN 300mm WITH 2 N16 BARS EACH SIDE, EACH FACE AND DISPLACE REINFORCEMENT EACH SIDE.
20. CURING OF ALL CONCRETE SURFACES SHALL COMMENCE IMMEDIATELY AFTER SURFACES ARE FINISHED AS SPECIFIED AND SHALL CONTINUE FOR A MINIMUM OF 7 DAYS.
21. ADMIXTURES SHALL NOT BE USED WITHOUT THE WRITTEN APPROVAL OF THE ENGINEER.
22. CEMENT SHALL BE TYPE A NORMAL CLASS PORTLAND CEMENT U.N.O.
23. MAXIMUM 56 DAY SHRINKAGE STRAIN TO BE 65μ WHEN TESTED IN ACCORDANCE WITH AS 1012.

ABBREVIATIONS USED ON THE PLANS

SW	STORMWATER	B1	CONCRETE KERB AND CHANNEL
B2	BARRIER KERB	LBK	LAYBACK KERB
W	WATER	AC	ASPHALTIC CONCRETE
FH	FIRE HYDRANT	TOB	TOP OF BANK
SV	SLUICE VALVE	BOB	BOTTOM OF BANK
GV	GATE VALVE	CL	CENTRELINE
EOS	EDGE OF SEAL	NRLG	NORTHEN RIVERS LOCAL GOVERNMENT
S	SITE	GKIP	GRATED KERB INLET PIT
APZ	ASSET PROTECTION ZONE	SEPP	STATE ENVIRONMENTAL PLANNING POLICY

LEGEND

GENERAL

SITE BOUNDARY
EXTERNAL BOUNDARIES
ROAD CENTERLINE
BATTERS
EXISTING CONTOURS (0.5m INT.)
DESIGN CONTOURS (0.5m INT.)
KERB & GUTTER
ROAD
PROPOSED RETAINING WALL
PROPOSED GUARDRAIL
EXISTING TREE (INDICATIVE)
EXISTING TREE (FROM SURVEY)
EXISTING EXTENT OF VEGETATION
SEPP 14 WETLAND
APZ 10m
APZ 30m
APZ 50m
20m RIPARIAN BUFFER ZONE
EXISTING DWELLING
PROPOSED CLUBHOUSE LOCATION

STORMWATER

EXISTING SW AND MANHOLE
PROPOSED SW AND MANHOLE
V GRATED PIT
PROPOSED SUBSOIL DRAIN AND FLUSH POINT
PROPOSED CULVERT
SWALE DRAIN EXISTING
SWALE DRAIN PROPOSED
MINOR OVERLAND FLOW
MAJOR OVERLAND FLOW
PRECAST CONCRETE HEADWALL
PROPOSED RIP RAP OVERFLOW WEIR
SCOUR OUTLET PROTECTION WITH ENERGY DISSIPATING ROCKS
ALL WEATHER GRAVEL ACCESS
EXISTING DETENTION AREA
STORMWATER CATCHMENT BOUNDARY
PROPOSED BIORETENTION BASIN
PROPOSED BIORETENTION SWALE

UTILITIES & SEWER

EXISTING SEWER PIPE & MANHOLE
PROPOSED SEWER PIPE & MANHOLE
PROPOSED RISING MAIN & SEWER PUMP STATION
OVERHEAD POWER AND POLE
TELSTRA AND COMMUNICATION PIT

WATER

EXISTING WATER PIPE
EXISTING EASEMENT
EXISTING STOP VALVE
PROPOSED WATER PIPE
PROPOSED RECYCLED WATER PIPE

EROSION AND SEDIMENT

SEDIMENT/SILT FENCE
CHECK DAM
FILTER BAG
VEHICLE SHAKEDOWN

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
A	75% ISSUE FOR CLIENT REVIEW	15/06/16	SA	SA	DH	AW
B	AMENDED ROAD WIDTH & SITE NUMBERS	20/06/16	SA	SA	DH	AW
C	ISSUE FOR CLIENT REVIEW	24/06/16	SA	SA	DH	AW
D	ISSUED FOR DEVELOPMENT APPLICATION	16/09/16	SA	SA	AW	AW
E	AMENDED TO COUNCIL COMMENTS	24/02/17	SA	SA	AW	AW

SCALES:
DO NOT SCALE FROM DRAWING

DRAWN BY: S.ADAM
DESIGN BY: S.ADAM
APPROVED BY:
DATE:
THIS DRAWING MUST NOT BE USED FOR CONSTRUCTION UNLESS SIGNED AS APPROVED

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C/- PLANNERS NORTH
3/ 69 CENTENNIAL CIRCUIT
BYRON BAY, NSW, 4281

LOCAL GOVERNMENT AUTHORITY:
BALLINA SHIRE COUNCIL

PROJECT:
67 SKENNARS HEAD ROAD

DRAWING TITLE:
NOTES AND LEGEND

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	0002	E

CAD FILE: T:\J107 - 67 SKENNARS HEAD ROAD - DA\6 - CAD\J107-0002.DWG PLOTTED BY: STEPHENA PLOT DATE: 23/05/2018 2:03:01 PM

100mm AT ORIGINAL SIZE

HENDERSON DR

SKENNARS HEAD RD

ASSUMED FLOWS
Q10 PIPE FLOW TO SITE 2.17m³/S.
Q10 OVERLAND FLOW TO SITE 2.42m³/S
Q100 PIPE FLOW TO SITE 2.29m³/S.
Q100 OVERLAND FLOW TO SITE 5.22m³/S

ILI 2.87

LO 3.16

ILI 0.58

ILO 2.93

N

ROAD RESERVE

LOT 9 DP 809951

EXISTING FLOW PATH IS A WATERWAY SUBJECT TO A CONTROLLED ACTIVITY PERMIT.

7m WIDE RIGHT OF CARRIAGEWAY WITHIN THE SITE BOUNDARY TO BE EXTINGUISHED

7m WIDE PUBLIC RESERVE (PT 34 DP 846639. POSSIBLE UPGRADE REQUIRED FOR SECONDARY EGRESS SUITABILITY

7m WIDE BATTLEAXE FOR LOT 38 DP830277.

EXISTING POINT OF STORMWATER DISCHARGE

LOT 239 DP 1201225

LOT 2 DP 251003

EXISTING 3.66m WIDE WATER MAIN EASEMENT THROUGH SITE TO BE RELOCATED

ILO 2.05
⌀300MM

EXISTING GRAVEL PAVEMENT

ILI 1.64 ⌀ 500MM

ILO 1.65 ⌀ 500MM

ILI 1.44 ⌀ 500MM

ILI 1.23 ⌀ 500MM

LOT 10 DP 809951

LOT 11 DP 584379

LOT 240 DP 1201225

LOT 38 DP 830277

443

REFER TO LEGEND ON DRAWING J109-0002

WARNING

BEWARE OF UNDERGROUND SERVICES

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LOCATION OF ALL BOUNDARIES LINES AND FEATURES BASED OF AERIAL MAPPING AND SITE INSPECTION AND ARE INDICATIVE ONLY

WORKS AS EXECUTED

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
A	75% ISSUE FOR CLIENT REVIEW	15/06/16	SA	SA	DH	AW
B	AMENDED ROAD WIDTH & SITE NUMBERS	20/06/16	SA	SA	DH	AW
C	ISSUE FOR CLIENT REVIEW	24/06/16	SA	SA	DH	AW
D	ISSUED FOR DEVELOPMENT APPLICATION	16/09/16	SA	SA	AW	AW
E	AMENDED TO COUNCIL COMMENTS	24/02/17	SA	SA	AW	AW
F	LOT LAYOUT AMENDED TO COUNCIL COMMENTS	23/05/18	SA	SA	AW	AW

SCALES:

0 10 20 40 60

Full Size 1:1000 ; Half Size 1:2000
Scale (m)

DO NOT SCALE FROM DRAWING

DRAWN BY: S.ADAM

DESIGN BY: S.ADAM

APPROVED BY:

DATE:

THIS DRAWING MUST NOT BE USED FOR CONSTRUCTION UNLESS SIGNED AS APPROVED

PLANIT ENGINEERING
SUITE 9A, 80-84 BALLINA STREET
PO BOX 161
LENNOX HEAD NSW 2478

TELEPHONE: 02 6687 4666
ABN: 99 613 049 568
EMAIL: admin@planitengineering.com.au

CLIENT:
LIVING GEMS
C/- PLANNERS NORTH
3/ 69 CENTENNIAL CIRCUIT
BYRON BAY, NSW, 4281

LOCAL GOVERNMENT AUTHORITY:
BALLINA SHIRE COUNCIL

PROJECT:
67 SKENNARS HEAD ROAD

DRAWING TITLE:
EXISTING CONDITIONS LAYOUT PLAN

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	0003	F

CAD FILE: T:\J107 - 67 SKENNARS HEAD ROAD - DA\6 - CAD\J107-0003.DWG PLOTTED BY: STEPHENA PLOT DATE: 23/05/2018 2:03:19 PM

100mm AT ORIGINAL SIZE

HENDERSON DR

SKENNARS HEAD RD

DRIVEWAY TO BE REMOVED, MEDIAN SEMI MOUNTABLE KERB AND ASPHALT FOOTPATH TO BE REINSTATED

EXISTING DWELLINGS TO BE USED AS SALES OFFICE/ SITE OFFICE TO BE DEMOLISHED ON CONSTRUCTION OF ROAD 2.

INDICATIVE TREES REQUIRED FOR REMOVAL. REFER TO ECOLOGIST REPORT FOR FURTHER DETAILS.

EXISTING ELECTRICAL POWER POLE AND LINE TO BE RELOCATED OUTSIDE OF THE PROPOSED DRIVEWAY ENVELOPE

EXISTING FENCE, VEGETATION FROM FENCE TO EXTENT OF VEGETATION AND EXISTING TELSTRA TO BE REMOVED AND RELOCATED (PENDING SERVICE LOCATION & APPROVALS).

OVERHEAD POWER TO BE REMOVED

EXISTING WATER MAIN TO BE DUG UP AND REMOVED FROM SITE. EXISTING EASEMENT TO BE EXTINGUISHED AND WATERMAIN RELOCATED

ROAD RESERVE

LOT 9 DP 809951

LOT 10 DP 809951

LOT 11 DP 584379

LOT 239 DP 1201225

LOT 240 DP 1201225

LOT 2 DP 251003

LOT 38 DP 830277

444

ILO 2.93

ILO 3.16

ILO 2.58

ILO 2.05 ⌀300MM

ILI 1.64 ⌀ 500MM

ILO 1.65 ⌀ 500MM

ILI 1.44 ⌀ 500MM

ILI 1.23 ⌀ 500MM

N

REFER TO LEGEND ON DRAWING J109-0002

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PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
B	AMENDED ROAD WIDTH & SITE NUMBERS	20/06/16	SA	SA	DH	AW
C	ISSUE FOR CLIENT REVIEW	24/06/16	SA	SA	DH	AW
D	AMENDED TO REVISED SITE LAYOUT	12/08/16	SA	SA	AW	AW
E	ISSUED FOR DEVELOPMENT APPLICATION	16/09/16	SA	SA	AW	AW
F	AMENDED TO COUNCIL COMMENTS	24/02/17	SA	SA	AW	AW
G	BASIN VOLUMES INCREASED	14/06/17	SA	SA	AW	AW
H	LOT LAYOUT AMENDED TO COUNCIL COMMENTS	23/05/18	SA	SA	AW	AW

SCALES:

0 10 20 40 60

Full Size 1:1000 ; Half Size 1:2000
Scale (m)

DO NOT SCALE FROM DRAWING

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DESIGN BY: S.ADAM
APPROVED BY:
DATE:

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LIVING GEMS
C/- PLANNERS NORTH
3/ 69 CENTENNIAL CIRCUIT
BYRON BAY, NSW, 4281

LOCAL GOVERNMENT AUTHORITY:
BALLINA SHIRE COUNCIL

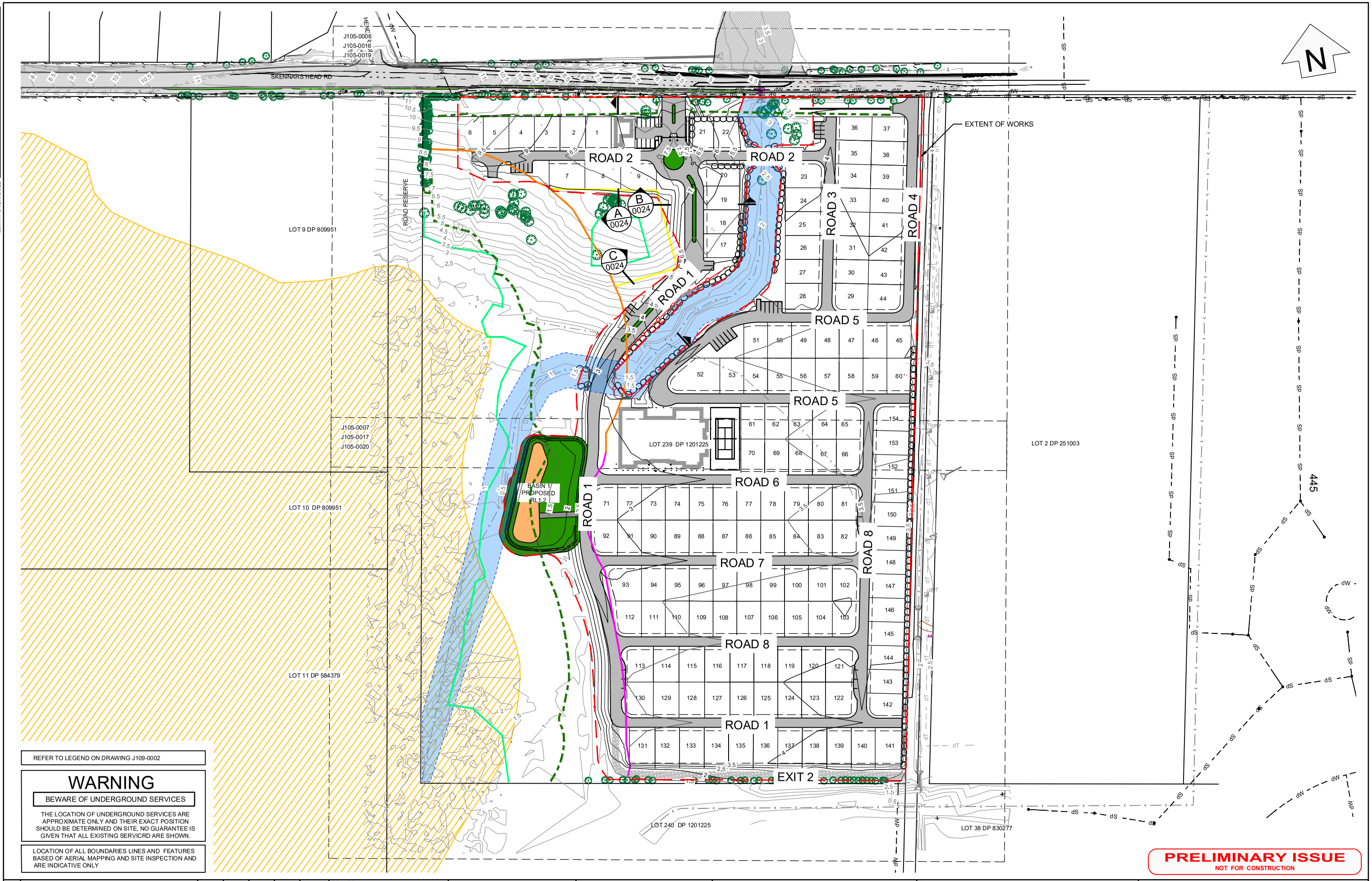
PROJECT:
67 SKENNARS HEAD ROAD

DRAWING TITLE:
DEMOLITION/ CLEARING LAYOUT PLAN

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	0004	H

CAD FILE: T:\J107 - 67 SKENNARS HEAD ROAD - DA\6 - CAD\J107-0004.DWG PLOTTED BY: STEPHENA PLOT DATE: 23/05/2018 2:03:39 PM

100mm AT ORIGINAL SIZE



REFER TO LEGEND ON DRAWING J109-0002

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NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
F	AMENDED TO COUNCIL COMMENTS	24/02/17	SA	SA	AW	AW
G	BASIN CAPACITY INCREASED	14/06/17	SA	SA	AW	AW
H	ENTRANCE AMENDED & LOT LAYOUT UPDATE	14/07/17	SA	SA	AW	AW
I	INTERNAL CHECK	21/08/17	SA	SA	AW	AW
J	SITE ENTRANCE RELOCATED	22/11/17	SA	SA	AW	AW
K	ENTRY LANES SHOWN	06/12/17	SA	SA	AW	AW
L	LOT LAYOUT AMENDED TO COUNCIL COMMENTS	23/05/18	SA	SA	AW	AW

SCALES:

0 10 20 40 60
Full Size 1:1000 ; Half Size 1:2000
Scale (m)

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3/ 69 CENTENNIAL CIRCUIT
BYRON BAY, NSW, 4281

LOCAL GOVERNMENT AUTHORITY:
BALLINA SHIRE COUNCIL

PROJECT:
67 SKENNARS HEAD ROAD

DRAWING TITLE:
OVERALL LAYOUT PLAN

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	0005	L

CAD FILE: T:\J107 - 67 SKENNARS HEAD ROAD - DA\6 - CAD\J107-0005.DWG PLOTTED BY: STEPHENA PLOT DATE: 23/05/2018 2:04:06 PM

100mm AT ORIGINAL SIZE

PARKING FOR SENIORS LIVING AT ENTRANCE.

ENTRANCE TO SITE COMPLIES WITH AS2890.2 FOR A MEDIUM RIGID VEHICLE ENTRANCE TO SITE. FOR DETAILS OF ENTRANCE AND WORKS ON SKENNARS HEAD ROAD REFER TO TRAFFIC REPORT BY RYTENSKILD TRAFFIC GROUP

ALTERNATE GATED ACCESS TO SITE FOR EMERGENCY VEHICLES. VEHICLE CROSSOVER TO COMPLY WITH NRLG STANDARD DRAWING R05C

SAFETY BARRIER REQUIRED ADJACENT WATERWAYS IN ACCORDANCE WITH 'AUSTROADS PART 6: ROADSIDE DESIGN, SAFETY AND BARRIERS'

INDICATIVE LOCATION OF COUNTRY CLUB. FINAL LOCATION TO BE DETERMINED AT DETAILED DESIGN. MINIMUM FLOOR LEVEL TO BE 2.1m AHD

INDICATIVE LOCATION OF RETAINING WALLS TO BE DESIGNED BY STRUCTURAL ENGINEER. MAXIMUM HEIGHT OF THE RETAINING WALLS PROPOSED IS 2400mm. FINAL LEVELS LEVELS DEPENDENT ON DETAILED DESIGN.

ROAD 1 · ROAD 2 · ROAD 3 · ROAD 4 · ROAD 5

ROAD RESERVE

ILI 2.87 · ILO 3.16 · ILI 3.58 · ILO 2.93

LOT 239 DP 1201225

REFER TO LEGEND ON DRAWING J109-0002

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NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
B	AMENDED ROAD WIDTH & SITE NUMBERS	20/06/16	SA	SA	DH	AW
C	ISSUE FOR CLIENT REVIEW	24/06/16	SA	SA	DH	AW
D	ISSUED FOR DEVELOPMENT APPLICATION	16/09/16	SA	SA	AW	AW
E	AMENDED TO COUNCIL COMMENTS	24/02/17	SA	SA	AW	AW
F	BASIN CAPACITY INCREASED	14/06/17	SA	SA	AW	AW
G	ENTRANCE AMENDED AND LOT LAYOUT UPDATED	14/07/17	SA	SA	AW	AW
H	LOT LAYOUT AMENDED TO COUNCIL COMMENTS	23/05/18	SA	SA	AW	AW

SCALES:
0 5 10 20 30
Full Size 1:500 ; Half Size 1:1000
Scale (m)
DO NOT SCALE FROM DRAWING

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3/ 69 CENTENNIAL CIRCUIT
BYRON BAY, NSW, 4281

LOCAL GOVERNMENT AUTHORITY:
BALLINA SHIRE COUNCIL

PROJECT:
67 SKENNARS HEAD ROAD

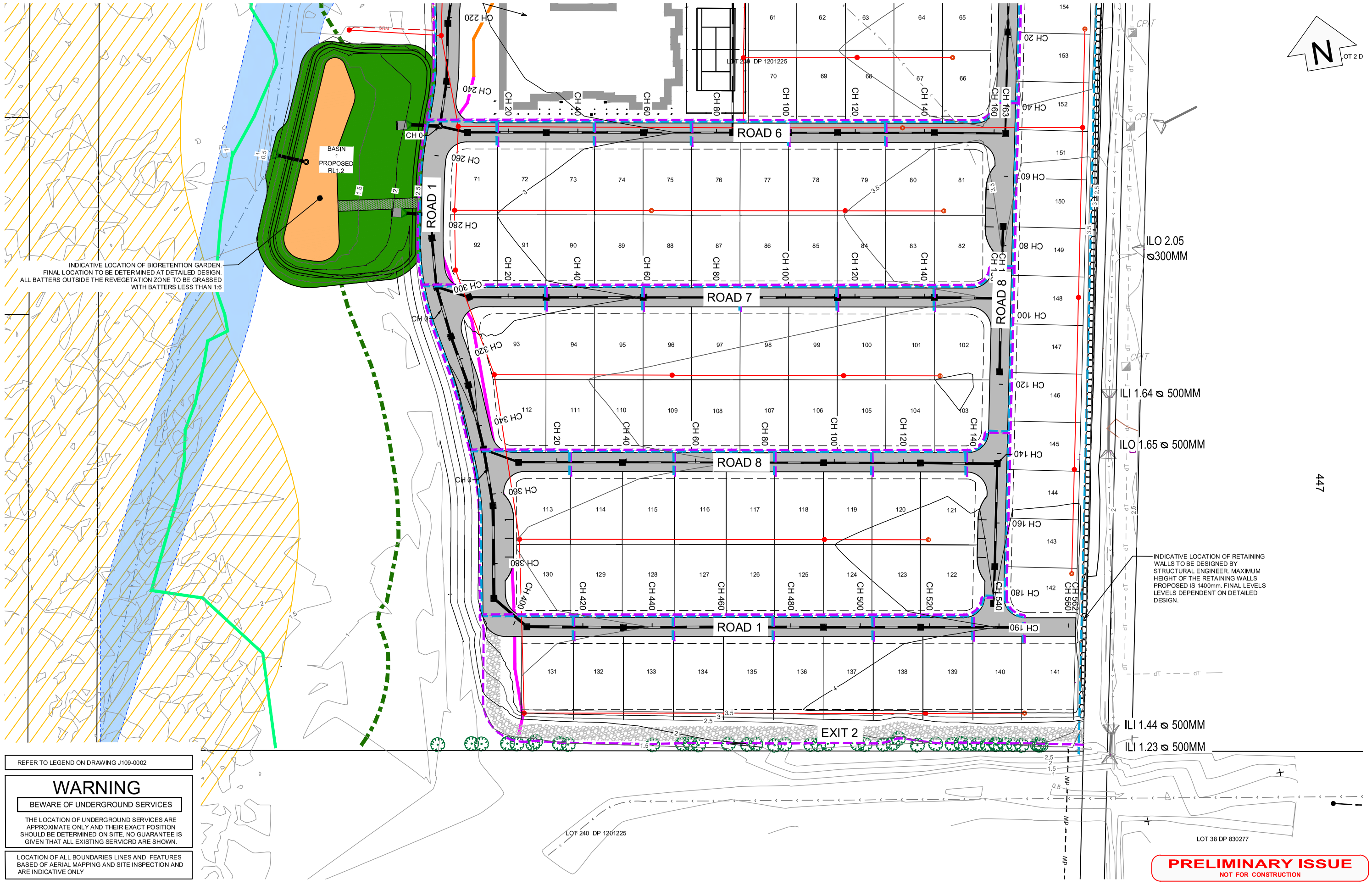
DRAWING TITLE:
ROADWORK LAYOUT PLAN
SHEET 1 OF 2

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	0006	H

CAD FILE: T:\J107 - 67 SKENNARS HEAD ROAD - DA\6 - CAD\J107-0006.DWG PLOTTED BY: STEPHENA PLOT DATE: 23/05/2018 2:04:51 PM

446

100mm AT ORIGINAL SIZE



447

REFER TO LEGEND ON DRAWING J109-0002

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NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
B	AMENDED ROAD WIDTH & SITE NUMBERS	20/06/16	SA	SA	DH	AW
C	ISSUE FOR CLIENT REVIEW	24/06/16	SA	SA	DH	AW
D	ISSUED FOR DEVELOPMENT APPLICATION	16/09/16	SA	SA	AW	AW
E	AMENDED TO COUNCIL COMMENTS	24/02/17	SA	SA	AW	AW
F	BASIN CAPACITY INCREASED	14/06/17	SA	SA	AW	AW
G	ENTRANCE AMENDED AND LOT LAYOUT UPDATED	14/07/17	SA	SA	AW	AW
H	LOT LAYOUT AMENDED TO COUNCIL COMMENTS	23/05/18	SA	SA	AW	AW

SCALES:
0 5 10 20 30
Full Size 1:500 ; Half Size 1:1000
Scale (m)
DO NOT SCALE FROM DRAWING

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BYRON BAY, NSW, 4281

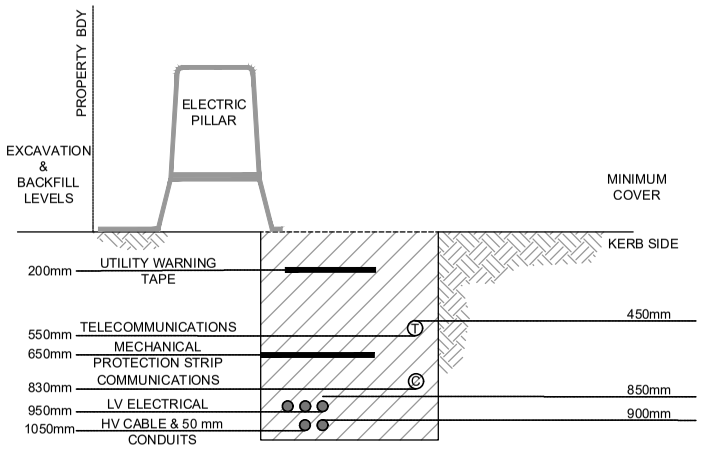
LOCAL GOVERNMENT AUTHORITY:
BALLINA SHIRE COUNCIL

PROJECT:
67 SKENNARS HEAD ROAD

DRAWING TITLE:
ROADWORK LAYOUT PLAN
SHEET 2 OF 2

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	0006	H

CAD FILE: T:\J107 - 67 SKENNARS HEAD ROAD - DA\6 - CAD\J107-0007.DWG PLOTTED BY: STEPHENA PLOT DATE: 23/05/2018 2:05:34 PM

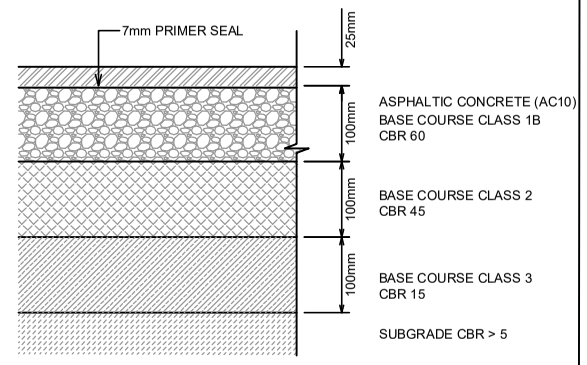


COMMUNICATIONS AND ELECTRICITY CROSS SECTION

SCALE: NTS

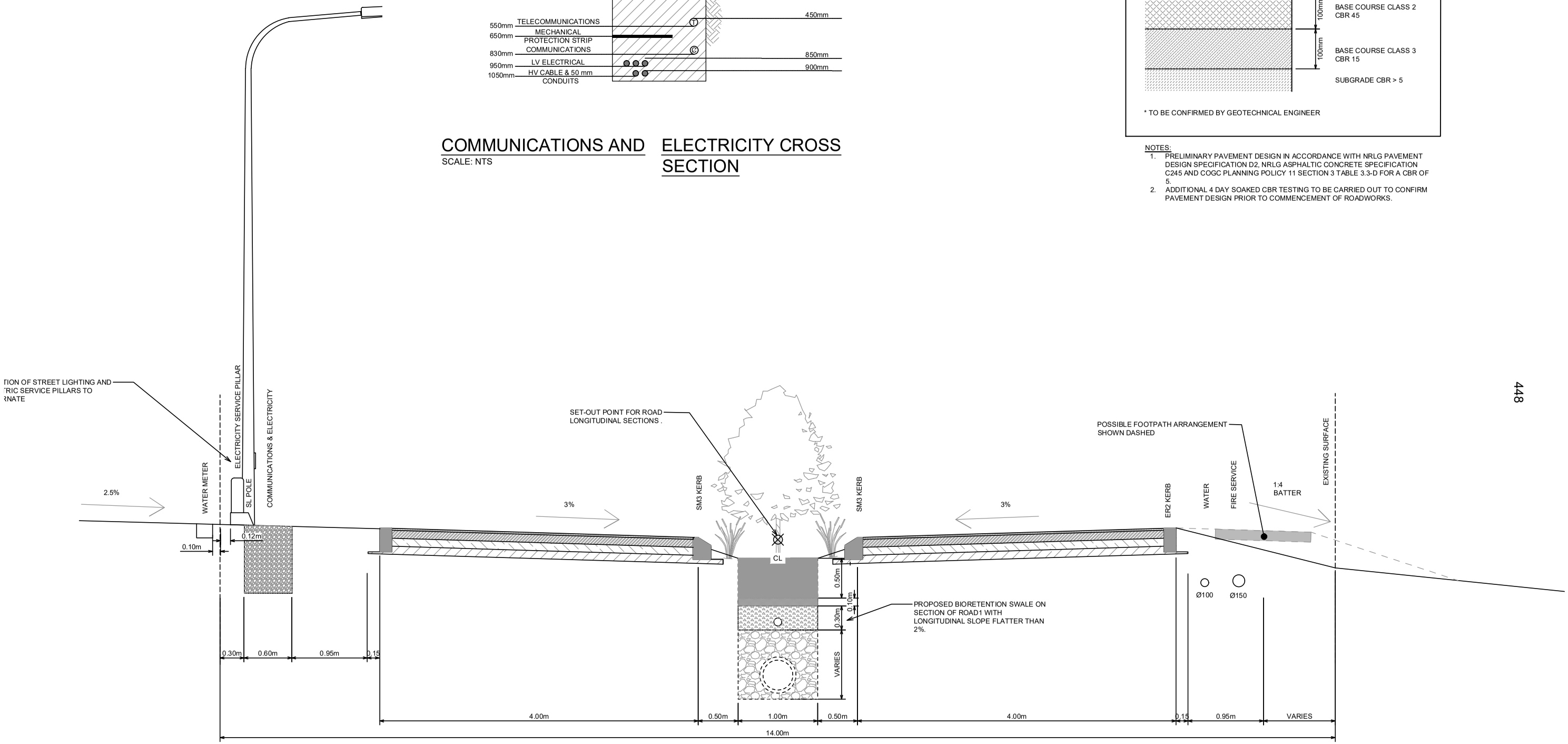
SKENNARS HEAD - PRELIM PAVEMENT SPECIFICATION

DESIGN SUBGRADE CBR = 5* | SCALE: N.T.S.



* TO BE CONFIRMED BY GEOTECHNICAL ENGINEER

NOTES:
1. PRELIMINARY PAVEMENT DESIGN IN ACCORDANCE WITH NRLG PAVEMENT DESIGN SPECIFICATION D2, NRLG ASPHALTIC CONCRETE SPECIFICATION C245 AND COGC PLANNING POLICY 11 SECTION 3 TABLE 3.3-D FOR A CBR OF 5.
2. ADDITIONAL 4 DAY SOAKED CBR TESTING TO BE CARRIED OUT TO CONFIRM PAVEMENT DESIGN PRIOR TO COMMENCEMENT OF ROADWORKS.



448

ROAD 1 - TYPICAL CROSS SECTION CH00-CH120m WITH INTERNAL BIORETENTION

SCALE: 1:25 @ A1, 1:50 @ A3

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
A	75% ISSUE FOR CLIENT REVIEW	15/06/16	SA	SA	DH	AW
B	AMENDED ROAD WIDTH & SITE NUMBERS	20/06/16	SA	SA	DH	AW
C	ISSUE FOR CLIENT REVIEW	24/06/16	SA	SA	DH	AW
D	ISSUED FOR DEVELOPMENT APPLICATION	16/09/16	SA	SA	AW	AW
E	AMENDED TO COUNCIL COMMENTS	24/02/17	SA	SA	AW	AW
F	LOT LAYOUT AMENDED TO COUNCIL COMMENTS	10/04/18	SA	SA	AW	AW

SCALES:
0 0.25 0.5 1.0 1.5
Full Size 1:25 ; Half Size 1:50
Scale (m)
DO NOT SCALE FROM DRAWING

DRAWN BY: S.ADAM
DESIGN BY: S.ADAM
APPROVED BY:
DATE:
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3/ 69 CENTENNIAL CIRCUIT
BYRON BAY, NSW, 4281

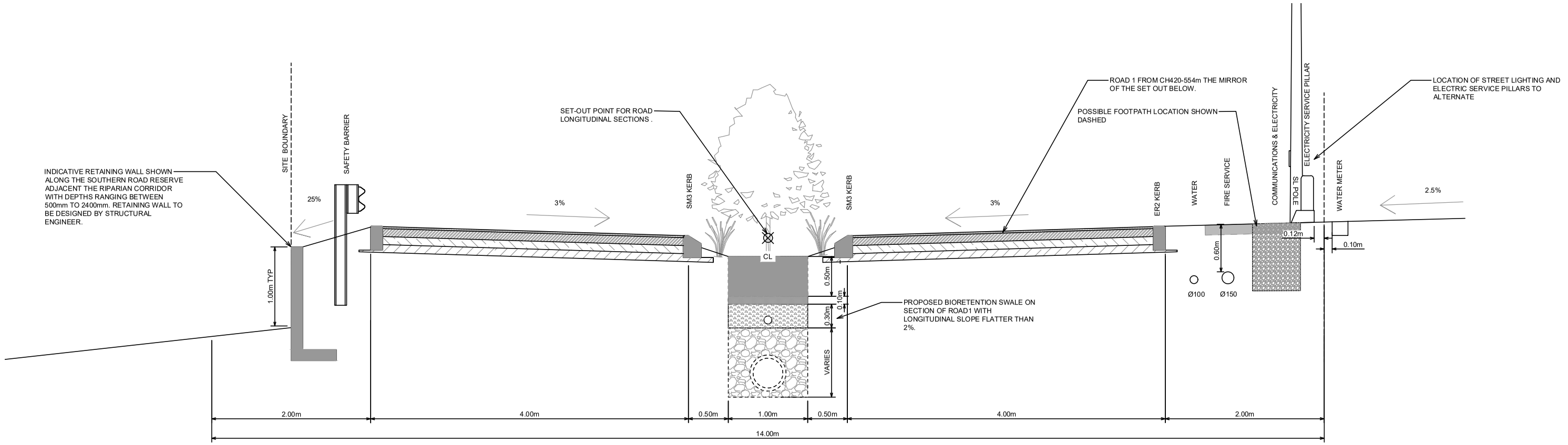
LOCAL GOVERNMENT AUTHORITY:
BALLINA SHIRE COUNCIL

PROJECT:
67 SKENNARS HEAD ROAD

DRAWING TITLE:
ROADWORKS TYPICAL CROSS SECTIONS
SHEET 1 OF 3

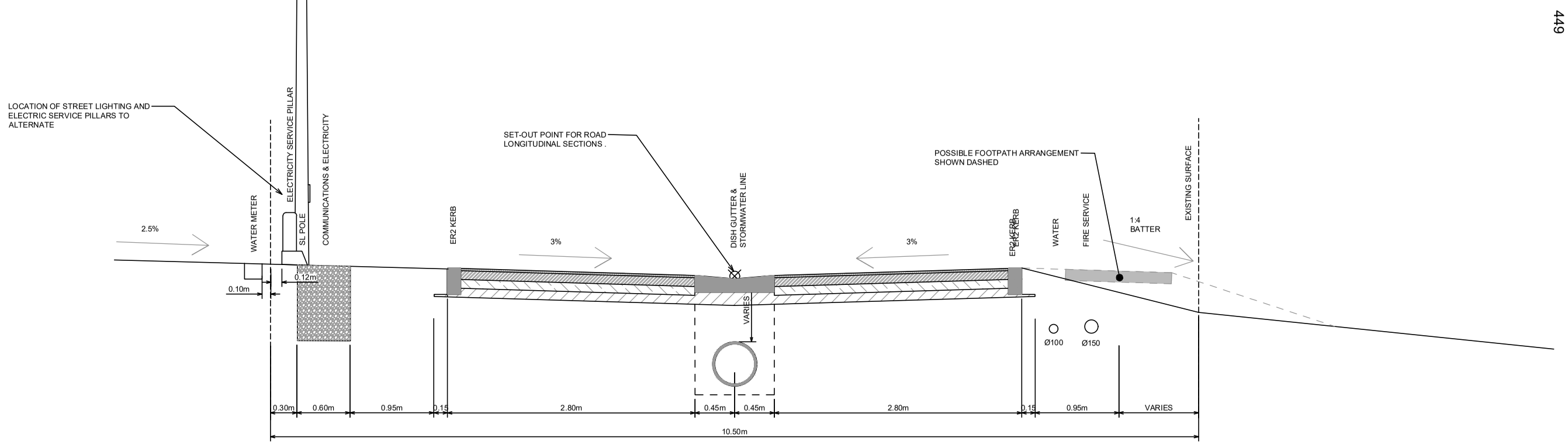
ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	0008	F

CAD FILE: T:\J107 - 67 SKENNARS HEAD ROAD - DA\6 - CAD\J107-0008.DWG PLOTTED BY: STEPHENA PLOT DATE: 23/05/2018 2:07:29 PM



ROAD 1 - TYPICAL CROSS SECTION CH120-CH160m WITH INTERNAL BIORETENTION

SCALE: 1:25 @ A1, 1:50 @ A3



ROAD 1 - TYPICAL CROSS SECTION CH160-CH390m

SCALE: 1:25 @ A1, 1:50 @ A3

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
A	75% ISSUE FOR CLIENT REVIEW	15/06/16	SA	SA	DH	AW
B	AMENDED ROAD WIDTH & SITE NUMBERS	20/06/16	SA	SA	DH	AW
C	ISSUE FOR CLIENT REVIEW	24/06/16	SA	SA	DH	AW
D	ISSUED FOR DEVELOPMENT APPLICATION	16/09/16	SA	SA	AW	AW
E	AMENDED TO COUNCIL COMMENTS	24/02/17	SA	SA	AW	AW
F	LOT LAYOUT AMENDED TO COUNCIL COMMENTS	10/04/18	SA	SA	AW	AW

SCALES:
0 0.25 0.5 1.0 1.5
Full Size 1:25 ; Half Size 1:50
Scale (m)
DO NOT SCALE FROM DRAWING

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3/ 69 CENTENNIAL CIRCUIT
BYRON BAY, NSW, 4281

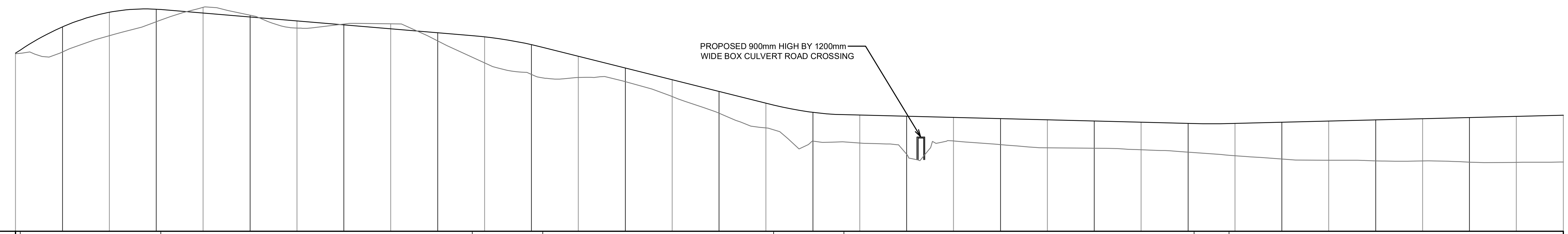
LOCAL GOVERNMENT AUTHORITY:
BALLINA SHIRE COUNCIL

PROJECT:
67 SKENNARS HEAD ROAD

DRAWING TITLE:
ROADWORK TYPICAL CROSS SECTIONS
SHEET 2 OF 3

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	0009	F

PROPOSED 900mm HIGH BY 1200mm WIDE BOX CULVERT ROAD CROSSING



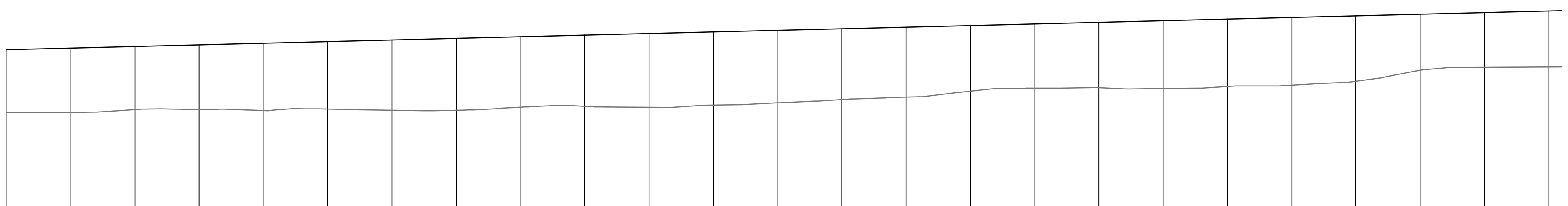
SCALE: 1:500H, 1:100V
DATUM: -2.00

VERTICAL GEOMETRY: 0.98 / 13.2% | 30.00 / 2.018 | 66.41 / -1.7% | 15.00 / 4.505 | 49.24 / -5.0% | 15.00 / 3.337 | 74.65 / -0.5% | 7.45 / 7.405 | 303.36 / 0.5%

HORIZONTAL GEOMETRY: L: 30.300 / 189° 23' 30" | L: 9.998 / 189° 23' 49" | L: 13.530 / 148° 31' 58" | L: 9.263 / R: 13.000 | L: 39.753 / 189° 21' 31" | L: 14.174 / R: 13.578 | L: 4.637 / 249° 28' 18" | L: 8.973 / R: 12.543 | L: 39.074 / 231° 35' 22" | L: 53.551 / R: 73.250 | L: 14.304 / 189° 42' 07" | L: 12.485 / R: 73.250 | L: 11.388 / 199° 28' 05" | L: 11.386 / R: 73.250 | L: 14.860 / 190° 33' 42" | L: 27.514 / R: 73.250 | L: 12.461 / 169° 02' 26" | L: 8.872 / R: 73.250

CHAINAGE	DESIGN LEVELS	CUT/FILL DEPTHS	EXISTING LEVELS
0	5.60	0.03	5.57
	6.72	1.07	6.72
20	7.35	1.00	6.35
	7.47	0.53	7.47
40	7.31	-0.25	7.56
	7.14	-0.08	7.14
60	6.98	0.31	6.67
	6.81	-0.03	6.81
80	6.64	-0.21	6.86
	6.47	0.35	6.47
100	6.30	1.11	5.19
	5.96	1.27	5.96
120	5.47	0.90	4.57
	4.97	0.58	4.97
140	4.47	0.72	3.75
	3.97	0.93	3.97
160	3.47	1.06	2.41
	3.07	1.22	3.07
180	2.96	1.19	1.77
	2.91	1.62	2.91
200	2.86	1.01	1.85
	2.81	1.11	2.81
220	2.76	1.19	1.56
	2.71	1.16	2.71
240	2.65	1.18	1.48
	2.60	1.23	2.60
260	2.60	1.38	1.23
	2.65	1.57	2.65
280	2.70	1.67	1.03
	2.75	1.75	2.75
300	2.80	1.80	1.00
	2.85	1.90	2.85
320	2.90	1.96	0.94
330	2.95	2.00	0.95

ROAD01 LONG SECTION CHAINAGE 0-330



SCALE: 1:500H, 1:100V
DATUM: -2.00

VERTICAL GEOMETRY: 303.36 / 0.5%

HORIZONTAL GEOMETRY: L: 2.4 / 169° 02' 26" / R: 73.250 | L: 18.872 | L: 18.649 / 175° 58' 48" | L: 16.376 / R: 73.250 | L: 22.822 / 188° 47' 22" | L: 14.042 / R: 9.000 | L: 158.674 / 099° 23' 52"

CHAINAGE	DESIGN LEVELS	CUT/FILL DEPTHS	EXISTING LEVELS
320	2.90	1.96	0.94
	2.95	2.00	2.95
340	3.00	1.97	1.04
	3.05	2.02	3.05
360	3.10	2.10	1.01
	3.15	2.10	3.15
380	3.20	2.18	1.02
	3.25	2.24	3.25
400	3.30	2.19	1.11
	3.35	2.21	3.35
420	3.40	2.29	1.11
	3.45	2.28	3.45
440	3.50	2.26	1.25
	3.55	2.21	3.55
460	3.60	2.18	1.43
	3.65	2.04	3.65
480	3.70	2.00	1.70
	3.75	2.03	3.75
500	3.80	2.11	1.70
	3.85	2.09	3.85
520	3.90	2.10	1.80
	3.95	2.03	3.95
540	4.00	1.74	2.26
	4.05	1.70	4.05
560	4.10	1.74	2.36
562			

ROAD01 LONG SECTION CHAINAGE 330-527

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
A	75% ISSUE FOR CLIENT REVIEW	15/06/16	SA	SA	DH	AW
B	AMENDED ROAD WIDTH & SITE NUMBERS	20/06/16	SA	SA	DH	AW
C	ISSUE FOR CLIENT REVIEW	24/06/16	SA	SA	DH	AW
D	ISSUED FOR DEVELOPMENT APPLICATION	16/09/16	SA	SA	AW	AW
E	AMENDED TO COUNCIL COMMENTS	24/02/17	SA	SA	AW	AW
F	ENTRANCE AMENDED AND LOT LAYOUT UPDATED	14/07/17	SA	SA	AW	AW
G	LOT LAYOUT AMENDED TO COUNCIL COMMENTS	23/05/18	SA	SA	AW	AW

SCALES:
0 5 10 20 30
Full Size 1:500 ; Half Size 1:1000
Scale (m)
0 1 2 4 6
Full Size 1:100 ; Half Size 1:200
Scale (m)
DO NOT SCALE FROM DRAWING

DRAWN BY: S.ADAM
DESIGN BY: S.ADAM
APPROVED BY:
DATE:
THIS DRAWING MUST NOT BE USED FOR CONSTRUCTION UNLESS SIGNED AS APPROVED

PLANIT ENGINEERING
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PO BOX 161
LENNOX HEAD NSW 2478
TELEPHONE: 02 6687 4666
ABN: 99 613 049 568
EMAIL: admin@planitengineering.com.au

CLIENT:
LIVING GEMS
C/- PLANNERS NORTH
3/ 69 CENTENNIAL CIRCUIT
BYRON BAY, NSW, 4281

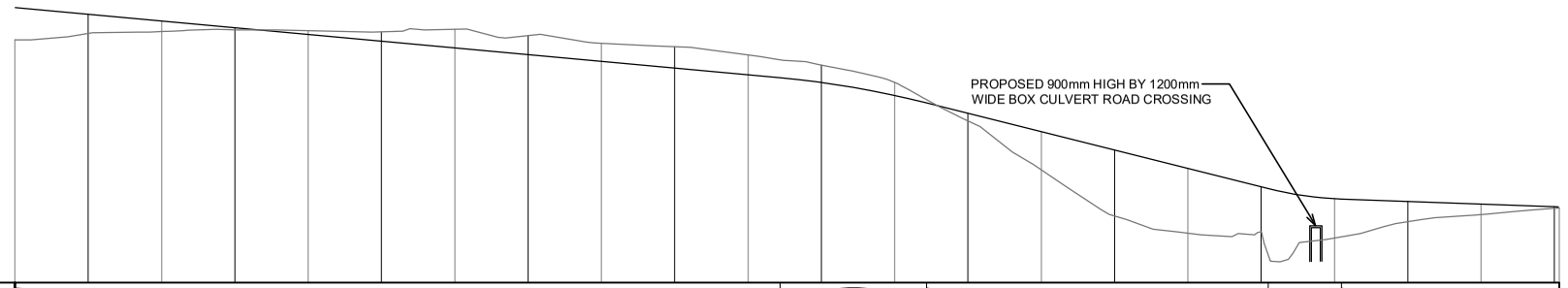
LOCAL GOVERNMENT AUTHORITY:
BALLINA SHIRE COUNCIL

PROJECT:
67 SKENNARS HEAD ROAD

DRAWING TITLE:
ROADWORKS LONG SECTIONS
SHEET 1 0F 5

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	0010	G

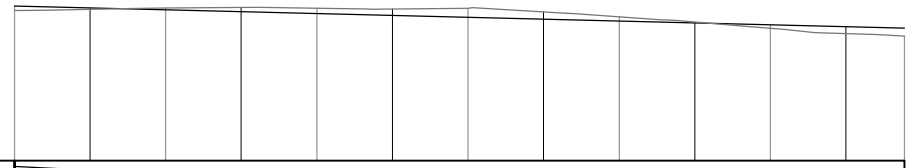
100mm AT ORIGINAL SIZE



SCALE: 1:500H, 1:100V
DATUM: 2.00

VERTICAL GEOMETRY	104.33 -1.8%										20.00 6.293		46.58 -5.0%				10.00 2.322	29.58 -0.7%				
HORIZONTAL GEOMETRY	L: 16.802 099° 22' 06"	L: 6.380 R: 42.750	L: 5.888 R: 42.750	L: 72.678 099° 20' 52"							L: 15.945 R: 60.093	L: 0.327 R: 343.992	L: 11.224	L: 77.638 099° 23' 49"								
DESIGN LEVELS	9.32	9.14	8.95	8.77	8.59	8.40	8.22	8.04	7.85	7.67	7.46	7.11	6.62	6.12	5.62	5.12	4.61	4.29	4.22	4.15	4.08	
CUT/FILL DEPTHS	0.53	0.29	0.06	-0.10	-0.26	-0.51	-0.52	-0.50	-0.58	-0.55	-0.48	-0.35	0.20	1.04	1.80	1.77	1.22	1.07	0.55	0.29	0.05	
EXISTING LEVELS 8.62	9.32	8.85	8.95	8.87	8.59	8.91	8.22	8.53	7.85	8.22	7.46	7.46	6.62	5.08	5.62	3.35	4.61	3.22	4.22	3.86	4.08	
CHAINAGE 0		20		40		60		80		100		120		140		160		180		200		211

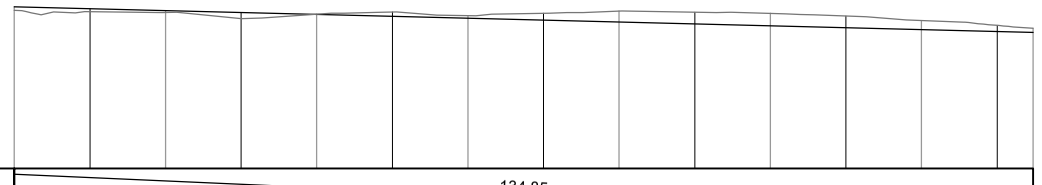
ROAD02 LONG SECTION



SCALE: 1:500H, 1:100V
DATUM: 0.00

VERTICAL GEOMETRY	117.74 -0.5%												
HORIZONTAL GEOMETRY													
DESIGN LEVELS 4.09	4.04	3.99	3.94	3.89	3.84	3.79	3.74	3.69	3.64	3.59	3.54		
CUT/FILL DEPTHS 0.12	0.04	-0.04	-0.12	-0.14	-0.17	-0.24	-0.20	-0.12	-0.03	0.09	0.18		
EXISTING LEVELS 3.97	4.04	4.03	3.94	4.03	3.84	4.03	3.74	3.80	3.64	3.50	3.54	3.29	
CHAINAGE 0		20		40		60		80		100		118	

ROAD03 LONG SECTION



SCALE: 1:500H, 1:100V
DATUM: 0.00

VERTICAL GEOMETRY	134.85 -0.5%														
HORIZONTAL GEOMETRY	L: 125.588 190° 44' 20"													L: 9.184 R: 6.003	
DESIGN LEVELS 4.27	4.22	4.17	4.12	4.07	4.02	3.97	3.92	3.87	3.82	3.77	3.72	3.67	3.62	3.60	
CUT/FILL DEPTHS 0.09	0.08	0.05	0.16	-0.01	-0.11	-0.07	-0.18	-0.29	-0.31	-0.33	-0.31	-0.24	-0.16	-0.11	
EXISTING LEVELS 4.19	4.22	4.13	4.12	4.08	4.02	4.04	3.92	4.16	3.82	4.10	3.72	3.92	3.62	3.71	
CHAINAGE 0		20		40		60		80		100		120		135	

ROAD04 LONG SECTION

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
A	75% ISSUE FOR CLIENT REVIEW	15/06/16	SA	SA	DH	AW
B	AMENDED ROAD WIDTH & SITE NUMBERS	20/06/16	SA	SA	DH	AW
C	ISSUE FOR CLIENT REVIEW	24/06/16	SA	SA	DH	AW
D	ISSUED FOR DEVELOPMENT APPLICATION	16/09/16	SA	SA	AW	AW
E	AMENDED TO COUNCIL COMMENTS	24/02/17	SA	SA	AW	AW
F	ENTRANCE AMENDED AND LOT LAYOUT UPDATED	14/07/17	SA	SA	AW	AW
G	LOT LAYOUT AMENDED TO COUNCIL COMMENTS	10/04/18	SA	SA	AW	AW

SCALES:
0 5 10 20 30
Full Size 1:500 ; Half Size 1:1000
Scale (m)
0 1 2 4 6
Full Size 1:100 ; Half Size 1:200
Scale (m)
DO NOT SCALE FROM DRAWING

DRAWN BY: S.ADAM
DESIGN BY: S.ADAM
APPROVED BY:
DATE:
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PLANIT ENGINEERING
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ABN: 99 613 049 568
EMAIL: admin@planitengineering.com.au

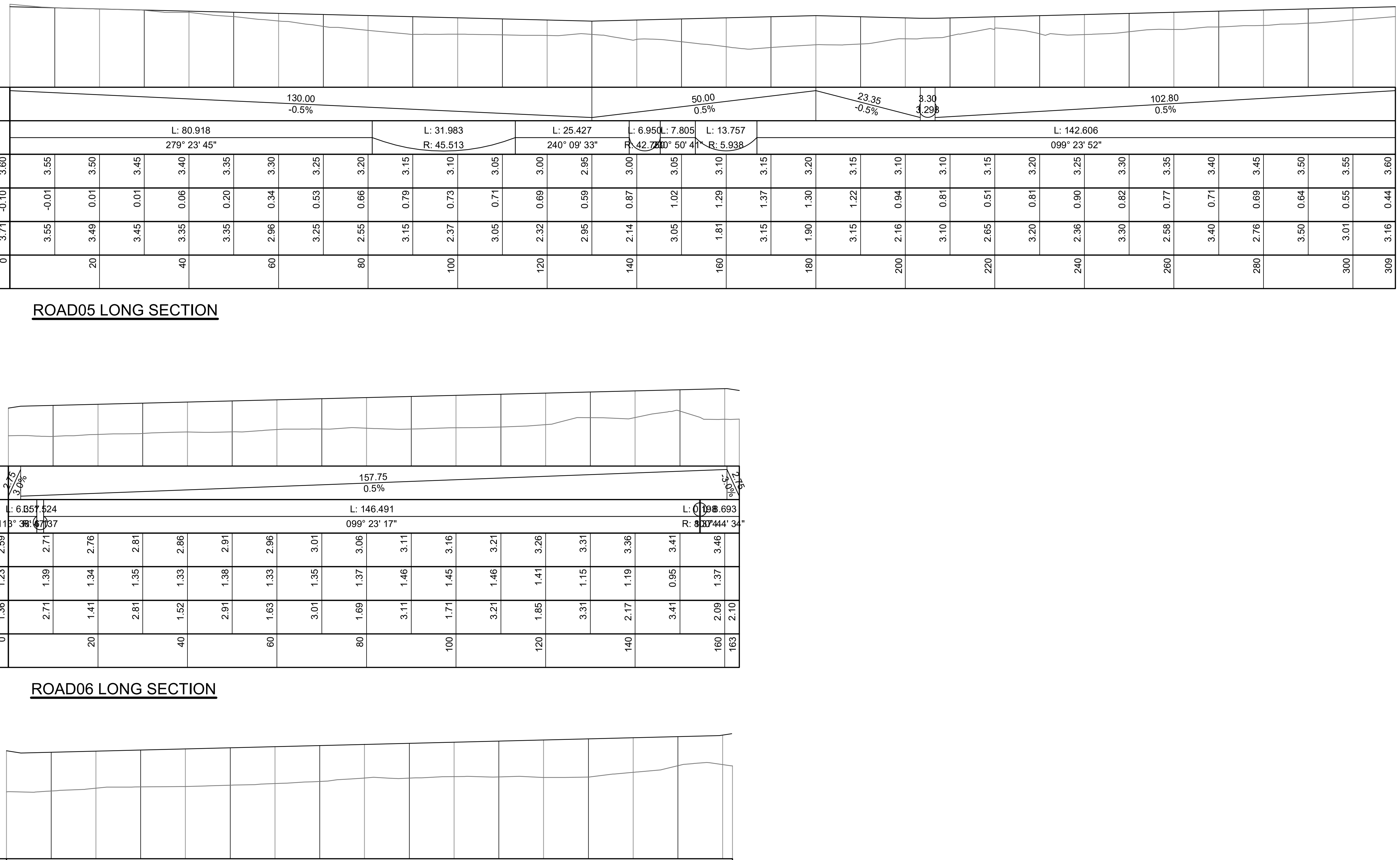
CLIENT:
LIVING GEMS
C/- PLANNERS NORTH
3/ 69 CENTENNIAL CIRCUIT
BYRON BAY, NSW, 4281

LOCAL GOVERNMENT AUTHORITY:
BALLINA SHIRE COUNCIL

PROJECT:
67 SKENNARS HEAD ROAD

DRAWING TITLE:
ROADWORKS LONG SECTION
SHEET 2 OF 5

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	0011	G



ROAD05 LONG SECTION

SCALE: 1:500H, 1:100V
DATUM: 0.00

VERTICAL GEOMETRY: 130.00 -0.5% | 50.00 0.5% | 23.35 -0.5% | 3.30 3.298 | 102.80 0.5%

HORIZONTAL GEOMETRY: L: 80.918 279° 23' 45" | L: 31.983 R: 45.513 | L: 25.427 240° 09' 33" | L: 6.950 R: 42.720 | L: 7.805 240° 50' 41" | L: 13.757 R: 5.938 | L: 142.606 099° 23' 52"

CHAINAGE	DESIGN LEVELS	CUT/FILL DEPTHS	EXISTING LEVELS
0	3.60	-0.10	3.71
	3.55	-0.01	3.55
20	3.50	0.01	3.49
	3.45	0.01	3.45
40	3.40	0.06	3.35
	3.35	0.20	3.35
60	3.30	0.34	2.96
	3.25	0.53	3.25
80	3.20	0.66	2.55
	3.15	0.79	3.15
100	3.10	0.73	2.37
	3.05	0.71	3.05
120	3.00	0.69	2.32
	2.95	0.59	2.95
140	3.00	0.87	2.14
	3.05	1.02	3.05
160	3.10	1.29	1.81
	3.15	1.37	3.15
180	3.20	1.30	1.90
	3.15	1.22	3.15
200	3.10	0.94	2.16
	3.10	0.81	3.10
220	3.15	0.51	2.65
	3.20	0.81	3.20
240	3.25	0.90	2.36
	3.30	0.82	3.30
260	3.35	0.77	2.58
	3.40	0.71	3.40
280	3.45	0.69	2.76
	3.50	0.64	3.50
300	3.55	0.55	3.01
309	3.60	0.44	3.16

ROAD06 LONG SECTION

SCALE: 1:500H, 1:100V
DATUM: 0.00

VERTICAL GEOMETRY: 2.75 -3.0% | 157.75 0.5% | 2.75 -3.0%

HORIZONTAL GEOMETRY: L: 6.857 113° 38' | L: 3.524 R: 6.037 | L: 146.491 099° 23' 17" | L: 0.198 R: 8.007 | L: 8.693 100° 44' 34"

CHAINAGE	DESIGN LEVELS	CUT/FILL DEPTHS	EXISTING LEVELS
0	2.59	1.23	1.36
	2.71	1.39	2.71
20	2.76	1.34	1.41
	2.81	1.35	2.81
40	2.86	1.33	1.52
	2.91	1.38	2.91
60	2.96	1.33	1.63
	3.01	1.35	3.01
80	3.06	1.37	1.69
	3.11	1.46	3.11
100	3.16	1.45	1.71
	3.21	1.46	3.21
120	3.26	1.41	1.85
	3.31	1.15	3.31
140	3.36	1.19	2.17
	3.41	0.95	3.41
160	3.46	1.37	2.09
163			2.10

ROAD07 LONG SECTION

SCALE: 1:500H, 1:100V
DATUM: -2.00

VERTICAL GEOMETRY
HORIZONTAL GEOMETRY: L: 5.783 070° 58' | L: 3.099 R: 6.236 | L: 144.438 099° 23' 36" | L: 0.279 R: 11.085 | L: 8.610 100° 44' 25"
DESIGN LEVELS
CUT/FILL DEPTHS
EXISTING LEVELS
CHAINAGE

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
A	75% ISSUE FOR CLIENT REVIEW	15/06/16	SA	SA	DH	AW
B	AMENDED ROAD WIDTH & SITE NUMBERS	20/06/16	SA	SA	DH	AW
C	ISSUE FOR CLIENT REVIEW	24/06/16	SA	SA	DH	AW
D	ISSUED FOR DEVELOPMENT APPLICATION	16/09/16	SA	SA	AW	AW
E	AMENDED TO COUNCIL COMMENTS	24/02/17	SA	SA	AW	AW
F	ENTRANCE AMENDED AND LOT LAYOUT UPDATED	14/07/17	SA	SA	AW	AW
G	LOT LAYOUT AMENDED TO COUNCIL COMMENTS	10/04/18	SA	SA	AW	AW

CAD FILE: T:\J107 - 67 SKENNARS HEAD ROAD - DA\6 - CAD\J107-0012.DWG PLOTTED BY: STEPHENA PLOT DATE: 23/05/2018 2:11:20 PM

SCALES: Full Size 1:500 ; Half Size 1:1000 Scale (m) 0 5 10 20 30
Full Size 1:100 ; Half Size 1:200 Scale (m) 0 1 2 4 6
DO NOT SCALE FROM DRAWING

DRAWN BY: S.ADAM
DESIGN BY: S.ADAM
APPROVED BY:
DATE:
THIS DRAWING MUST NOT BE USED FOR CONSTRUCTION UNLESS SIGNED AS APPROVED

PLANIT ENGINEERING
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PO BOX 161
LENNOX HEAD NSW 2478
TELEPHONE: 02 6687 4666
ABN: 99 613 049 568
EMAIL: admin@planitengineering.com.au

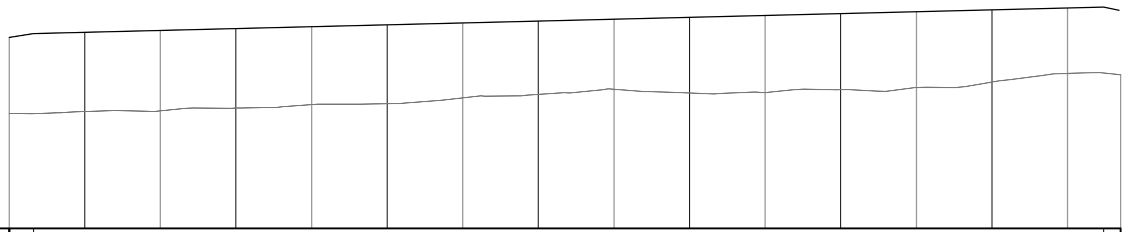
CLIENT: LIVING GEMS
C/- PLANNERS NORTH
3/ 69 CENTENNIAL CIRCUIT
BYRON BAY, NSW, 4281

LOCAL GOVERNMENT AUTHORITY: BALLINA SHIRE COUNCIL

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

PROJECT: 67 SKENNARS HEAD ROAD
DRAWING TITLE: ROADWORKS LONG SECTION SHEET 3 OF 5
ORIGINAL SIZE: A1 | PLANIT JOB No.: J107 | DRAWING No.: 0012 | REV: G

100mm AT ORIGINAL SIZE



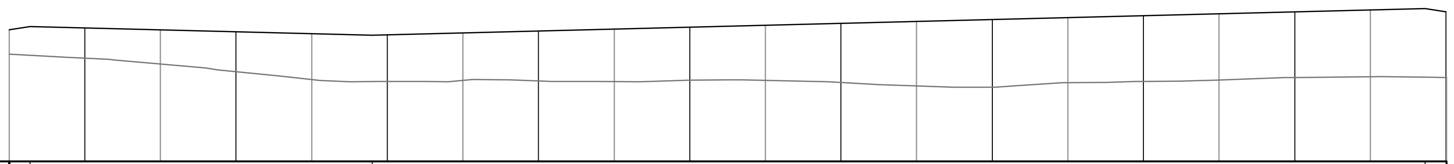
SCALE: 1:500H, 1:100V
DATUM: -2.00

VERTICAL GEOMETRY: 3.25 / 3.0% ; 141.52 / 0.5% ; 2.04 / -4.1%

HORIZONTAL GEOMETRY: L: 6.411 / R: 6.000 / 085° 19' ; L: 130.268 / 099° 27' 34" ; L: 0.195 / R: 8.000 / 105° 44' 06"

CHAINAGE	0		20		40		60		80		100		120		140	147
DESIGN LEVELS	3.07	3.20	3.25	3.30	3.35	3.40	3.45	3.50	3.55	3.60	3.65	3.70	3.75	3.80	3.85	
CUT/FILL DEPTHS	2.02	2.10	2.13	2.11	2.07	2.09	1.99	1.95	1.86	2.00	2.05	2.02	2.01	1.92	1.73	
EXISTING LEVELS	1.05	3.20	1.12	3.30	1.28	3.40	1.46	3.50	1.69	3.60	1.60	3.70	1.74	3.80	2.11	2.07

ROAD08 LONG SECTION



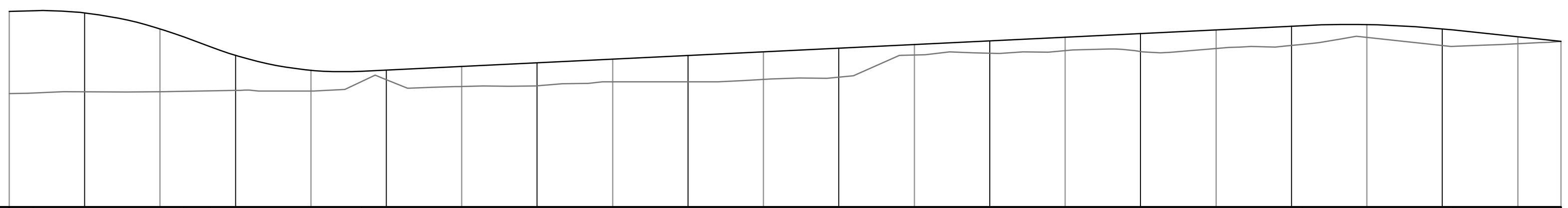
SCALE: 1:500H, 1:100V
DATUM: 0.00

VERTICAL GEOMETRY: 2.75 / 3.0% ; 45.25 / -0.5% ; 139.25 / 0.5% ; 2.76 / -3.0%

HORIZONTAL GEOMETRY

CHAINAGE	0		20		40		60		80		100		120		140		160		180	190
DESIGN LEVELS	3.47	3.52	3.47	3.42	3.37	3.34	3.39	3.44	3.49	3.54	3.59	3.64	3.69	3.74	3.79	3.84	3.89	3.94	3.99	3.94
CUT/FILL DEPTHS	0.64	0.80	0.90	1.05	1.21	1.23	1.26	1.32	1.39	1.40	1.45	1.56	1.70	1.78	1.71	1.73	1.74	1.73	1.76	1.74
EXISTING LEVELS	2.83	3.52	2.57	3.42	2.15	3.34	2.13	3.44	2.10	3.54	2.13	3.64	1.99	3.74	2.07	3.84	2.14	3.94	2.23	2.20

ROAD09 LONG SECTION



SCALE: 1:500H, 1:100V
DATUM: -2.00

VERTICAL GEOMETRY: 3.18 / 0.5% ; 20.00 / 2.512 ; 3.51 / -7.5% ; 20.00 / 2.368 ; 124.75 / 1.0% ; 20.00 / 6.471 ; 14.34 / -2.1%

HORIZONTAL GEOMETRY: L: 29.804 / 190° 03' 36" ; L: 13.794 / R: 9.000 ; L: 6.154 / 102° 14' 48" ; L: 9.906 / R: 200.000 ; L: 86.138 / 099° 24' 25" ; L: 33.217 / 100° 35' 44"

CHAINAGE	0		20		40		60		80		100		120		140		160		180		200	206
DESIGN LEVELS	3.20	3.16	2.73	2.03	1.63	1.64	1.73	1.83	1.93	2.03	2.12	2.22	2.32	2.41	2.51	2.61	2.71	2.80	2.84	2.73	2.52	2.40
CUT/FILL DEPTHS	2.19	2.10	1.67	0.93	0.55	0.25	0.53	0.61	0.60	0.70	0.73	0.77	0.28	0.33	0.36	0.48	0.50	0.51	0.34	0.44	0.18	0.00
EXISTING LEVELS	1.01	3.16	1.06	2.03	1.08	1.64	1.20	1.83	1.32	2.03	1.39	2.22	2.04	2.41	2.16	2.61	2.21	2.80	2.51	2.73	2.34	2.40

FIRE TRAIL LONG SECTION CHAINAGE 330-407

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
A	75% ISSUE FOR CLIENT REVIEW	15/06/16	SA	SA	DH	AW
B	AMENDED ROAD WIDTH & SITE NUMBERS	20/06/16	SA	SA	DH	AW
C	ISSUE FOR CLIENT REVIEW	24/06/16	SA	SA	DH	AW
D	ISSUED FOR DEVELOPMENT APPLICATION	16/09/16	SA	SA	AW	AW
E	AMENDED TO COUNCIL COMMENTS	24/02/17	SA	SA	AW	AW
F	ENTRANCE AMENDED AND LOT LAYOUT UPDATED	14/07/17	SA	SA	AW	AW
G	LOT LAYOUT AMENDED TO COUNCIL COMMENTS	10/04/18	SA	SA	AW	AW

CAD FILE: T:\J107 - 67 SKENNARS HEAD ROAD - DA\6 - CAD\J107-0013.DWG PLOTTED BY: STEPHENA PLOT DATE: 23/05/2018 2:12:11 PM

SCALES:
Full Size 1:500 ; Half Size 1:1000 Scale (m) 0 5 10 20 30
Full Size 1:100 ; Half Size 1:200 Scale (m) 0 1 2 4 6
DO NOT SCALE FROM DRAWING

DRAWN BY: S.ADAM
DESIGN BY: S.ADAM
APPROVED BY:
DATE:
THIS DRAWING MUST NOT BE USED FOR CONSTRUCTION UNLESS SIGNED AS APPROVED

PLANIT ENGINEERING
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EMAIL: admin@planitengineering.com.au

CLIENT:
LIVING GEMS
C/- PLANNERS NORTH
3/ 69 CENTENNIAL CIRCUIT
BYRON BAY, NSW, 4281

LOCAL GOVERNMENT AUTHORITY:
BALLINA SHIRE COUNCIL

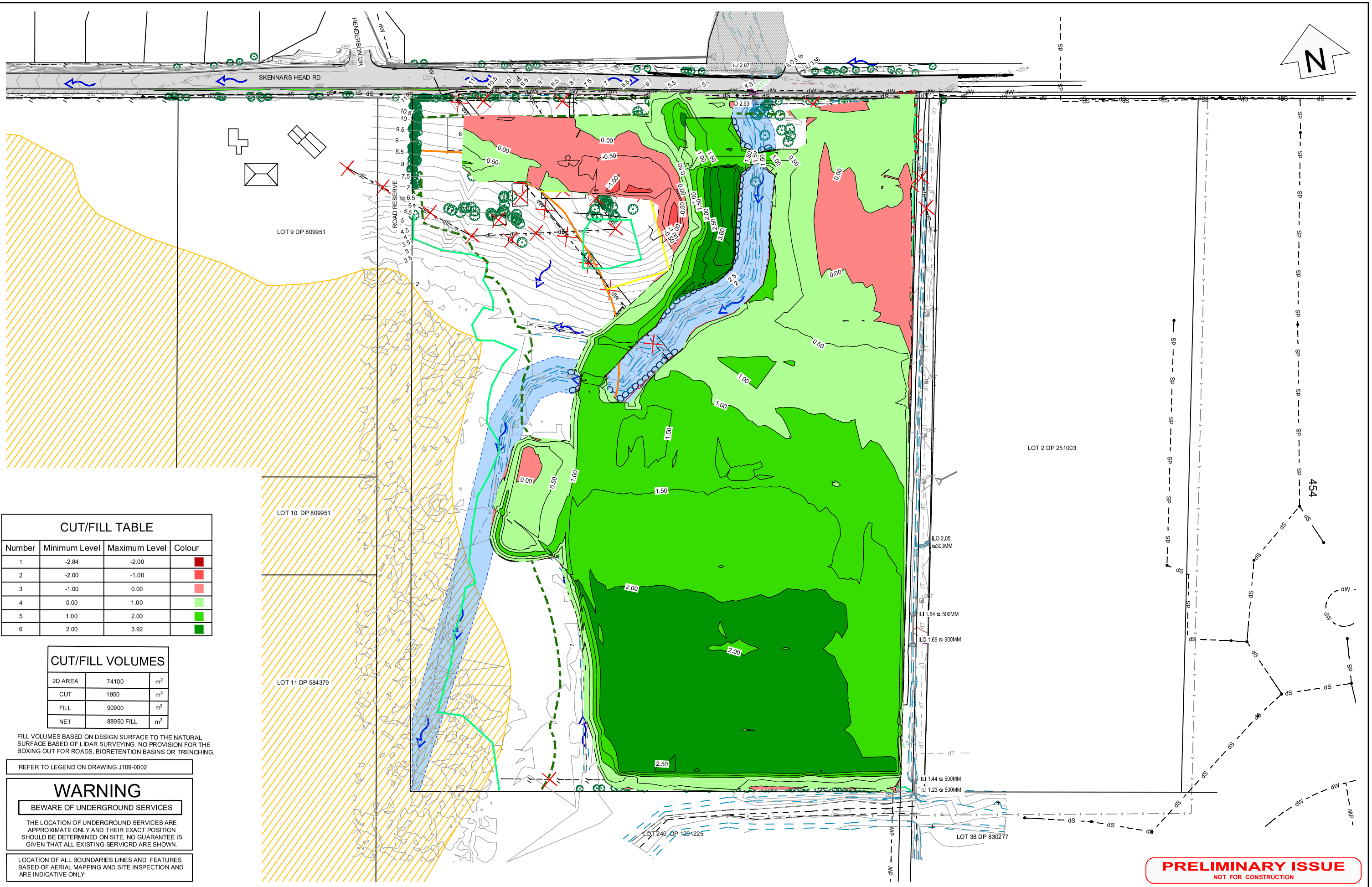
PROJECT:
67 SKENNARS HEAD ROAD

DRAWING TITLE:
ROADWORKS LONG SECTION
SHEET 4 OF 5

ORIGINAL SIZE: A1 | PLANIT JOB No.: J107 | DRAWING No.: 0013 | REV: G

100mm AT ORIGINAL SIZE

100mm AT ORIGINAL SIZE



CUT/FILL TABLE

Number	Minimum Level	Maximum Level	Colour
1	-2.84	-2.00	
2	-2.00	-1.00	
3	-1.00	0.00	
4	0.00	1.00	
5	1.00	2.00	
6	2.00	3.92	

CUT/FILL VOLUMES

2D AREA	74100	m^2
CUT	1950	m^3
FILL	90900	m^3
NET	88950 FILL	m^3

FILL VOLUMES BASED ON DESIGN SURFACE TO THE NATURAL SURFACE BASED OF LIDAR SURVEYING. NO PROVISION FOR THE BOXING OUT FOR ROADS, BIORETENTION BASINS OR TRENCHING.

REFER TO LEGEND ON DRAWING J109-0002

WARNING

BEWARE OF UNDERGROUND SERVICES

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LOCATION OF ALL BOUNDARIES LINES AND FEATURES BASED OF AERIAL MAPPING AND SITE INSPECTION AND ARE INDICATIVE ONLY

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
A	75% ISSUE FOR CLIENT REVIEW	15/06/16	SA	SA	DH	AW
B	AMENDED ROAD WIDTH & SITE NUMBERS	20/06/16	SA	SA	DH	AW
C	ISSUE FOR CLIENT REVIEW	24/06/16	SA	SA	DH	AW
D	ISSUED FOR DEVELOPMENT APPLICATION	16/09/16	SA	SA	AW	AW
E	AMENDED TO COUNCIL COMMENTS	24/02/17	SA	SA	AW	AW
F	ENTRANCE AMENDED AND LOT LAYOUT UPDATED	14/07/17	SA	SA	AW	AW
G	LOT LAYOUT AMENDED TO COUNCIL COMMENTS	23/05/18	SA	SA	AW	AW

SCALES:

0 10 20 40 60
Full Size 1:1000 ; Half Size 1:2000
Scale (m)

DO NOT SCALE FROM DRAWING

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DESIGN BY: S.ADAM
APPROVED BY:
DATE:
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CLIENT: LIVING GEMS
C/- PLANNERS NORTH
3/ 69 CENTENNIAL CIRCUIT
BYRON BAY, NSW, 4281

LOCAL GOVERNMENT AUTHORITY: BALLINA SHIRE COUNCIL

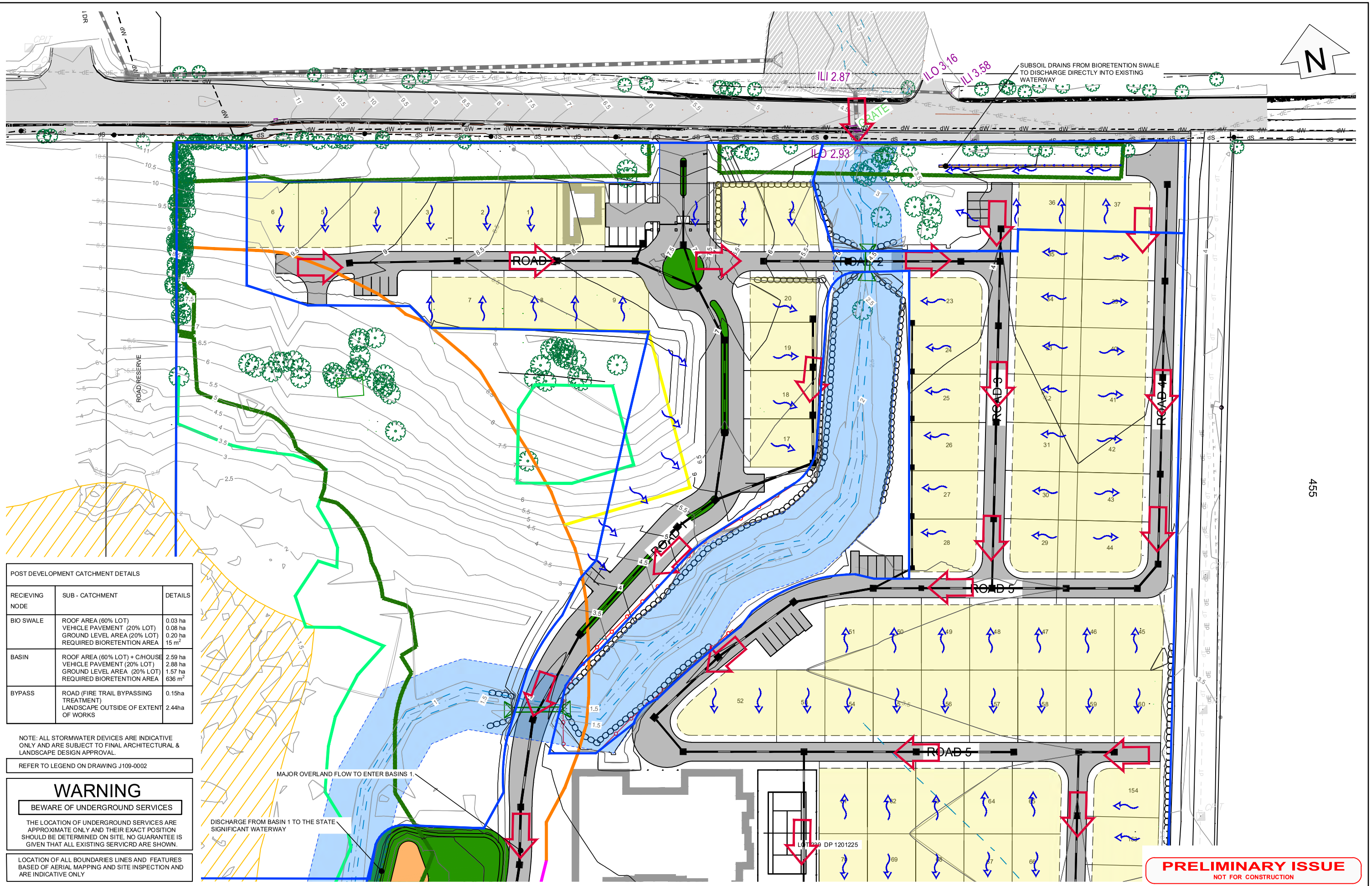
PROJECT: 67 SKENNARS HEAD ROAD

DRAWING TITLE: EARTHWORKS CUT/ FILL

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	0015	G

CAD FILE: T:\J107 - 67 SKENNARS HEAD ROAD - DA\6 - CAD\J107-0015.DWG PLOTTED BY: STEPHENA PLOT DATE: 23/05/2018 2:13:05 PM

100mm AT ORIGINAL SIZE



POST DEVELOPMENT CATCHMENT DETAILS		
RECIEVING NODE	SUB - CATCHMENT	DETAILS
BIO SWALE	ROOF AREA (60% LOT) VEHICLE PAVEMENT (20% LOT) GROUND LEVEL AREA (20% LOT) REQUIRED BIORETENTION AREA	0.03 ha 0.08 ha 0.20 ha 15 m^2
BASIN	ROOF AREA (60% LOT) + C/HOUSE VEHICLE PAVEMENT (20% LOT) GROUND LEVEL AREA (20% LOT) REQUIRED BIORETENTION AREA	2.59 ha 2.88 ha 1.57 ha 636 m^2
BYPASS	ROAD (FIRE TRAIL BYPASSING TREATMENT) LANDSCAPE OUTSIDE OF EXTENT OF WORKS	0.15ha 2.44ha

NOTE: ALL STORMWATER DEVICES ARE INDICATIVE ONLY AND ARE SUBJECT TO FINAL ARCHITECTURAL & LANDSCAPE DESIGN APPROVAL.

REFER TO LEGEND ON DRAWING J109-0002

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D	ISSUED FOR DEVELOPMENT APPLICATION	16/09/16	SA	SA	AW	AW
E	AMENDED TO COUNCIL COMMENTS	24/02/17	SA	SA	AW	AW
F	BASIN CAPACITY INCREASED	14/06/17	SA	SA	AW	AW
G	ENTRANCE AMENDED AND LOT LAYOUT UPDATED	14/07/17	SA	SA	AW	AW
H	LOT LAYOUT AMENDED TO COUNCIL COMMENTS	23/05/18	SA	SA	AW	AW

SCALES:

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LOCAL GOVERNMENT AUTHORITY:
BALLINA SHIRE COUNCIL

PROJECT:
67 SKENNARS HEAD ROAD

DRAWING TITLE:
STORMWATER DRAINAGE PLAN
SHEET 1 OF 2

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	0016	H

CAD FILE: T:\J107 - 67 SKENNARS HEAD ROAD - DA\6 - CAD\J107-0016.DWG PLOTTED BY: STEPHENA PLOT DATE: 23/05/2018 2:13:52 PM

100mm AT ORIGINAL SIZE

OUTLET WITH WATER DISSIPATING ROCKS TO DISCHARGE INTO THE BASIN 1

DISCHARGE FROM BASIN 1 TO THE STATE SIGNIFICANT WATERWAY

BASIN 1 PROPOSED RL1.2

MAJOR OVERLAND FLOW DETAINED IN BASIN 1

SEDIMENT TREATMENT FOR BASIN 1 NOMINATED AS 2 BY GROSS POLLUTANT TRAPS WITH FLOW ENTERING AT 2 LOCATION TO AID IN EVENLY DISTRIBUTING FLOWS TO THE VEGETATED SURFACE

LOT 239 DP 1201225

FLOW FROM CAR PARK INTO SW

ROAD 6

ROAD 7

ROAD 8

ROAD 1

EXIT 2

ILO 2.05 ⌀300MM

ILI 1.64 ⌀ 500MM

ILO 1.65 ⌀ 500MM

ILI 1.44 ⌀ 500MM

ILI 1.23 ⌀ 500MM

LOT 240 DP 1201225

LOT 38 DP 830277

456

NOTE: ALL STORMWATER DEVICES ARE INDICATIVE ONLY AND ARE SUBJECT TO FINAL ARCHITECTURAL & LANDSCAPE DESIGN APPROVAL.

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G	LOT LAYOUT AMENDED TO COUNCIL COMMENTS	23/05/18	SA	SA	AW	AW

SCALES:

0 5 10 20 30

Full Size 1:500 ; Half Size 1:1000
Scale (m)

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BALLINA SHIRE COUNCIL

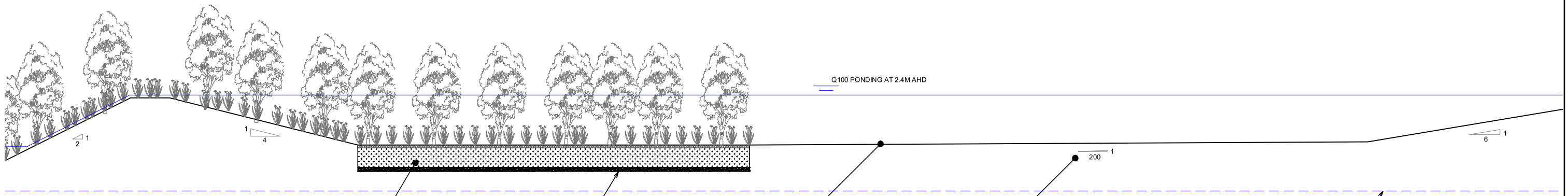
PROJECT:
67 SKENNARS HEAD ROAD

DRAWING TITLE:
STORMWATER DRAINAGE PLAN
SHEET 2 OF 2

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	0016	G

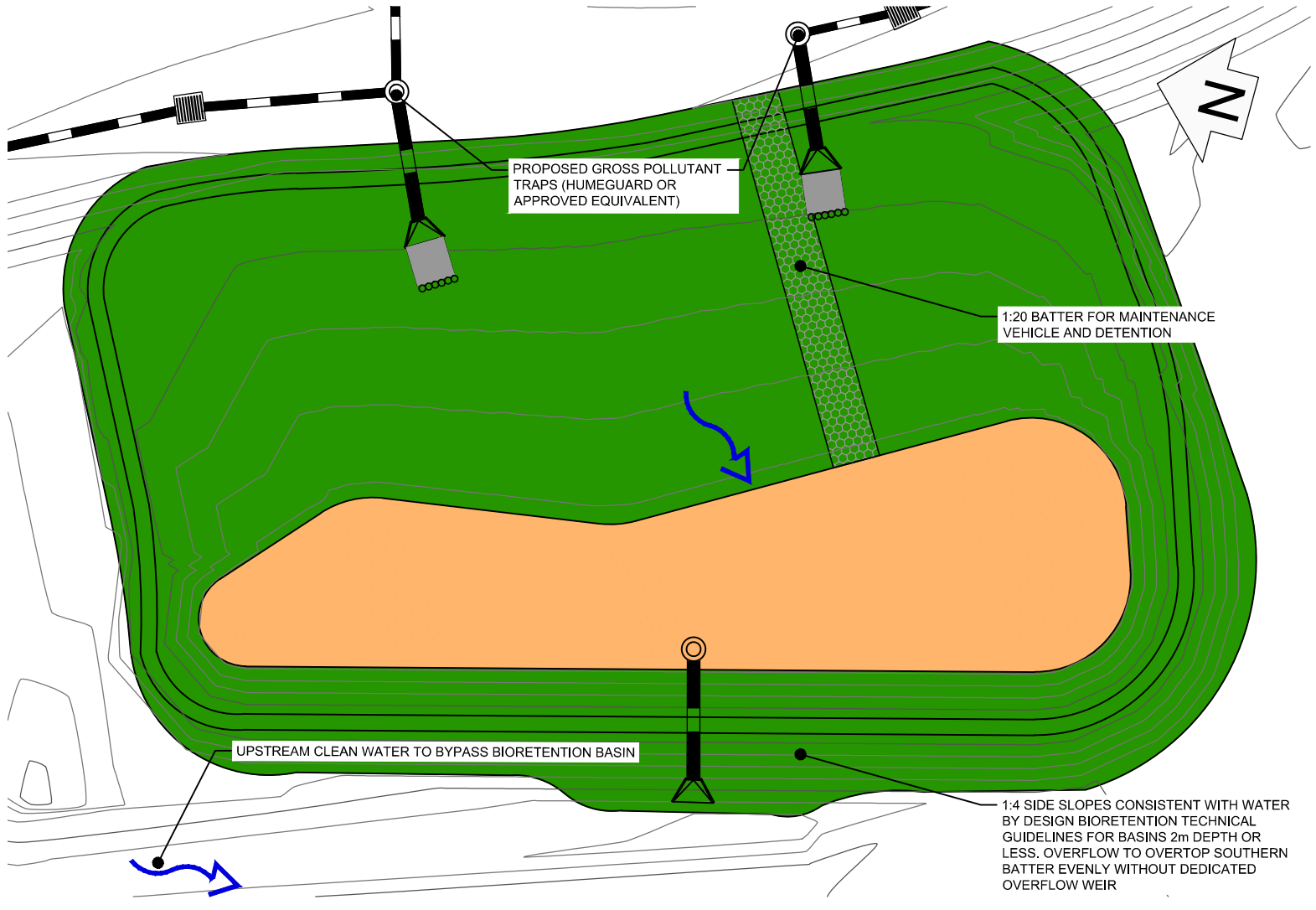
CAD FILE: T:\J107 - 67 SKENNARS HEAD ROAD - DA\6 - CAD\J107-0017.DWG PLOTTED BY: STEPHENA PLOT DATE: 23/05/2018 2:14:38 PM

100mm AT ORIGINAL SIZE



BIORETENTION BASIN TYPICAL CROSS SECTION

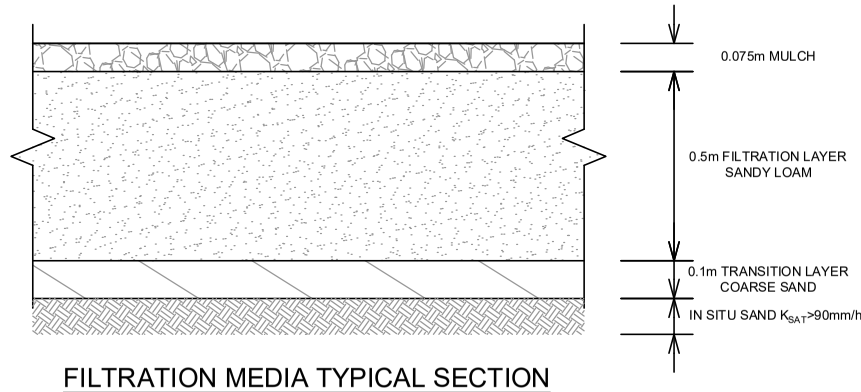
SCALE: 1:50 @ A1, 1 :100@ A3



TYPICAL SUB-SURFACE DRAINAGE LAYOUT

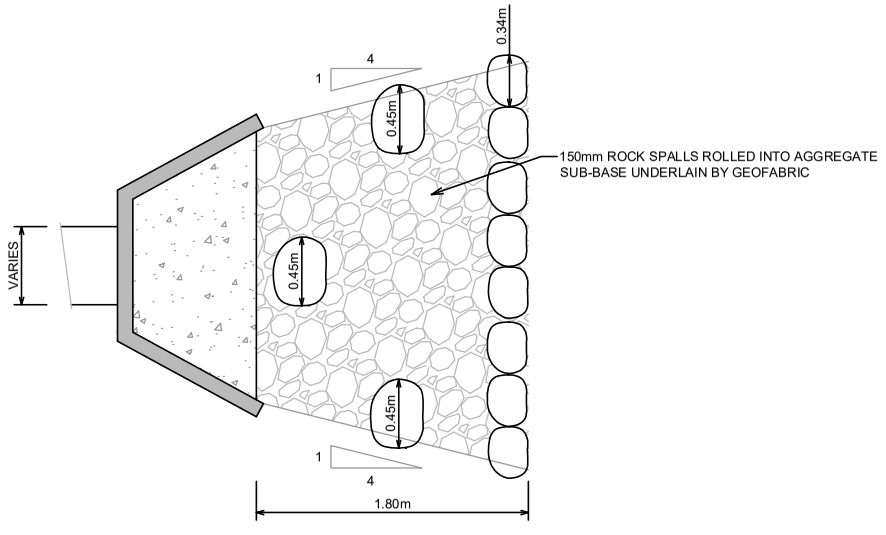
SCALE: 1:100 @ A1, 1 :200 @ A3

REFER TO LEGEND ON DRAWING J109-0002



FILTRATION MEDIA TYPICAL SECTION

SCALE: 1:10 @ A1, 1:20 A3



BASIN INLET SCOUR PROTECTION - PLAN

SCALE: 1:25 @ A1, 1:50 @ A3

PRELIMINARY ISSUE
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457

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
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F	ENTRANCE AMENDED AND LOT LAYOUT UPDATED	14/07/17	SA	SA	AW	AW
G	LOT LAYOUT AMENDED TO COUNCIL COMMENTS	10/04/18	SA	SA	AW	AW

SCALES:
0 1 2 4 6
Full Size 1:100 ; Half Size 1:200
Scale (m)
0 0.1 0.2 0.4 0.6
Full Size 1:10 ; Half Size 1:20
Scale (m)
0 0.5 1 2 3
Full Size 1:50 ; Half Size 1:100
Scale (m)
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3/ 69 CENTENNIAL CIRCUIT
BYRON BAY, NSW, 4281

LOCAL GOVERNMENT AUTHORITY:
BALLINA SHIRE COUNCIL

PROJECT:
67 SKENNARS HEAD ROAD

DRAWING TITLE:
BIORETENTION BASIN TYPICAL DETAILS

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	0018	G

CAD FILE: T:\J107 - 67 SKENNARS HEAD ROAD - DA\6 - CAD\J107-0018.DWG PLOTTED BY: STEPHENA PLOT DATE: 23/05/2018 2:15:05 PM

100mm AT ORIGINAL SIZE

CONNECT POTABLE AND RECYCLED WATER TO COUNCIL SYSTEMS

CONNECT SEWER RISING MAIN TO COUNCIL SYSTEM

PROPOSED 200mm Ø RELOCATED WATER MAIN

PROPOSED INTERNAL WATER SERVICING. 150mm RECYCLED WATER MAIN CLOSEST TO PROPERTY BOUNDARY AND 100mm POTABLE WATER MAIN OFFSET A MINIMUM OF 300mm FROM THE EDGE OF TRAFFICWAY.

PROPOSED 200mm Ø RELOCATED WATER MAIN

PROPOSED SECONDARY CONNECTION TO COUNCILS WATER MAIN

SEWER PUMP STATION
8.7 L/S, AT AN INVERT OF APPROXIMATELY -0.4m AHD

ROAD 1
ROAD 2
ROAD 3
ROAD 4
ROAD 5
EXIT
ROAD RESERVE
LOT 239 DP 1201225

REFER TO LEGEND ON DRAWING J109-0002

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SCALES:

0 5 10 20 30
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Scale (m)

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3/ 69 CENTENNIAL CIRCUIT
BYRON BAY, NSW, 4281

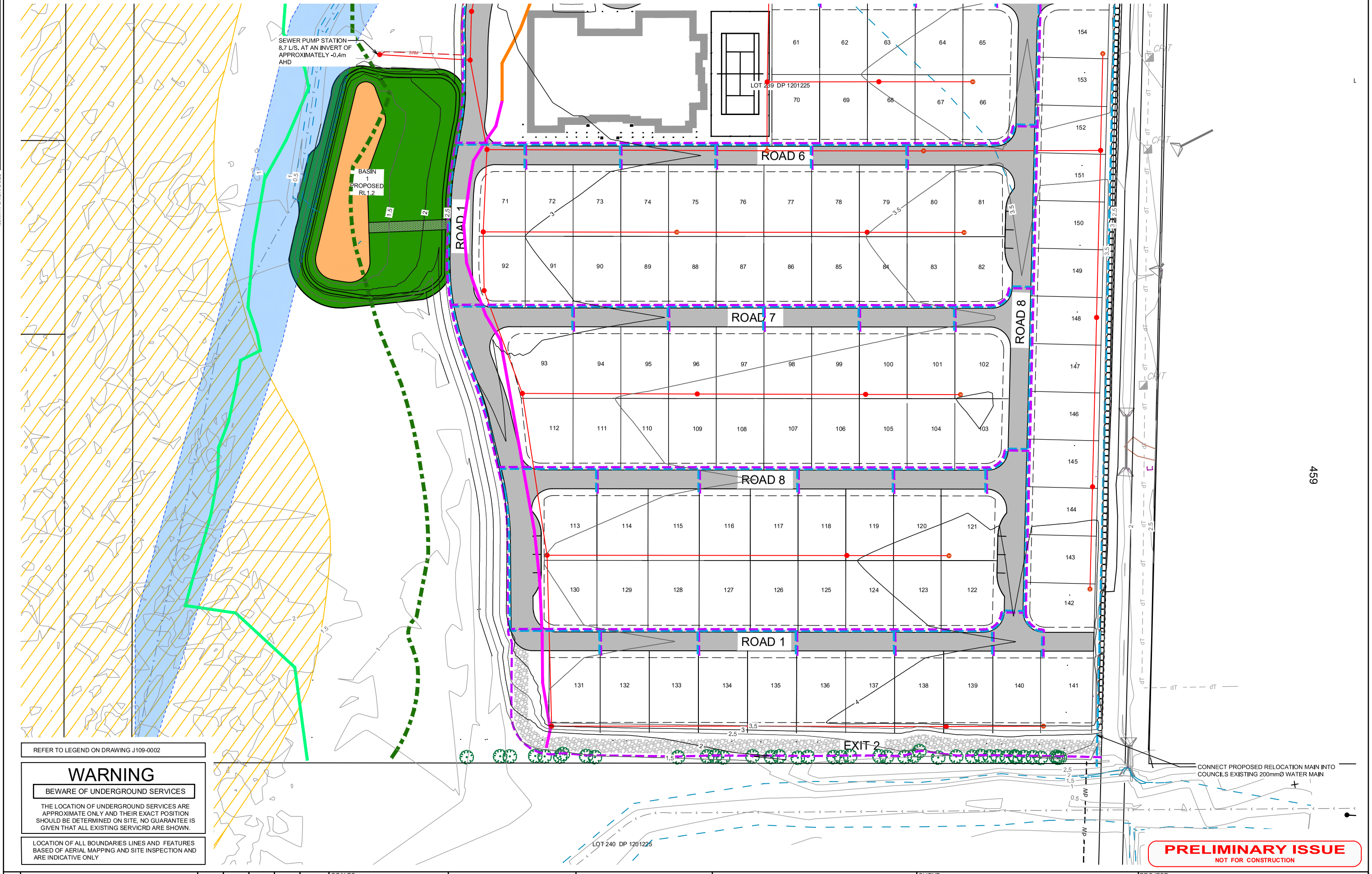
LOCAL GOVERNMENT AUTHORITY:
BALLINA SHIRE COUNCIL

PROJECT:
67 SKENNARS HEAD ROAD

DRAWING TITLE:
SEWER AND WATER LAYOUT PLAN
SHEET 1 OF 2

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	0019	G

CAD FILE: T:\J107 - 67 SKENNARS HEAD ROAD - DA\6 - CAD\J107-0019.DWG PLOTTED BY: STEPHENA PLOT DATE: 23/05/2018 2:15:43 PM



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67 SKENNARS HEAD ROAD

DRAWING TITLE:
SEWER AND WATER LAYOUT PLAN
SHEET 2 OF 2

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	0020	G

CAD FILE: T:\J107 - 67 SKENNARS HEAD ROAD - DA\6 - CAD\J107-0020.DWG PLOTTED BY: STEPHENA PLOT DATE: 23/05/2018 2:16:17 PM

100mm AT ORIGINAL SIZE

GENERAL NOTES

G.1. ALL WORK IS TO BE IN ACCORDANCE WITH THE PLAN AND THE "BLUE BOOK" SEDIMENT CONTROL BOOKS.

G.2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE IMPLEMENTATION OF THE EROSION AND SEDIMENT CONTROL PLAN.

G.3. THE CONTRACTOR SHALL INFORM ALL STAFF AND SUB-CONTRACTORS OF THEIR OBLIGATIONS UNDER THE EROSION AND SEDIMENT CONTROL PLAN.

G.4. CONTROL MEASURES SHALL BE IN PLACE PRIOR TO EACH SITE DISTURBANCE.

G.5. SITE DISTURBANCE SHALL BE STAGED WHERE POSSIBLE AND RESTRICTED TO THE WORKS ZONE.

G.6. ALL WORKS ARE TO BE INSPECTED, AND MAINTAINED WHERE NECESSARY, ON A WEEKLY BASIS AND AFTER EACH RAIN EVENT.

G.7. ADEQUATE MEASURES SHALL BE TAKEN TO PREVENT DUST FROM AFFECTING THE AMENITY OF THE NEIGHBOURHOOD DURING CONSTRUCTION. IN PARTICULAR, THE FOLLOWING MEASURES MUST BE ADOPTED:

(1) EARTHWORKS AND SCHEDULING ACTIVITIES SHALL BE MANAGED TO COINCIDE WITH THE NEXT STAGE OF DEVELOPMENT TO MINIMISE THE AMOUNT OF TIME THE SITE IS LEFT CUT OR EXPOSED;

(2) ALL MATERIALS SHALL BE STORED OR STOCKPILED IN SUITABLE LOCATIONS;

(3) THE SURFACE SHOULD BE DAMPENED SLIGHTLY TO PREVENT DUST FROM BECOMING AIRBORNE BUT SHOULD NOT BE WET TO THE EXTENT THAT RUN-OFF OCCURS;

(4) ALL VEHICLES CARRYING SPOIL OR RUBBLE TO OR FROM THE SITE SHALL AT ALL TIMES BE COVERED TO PREVENT THE ESCAPE OF DUST OR OTHER MATERIAL;

(5) ALL EQUIPMENT WHEELS SHALL BE WASHED BEFORE EXITING THE SITE USING MANUAL OR AUTOMATED SPRAYERS AND DRIVE - THROUGH WASHING BAYS;

(6) GATES SHALL BE CLOSED BETWEEN VEHICLE MOVEMENTS AND SHALL BE FITTED WITH SHADE CLOTH; AND

(7) CLEANING OF FOOTPATHS AND ROADWAYS SHALL BE CARRIED OUT REGULARLY.

G.8. FAILURE TO IMPLEMENT ANY PART OF THE PLAN WILL CONSTITUTE A HOLD POINT.

REVEGETATION

R.1 REVEGETATION SHALL BE ON-GOING AND PROGRESSIVE.

R.3 WHERE ANY BREAK IN OPERATIONS, OR WHERE WORK IS CEASED IN AN AREA FOR LONGER THAN 4 WEEKS, THE EXPOSED AREAS SHALL BE STABILISED (eg. TEMPORARY TOPSOILING AND SEEDING WITH AN APPROPRIATE COVERCROP, MULCHES, BLANKETS/ MATTINGS).

R.4 SEED SELECTION AND RATE TO BE APPROVED BY SUPERINTENDENT PRIOR TO APPLICATION.

R.5 THE CONTRACTOR SHALL PROVIDE SUITABLE SEED BED PREPARATION PRIOR TO THE SOWING OF VEGETATION SEED SPECIES.

R.6 REVEGETATION WORKS SHALL BE MAINTAINED/ENHANCED (eg RESEEDING, FERTILISING, WATERING) UNTIL A MINIMUM OF 70% GROUND COVER IS ESTABLISHED.

EROSION CONTROL

E.1 STORMWATER DRAINAGE AND CULVERTS NEED TO BE INSTALLED EARLY TO CATER FOR RAIN RUNOFF.

E.2 SOIL MATERIAL STOCKPILES SHALL BE LOCATED AWAY FROM DEPRESSION FLOWLINES.

E.3 BARRIER OR SIMILAR FENCING IS TO BE USED TO PROTECT NO-GO AREAS.

E.4 SITE ACCESS SHALL INCLUDE A SOIL RETENTION SYSTEM (eg VEHICLE SHAKEDOWN GRID)

E.5 TEMPORARY DIVERSION DRAINS/BANKS (AT 3% SLOPE) ARE TO BE SUCCESSIVELY INSTALLED DOWNSLOPE (eg ROAD FORMATIONS) PRIOR TO ANY BREAKS IN CONSTRUCTION (eg WEEKENDS). SEDIMENT TRAPS ARE TO BE PLACED AT THEIR OUTLETS.

E.6 ALL DIVERSION BANKS SHALL BE STABILISED.

E.7 NO MORE THAN 150m OF TRENCHING TO BE OPEN AT ANY ONE TIME.

SEDIMENT CONTROL

S.1 THE NEED FOR SEDIMENT CONTROL MEANS THAT EROSION CONTROL HAS NOT BEEN ACHIEVED.

S.2 SEDIMENT FENCING IS TO BE INSTALLED TO THE MANUFACTURERS SPECIFICATIONS AND:

(A) BE SPACED SUCCESSIVELY DOWNSLOPE NO GREATER THAN 50m APART AND APPROXIMATELY AT EVERY 1m FALL IN GROUNDSLOPE.

(B) BE INSTALLED TO THE CONTOUR

(C) HAVE THE ENDS TURNED UPSLOPE 500mm WHERE APPROPRIATE TO CREATE STORAGE.

S.3 SEDIMENT TRAPS SHALL BE INSTALLED IN ACCORDANCE WITH PLAN DETAILS. THEY WILL:

(A) BE AS LARGE AS PRACTICAL

(B) BE CONSTRUCTED TO SUIT EXPECTED FLOW CONDITIONS.

(C) BE LOCATED APPROXIMATELY EVERY 1m FALL IN GROUNDSLOPE.

(D) PROVIDE FOR SAFE OVERFLOW.

S.4 SEDIMENT CONTROLS ARE TO BE LOCATED AS CLOSE TO DISTURBED AREAS AS PRACTICAL.

S.5 TRAPPED SEDIMENT TO BE REMOVED TO AN APPROPRIATE NOMINATED LOCATION.

S.6 TEMPORARY CONTROL MEASURES SHALL REMAIN IN PLACE UNTIL CATCHMENT THEY ARE SERVING IS STABILISED (FOR GRASS THIS WILL MEAN 70% GROUNDCOVER).

S.7 PROVIDE SEDIMENT BAGS IN KERB AND GUTTER UPSTREAM OF EXISTING KERB INLET PITS UNTIL DISTURBED AREAS ARE ADEQUATELY STABILISED.

S.8 PRIOR TO APPROVAL OF STORMWATER PIPES AND PITS, PREVENT RUNOFF DRAINING INTO PIPE SYSTEM BY SAND BAGGING AND DIVERSION TO OTHER CONTROL MEASURES.

S.9 ON COMPLETION OF PITS, CONSTRUCT SEDIMENT TRAPS IN ACCORDANCE WITH DETAILS UNTIL EARTHWORK ZONES ARE STABILISED WITH GRASS COVER.

NOTE: THIS DRAWINGS IS PROVIDED AS A GUIDE ONLY AND IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE ADEQUATE EROSION AND SEDIMENT CONTROL OF THE SITE DURING ALL PHASES OF WORKS TO THE SATISFACTION OF THE SUPERINTENDENT AND LOCAL COUNCIL

REFER TO LEGEND ON DRAWING J109-0002

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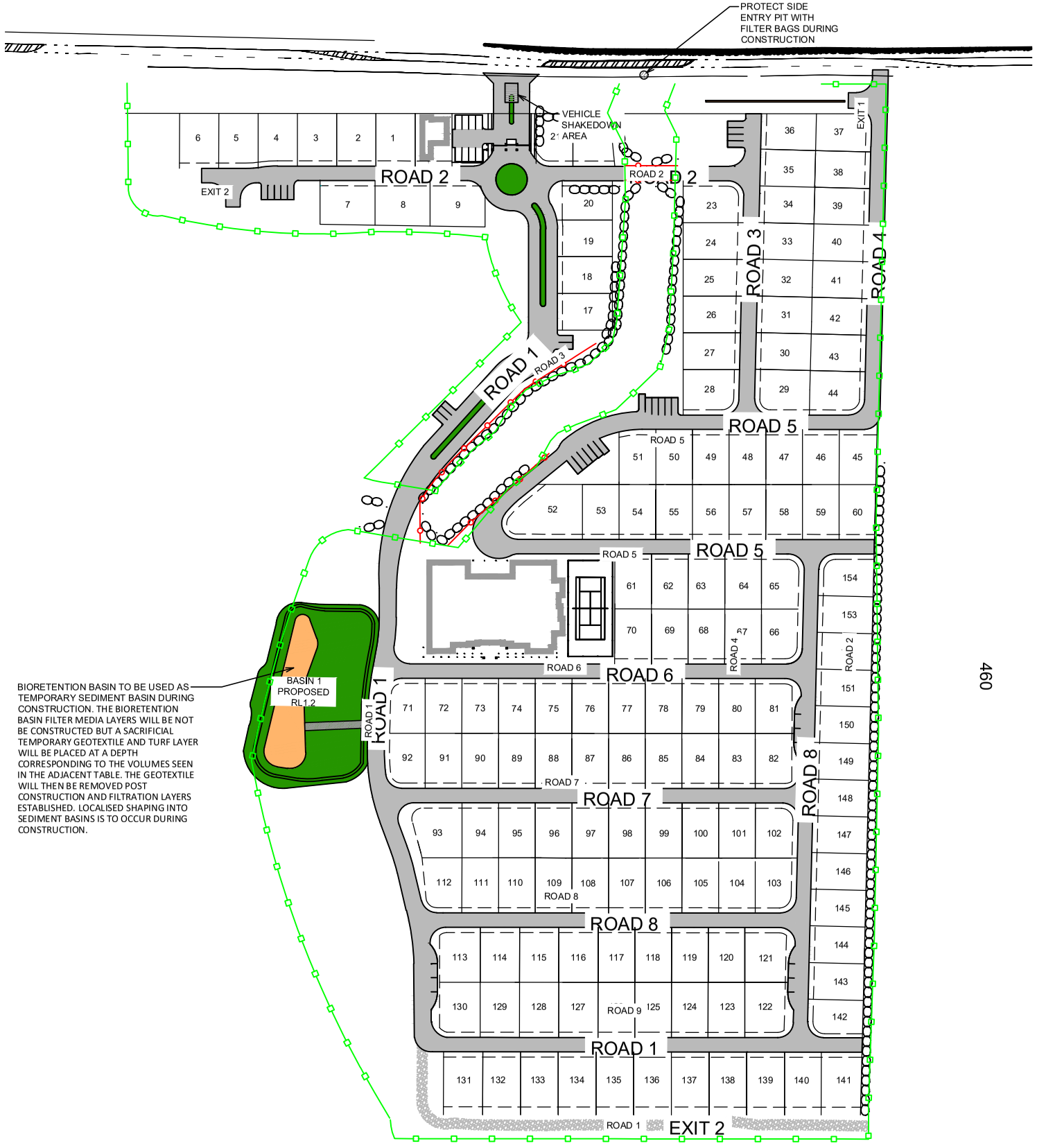

460

PRELIMINARY ISSUE
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REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
B	AMENDED ROAD WIDTH & SITE NUMBERS	20/06/16	SA	SA	DH	AW
C	ISSUE FOR CLIENT REVIEW	24/06/16	SA	SA	DH	AW
D	ISSUED FOR DEVELOPMENT APPLICATION	16/09/16	SA	SA	AW	AW
E	AMENDED TO COUNCIL COMMENTS	24/02/17	SA	SA	AW	AW
F	BASIN CAPACITY INCREASED	14/06/17	SA	SA	AW	AW
G	ENTRANCE AMENDED AND LOT LAYOUT UPDATED	14/07/17	SA	SA	AW	AW
H	LOT LAYOUT AMENDED TO COUNCIL COMMENTS	23/05/18	SA	SA	AW	AW

SCALES:
0 10 20 40 60
Full Size 1:1000 ; Half Size 1:2000
Scale (m)
DO NOT SCALE FROM DRAWING

DRAWN BY: S.ADAM
DESIGN BY: S.ADAM
APPROVED BY:
DATE:
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PLANIT ENGINEERING
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LENNOX HEAD NSW 2478
TELEPHONE: 02 6687 4666
ABN: 99 613 049 568
EMAIL: admin@planitengineering.com.au

CLIENT:
LIVING GEMS
C/- PLANNERS NORTH
3/ 69 CENTENNIAL CIRCUIT
BYRON BAY, NSW, 4281

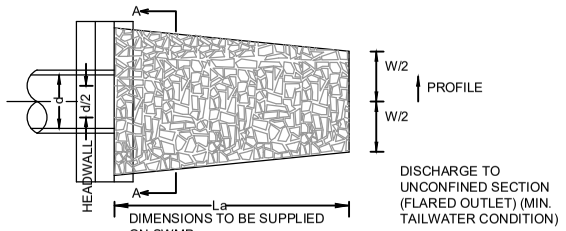
LOCAL GOVERNMENT AUTHORITY:
BALLINA SHIRE COUNCIL

PROJECT:
67 SKENNARS HEAD ROAD

DRAWING TITLE:
EROSION AND SEDIMENT CONTROL LAYOUT PLAN

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	0021	H

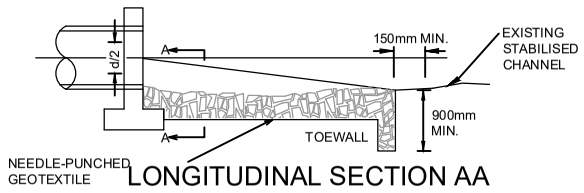
CAD FILE: T:\J107 - 67 SKENNARS HEAD ROAD - DA\6 - CAD\J107-0021.DWG PLOTTED BY: STEPHENA PLOT DATE: 23/05/2018 2:16:40 PM



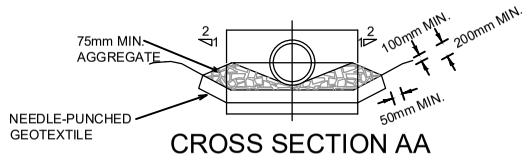
PLAN VIEW

CONSTRUCTION NOTES

1. COMPACT THE SUBGRADE FILL TO THE DENSITY OF THE SURROUNDING UNDISTURBED MATERIAL.
2. PREPARE A SMOOTH, EVEN FOUNDATION FOR THE STRUCTURE THAT WILL ENSURE THAT THE NEEDLE-PUNCHED GEOTEXTILE DOES NOT SUSTAIN SERIOUS DAMAGE WHEN COVERED WITH ROCK.
3. SHOULD ANY MINOR DAMAGE TO THE GEOTEXTILE OCCUR, REPAIR IT BEFORE SPREADING ANY AGGREGATE. FOR REPAIRS, PATCH ONE PIECE OF FABRIC OVER THE DAMAGE, MAKING SURE THAT ALL JOINTS AND PATCHES OVERLAP MORE THAN 300mm.
4. LAY ROCK FOLLOWING THE DRAWING, ACCORDING TO TABLE 5.2 OF LANDCOM (2004) AND WITH MIN. DIAMETER OF 75mm.
5. ENSURE THAT ANY CONCRETE OR RIPRAP USED FOR THE ENERGY DISSIPATER OR THE OUTLET PROTECTION CONFORMS TO THE GRADING LIMITS SPECIFIED ON THE SWMP.



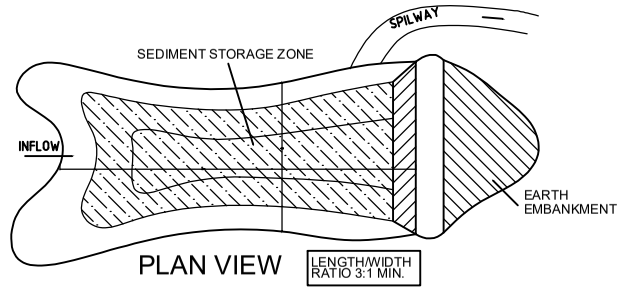
LONGITUDINAL SECTION AA



CROSS SECTION AA

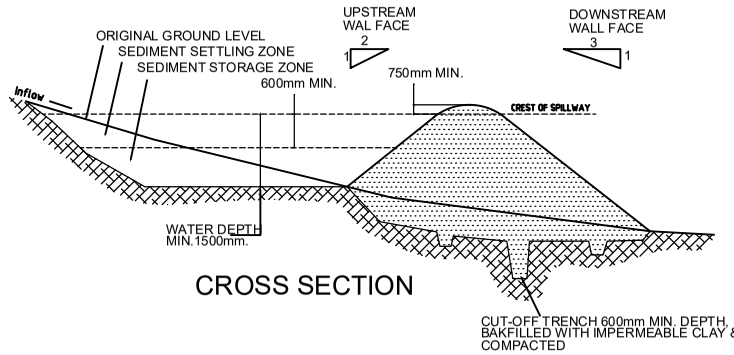
ENERGY DISSIPATER

NOT TO SCALE



PLAN VIEW

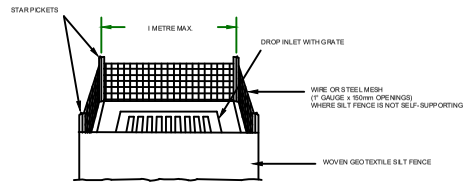
LENGTH/WIDTH RATIO 3:1 MIN.



CROSS SECTION

SILT FENCE TO GRATED DROP INLET PIT

NOT TO SCALE

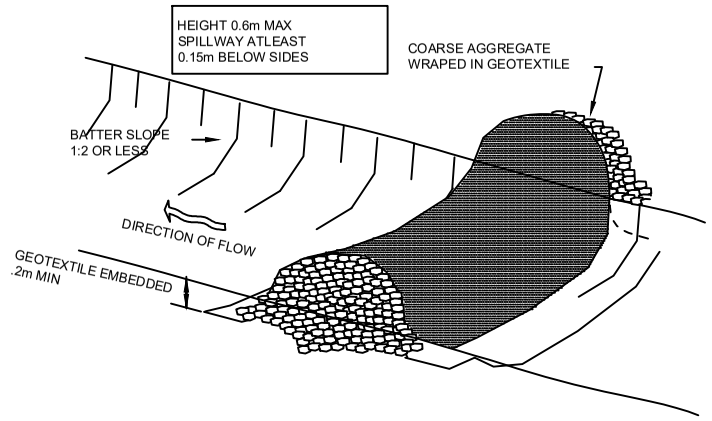


SILT FENCE TO GRATED DROP INLET PIT

NOT TO SCALE

CONSTRUCTION NOTES:

1. FABRICATE A SEDIMENT BARRIER MADE FROM GEOTEXTILE OR STRAW BALES
2. SUPPORT GEOTEXTILE WITH MESH TIED TO POSTS AT 1 METRE CENTRES.
3. DO NOT COVER INLET WITH GEOTEXTILE



CONSTRUCTION NOTES

1. TRENCH STRUCTURE 200mm INTO GROUND SURFACE WHEREVER THE STRUCTURE CONTACTS THE GULLY BASE. FILL TRENCHES TO 100mm ABOVE GROUND SURFACE TO REDUCE RISK OF UNDERCUTTING.
2. ENSURE HEIGHT OF SPILLWAY IS LESS THAN 1m ABOVE THE GULLY FLOOR.

461

TOPSOIL STOCKPILE

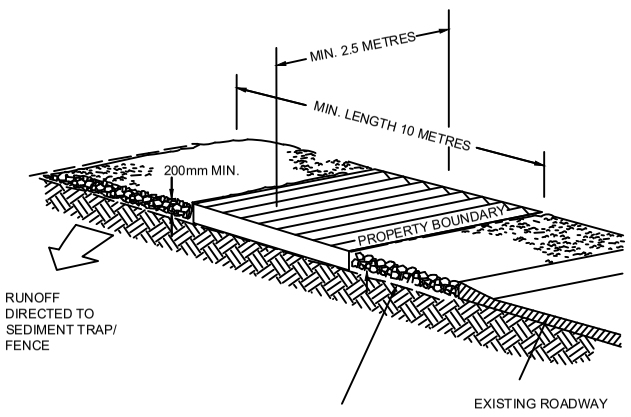
NOT TO SCALE

CONSTRUCTION NOTES

1. WHERE POSSIBLE LOCATE STOCKPILE AT LEAST 5m FROM EXISTING VEGETATION, CONCENTRATED WATER FLOWS, ROADS AND HAZARD AREAS.
2. CONSTRUCT ON THE CONTOUR AS A LOW, FLAT, ELONGATED MOUND.
3. WHERE THERE IS SUFFICIENT AREA TOPSOIL STOCKPILE SHALL BE LESS THAN 2m IN HEIGHT.
4. REHABILITATE IN ACCORDANCE WITH THE SWMP/ESCP.
5. CONSTRUCT EARTH BANK (STANDARD DRAWING 5-5) ON THE UPSLOPE SIDE TO DIVERT RUNOFF AROUND THE STOCKPILE AND A SEDIMENT FENCE (STANDARD DRAWING 6-8) 1 TO 2m DOWNSLOPE OF STOCKPILE.

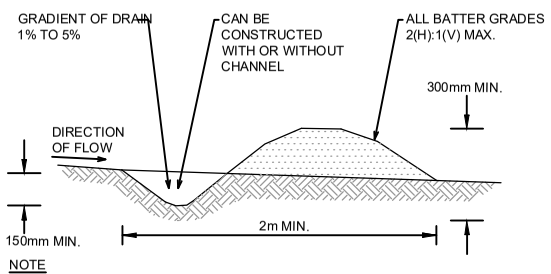
SEDIMENT FENCE

NOT TO SCALE



ROCK CHECK DAMS

NOT TO SCALE



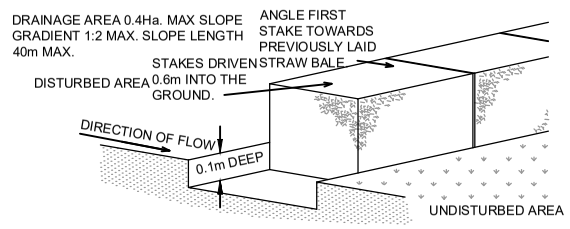
NOTE
ONLY TO BE USED AS TEMPORARY BANK WHERE MAX. UPSLOPE LENGTH IS 80m.

EARTH BANK (LOW FLOW)

NOT TO SCALE

CONSTRUCTION NOTES

1. CONSTRUCT WITH GRADIENT OF 1% TO 5%.
2. AVOID REMOVING TREES AND SHRUBS IF POSSIBLE.
3. DRAINS TO BE CIRCULAR, PARABOLIC OR TRAPEZOIDAL CROSS SECTION NOT V-SHAPED.
4. EARTH BANKS TO BE ADEQUATELY COMPACTED IN ORDER TO PREVENT FAILURE.
5. PERMANENT OR TEMPORARY STABILISATION OF THE EARTH BANK TO BE COMPLETED WITHIN 10 DAYS OF CONSTRUCTION.
6. ALL OUTLETS FROM DISTURBED LANDS ARE TO FEED INTO A SEDIMENT BASIN OR SIMILAR.
7. DISCHARGE RUNOFF COLLECTED FROM UNDISTURBED LANDS ONTO EITHER A STABILISED OR AN UNDISTURBED DISPOSAL SITE WITHIN THE SAME SUBCATCHMENT AREA FROM WHICH THE WATER ORIGINATED.
8. COMPACT BANK WITH A SUITABLE IMPLEMENT IN SITUATIONS WHERE THEY ARE REQUIRED TO FUNCTION FOR MORE THAN FIVE DAYS.
9. EARTH BANKS TO BE FREE OF PROJECTIONS OR OTHER IRREGULARITIES THAT WILL IMPEDE NORMAL FLOW.



STRAW BALE SEDIMENT FILTER

NOT TO SCALE

CONSTRUCTION NOTES

1. COMPACT SUBGRADE
2. COVER WITH NEEDLE PUNCHED GEOTEXTILE.
3. CONSTRUCT 200mm THICK PAD OVER GEOTEXTILE USING ROADBASE OR 30mm AGGREGATE. MINIMUM LENGTH OF 10m AND MINIMUM WIDTH OF 2.5m.GEOTEXTILE MAY BE A WOVEN OR NEEDLE PUNCHED PRODUCT WITH A MINIMUM CBR BURST STRENGTH (AS3706.4-90) of 2500 N.
4. CONSTRUCT HUMP IMMEDIATELY WITHIN BOUNDARY TO DIVERT WATER TO A SEDIMENT FENCE OR OTHER SEDIMENT TRAP.

SHAKE DOWN AREA

NOT TO SCALE

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
A	75% ISSUE FOR CLIENT REVIEW	15/06/16	SA	SA	DH	AW
B	AMENDED ROAD WIDTH & SITE NUMBERS	20/06/16	SA	SA	DH	AW
C	ISSUE FOR CLIENT REVIEW	24/06/16	SA	SA	DH	AW

SCALES:

DO NOT SCALE FROM DRAWING

DRAWN BY: S.ADAM
DESIGN BY: S.ADAM
APPROVED BY:
DATE:

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PLANIT ENGINEERING
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TELEPHONE: 02 6687 4666
ABN: 99 613 049 568
EMAIL: admin@planitengineering.com.au

CLIENT: LIVING GEMS
C/- PLANNERS NORTH
3/ 69 CENTENNIAL CIRCUIT
BYRON BAY, NSW, 4281

LOCAL GOVERNMENT AUTHORITY: BALLINA SHIRE COUNCIL

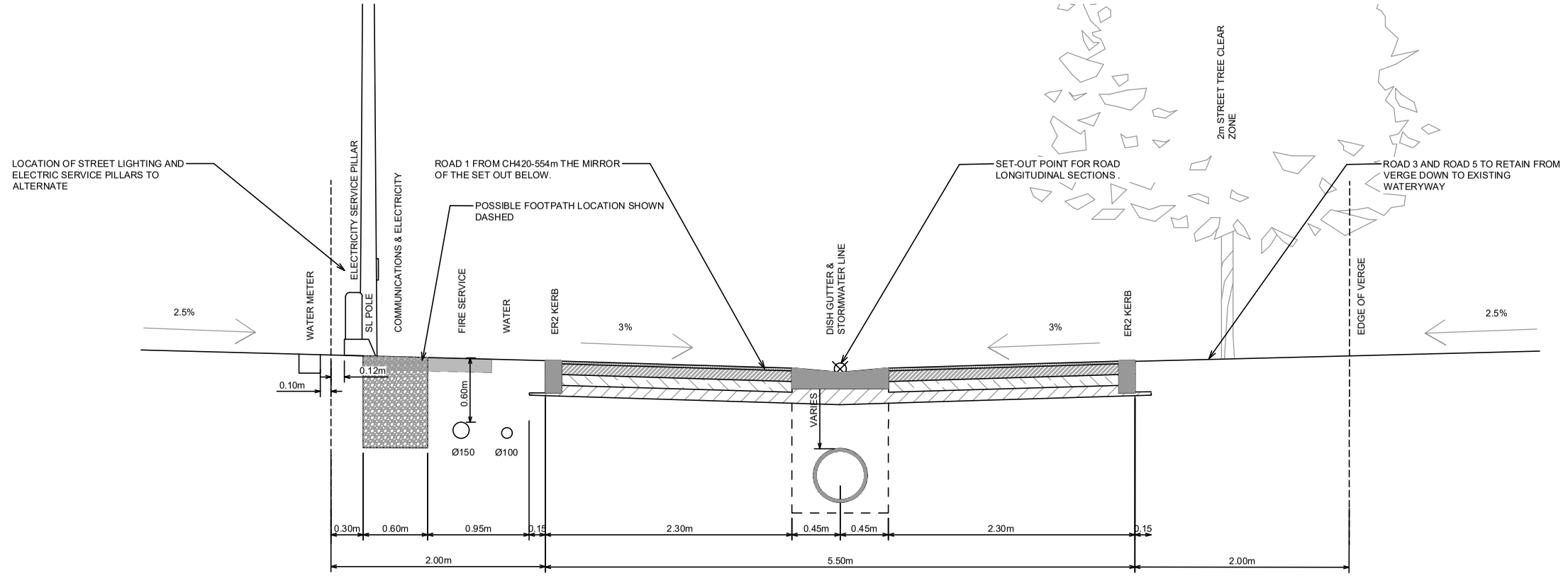
PROJECT: 67 SKENNARS HEAD ROAD

DRAWING TITLE: EROSION AND SEDIMENT NOTES

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	0022	C

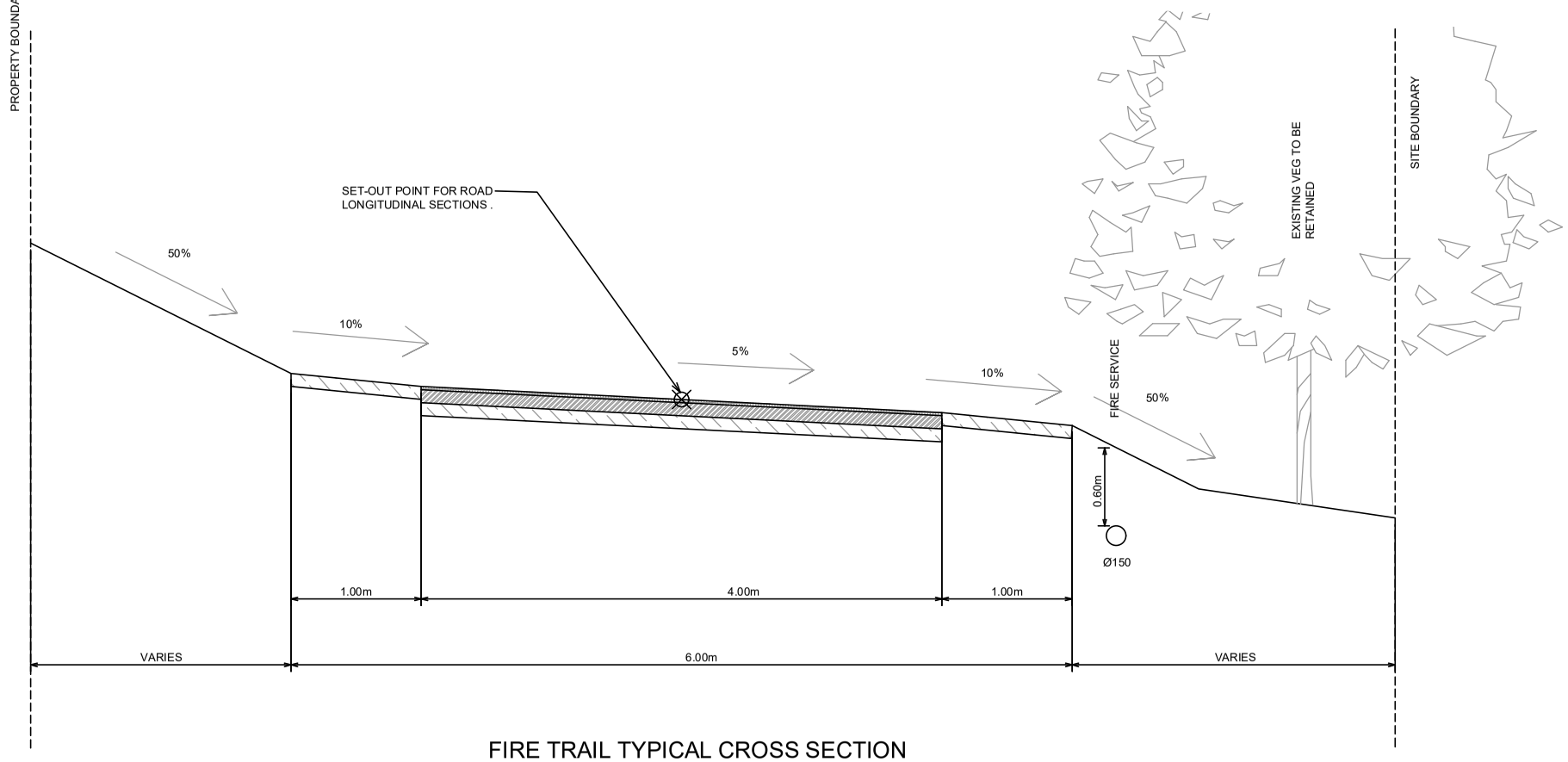
CAD FILE: T:\J107 - 67 SKENNARS HEAD ROAD - DA\6 - CAD\J107-0022.DWG PLOTTED BY: STEPHENA PLOT DATE: 23/05/2018 2:17:00 PM

100mm AT ORIGINAL SIZE



ROAD 2 - ROAD 9 TYPICAL CROSS SECTIONS

SCALE: 1:25 @ A1, 1:50 @ A3



FIRE TRAIL TYPICAL CROSS SECTION

SCALE: 1:25 @ A1, 1:50 @ A3

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
A	75% ISSUE FOR CLIENT REVIEW	24/02/17	SA	SA	AW	AW
B	LOT LAYOUT AMENDED TO COUNCIL COMMENTS	10/04/18	SA	SA	AW	AW

SCALES:
0 0.25 0.5 1.0 1.5
Full Size 1:25 ; Half Size 1:50
Scale (m)
DO NOT SCALE FROM DRAWING

DRAWN BY: S.ADAM
DESIGN BY: S.ADAM
APPROVED BY:
DATE:
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PLANIT ENGINEERING
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CLIENT:
LIVING GEMS
C/- PLANNERS NORTH
3/ 69 CENTENNIAL CIRCUIT
BYRON BAY, NSW, 4281

LOCAL GOVERNMENT AUTHORITY:
BALLINA SHIRE COUNCIL

PROJECT:
67 SKENNARS HEAD ROAD

DRAWING TITLE:
ROADWORK TYPICAL CROSS SECTION
SHEET 3 OF 3

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	0023	B

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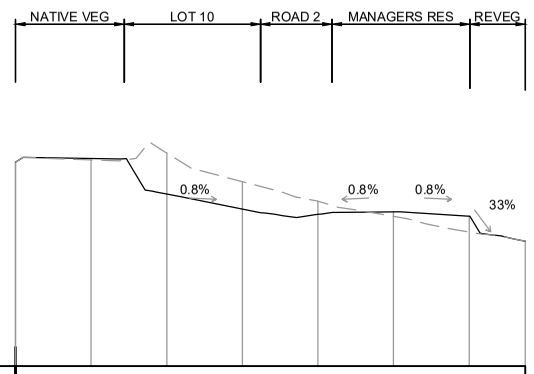
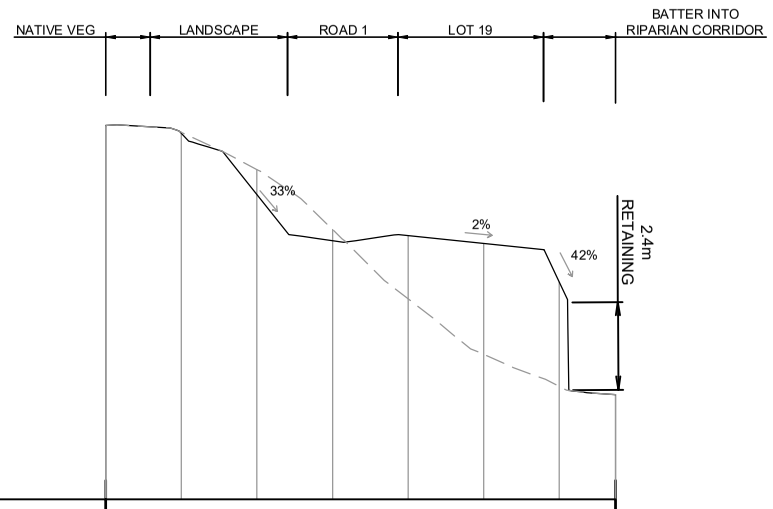


SCALE: 1:500H, 1:100V
DATUM: 4.00

HORIZONTAL GEOMETRY		L: 71.509							
		009° 01' 02"							
DESIGN LEVELS	9.39	9.49	8.55	8.16	8.01	8.08	7.97	7.31	
CUT/FILL DEPTHS	0.00	0.04	-1.09	-0.73	-0.35	0.11	0.42	0.00	
EXISTING LEVELS	9.39	9.46	9.64	8.88	8.36	7.96	7.54	7.31	
CHAINAGE	0	10	20	30	40	50	60	67	

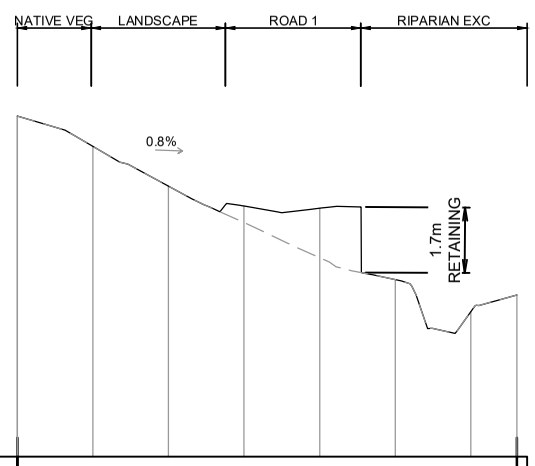
SECTION A LONG SECTION



SCALE: 1:500H, 1:100V
DATUM: 0.00

HORIZONTAL GEOMETRY									
DESIGN LEVELS	9.89	9.68	8.06	6.84	6.98	6.77	5.74	2.77	
CUT/FILL DEPTHS	0.00	-0.03	-0.67	-0.30	1.67	2.93	2.76	0.00	
EXISTING LEVELS	9.89	9.71	8.72	7.14	5.30	3.83	2.99	2.77	
CHAINAGE	0	10	20	30	40	50	60	67	

SECTION B LONG SECTION



SCALE: 1:500H, 1:100V
DATUM: -2.00

HORIZONTAL GEOMETRY									
DESIGN LEVELS	7.01	6.20	5.15	4.63	4.57	2.68	1.84		
CUT/FILL DEPTHS	0.00	0.00	0.00	0.44	1.31	0.00	0.00		
EXISTING LEVELS	7.01	6.20	5.15	4.19	3.26	2.68	1.84		
CHAINAGE	0	10	20	30	40	50	60	67	

SECTION C LONG SECTION

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
A	LOT LAYOUT AMENDED TO COUNCIL COMMENTS	23/05/18	SA	SA	AW	AW

SCALES:
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Full Size 1:500 ; Half Size 1:1000
Scale (m)
0 1 2 4 6
Full Size 1:100 ; Half Size 1:200
Scale (m)
DO NOT SCALE FROM DRAWING

DRAWN BY: S.ADAM
DESIGN BY: S.ADAM
APPROVED BY:
DATE:
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ABN: 99 613 049 568
EMAIL: admin@planitengineering.com.au

CLIENT:
LIVING GEMS
C/- PLANNERS NORTH
3/ 69 CENTENNIAL CIRCUIT
BYRON BAY, NSW, 4281

LOCAL GOVERNMENT AUTHORITY:
BALLINA SHIRE COUNCIL

PROJECT:
67 SKENNARS HEAD ROAD

DRAWING TITLE:
HILL SECTIONS

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	0024	A

CAD FILE: T:\J107 - 67 SKENNARS HEAD ROAD - DA\6 - CAD\J107-0024.DWG PLOTTED BY: STEPHENA PLOT DATE: 23/05/2018 2:20:26 PM

BUILDER: GTH PROJECT NO 4 PTY LTD
WMS CHARTERED ACCOUNTANTS
SUITE 1401, LEVEL 14, THE ROCKET,
203 ROBINA TOWN CENTRE DRIVE, ROBINA QLD 4226
PO BOX 8087, GOLD COAST MAIL CENTRE QLD 9726
PH (07) 3804 7833
EMAIL: ADRIAN@GEMLIFE.COM.AU
QBCC LICENCE NUMBER: 15029129

AMENDMENTS: DATE/ ISSUE

A. 04.11.17	G. 19.03.18	M. 23.04.18
B. 06.11.17	H. 22.03.18	N. 11.05.18
C. 06.11.17	I. 28.03.18	O. 21.05.18
D. 23.02.18	J. 07.04.18	
E. 24.02.18	K. 09.04.18	
F. 01.03.18	L. 10.04.18	

GENERAL NOTES

ALL WORK TO COMPLY WITH THE POSITIONS OF THE BCA AND NCC OF AUSTRALIA, AUSTRALIAN STANDARDS AND ANY BYLAWS OR REQUIREMENTS OF THE LOCAL AUTHORITY.

USE FIGURED DIMENSIONS ONLY.
DO NOT SCALE - VERIFY ALL DIMENSIONS PRIOR TO ORDERING OR SHOP FABRICATION.
IF IN DOUBT ASK.

PLEASE READ CAREFULLY

THIS PLAN CERTIFIED CORRECT IS THE ONE REFERRED TO IN THE CONTRACT & SPECIFICATIONS AND I UNDERSTAND CHANGES HEREAFTER MAY NOT BE POSSIBLE. THESE SUPERCEDE ALL OTHER PREVIOUS PLANS OR SKETCHES.

OWNER/S ____________________

WITNESS ____________________ DATE ________

CLIENT: GemLife

SITE: 67 SKENNARS HEAD ROAD LENNOX HEAD

MODEL: SITE PLAN

JOB NO.: LH-01

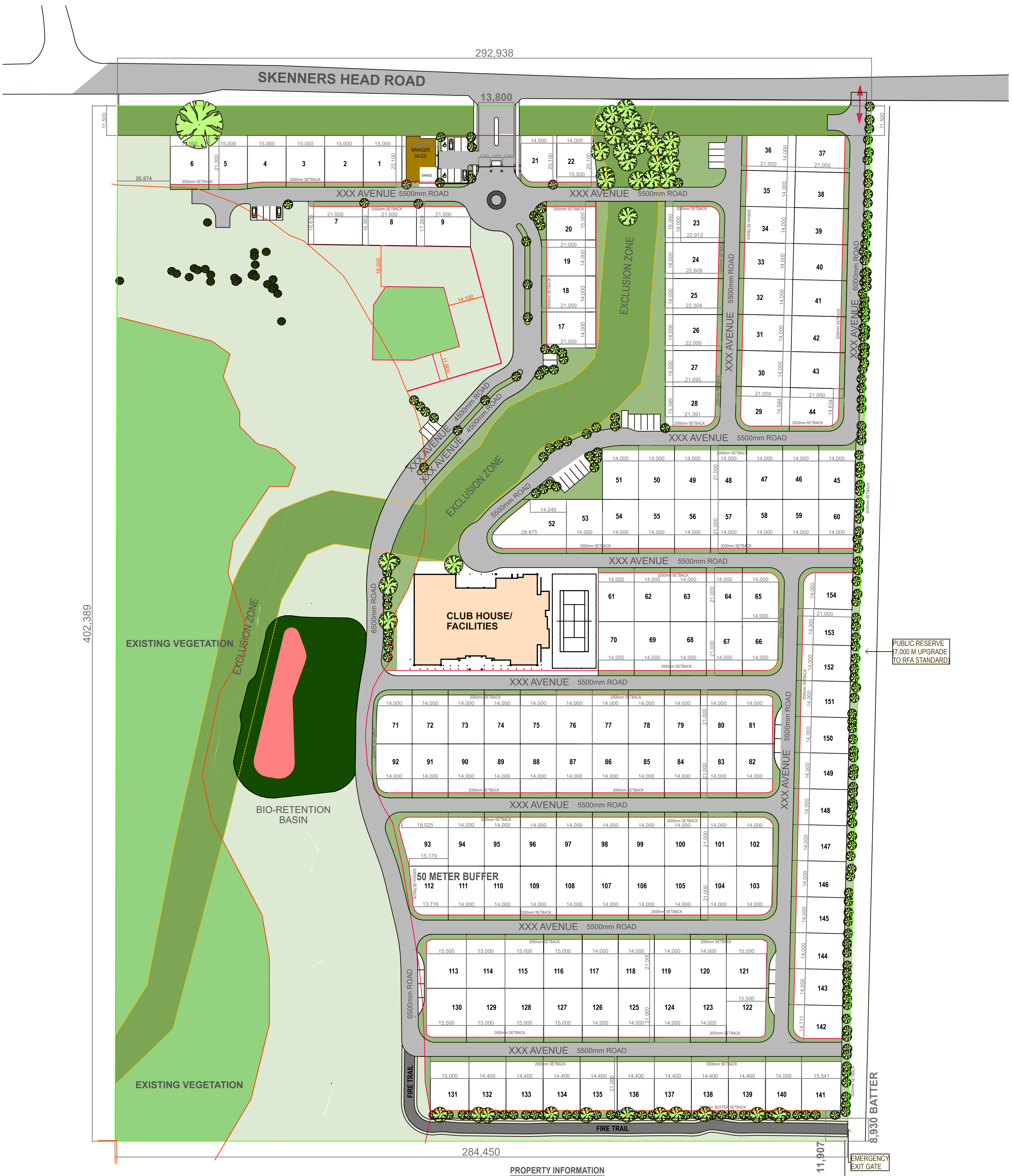
ISSUE DATE: 21/05/18

ISSUE: O

SHT NO.: 1 OF 1

DRAWN: FJ

GemLife LENNOX HEAD



SCALE 1:1500 @ A3

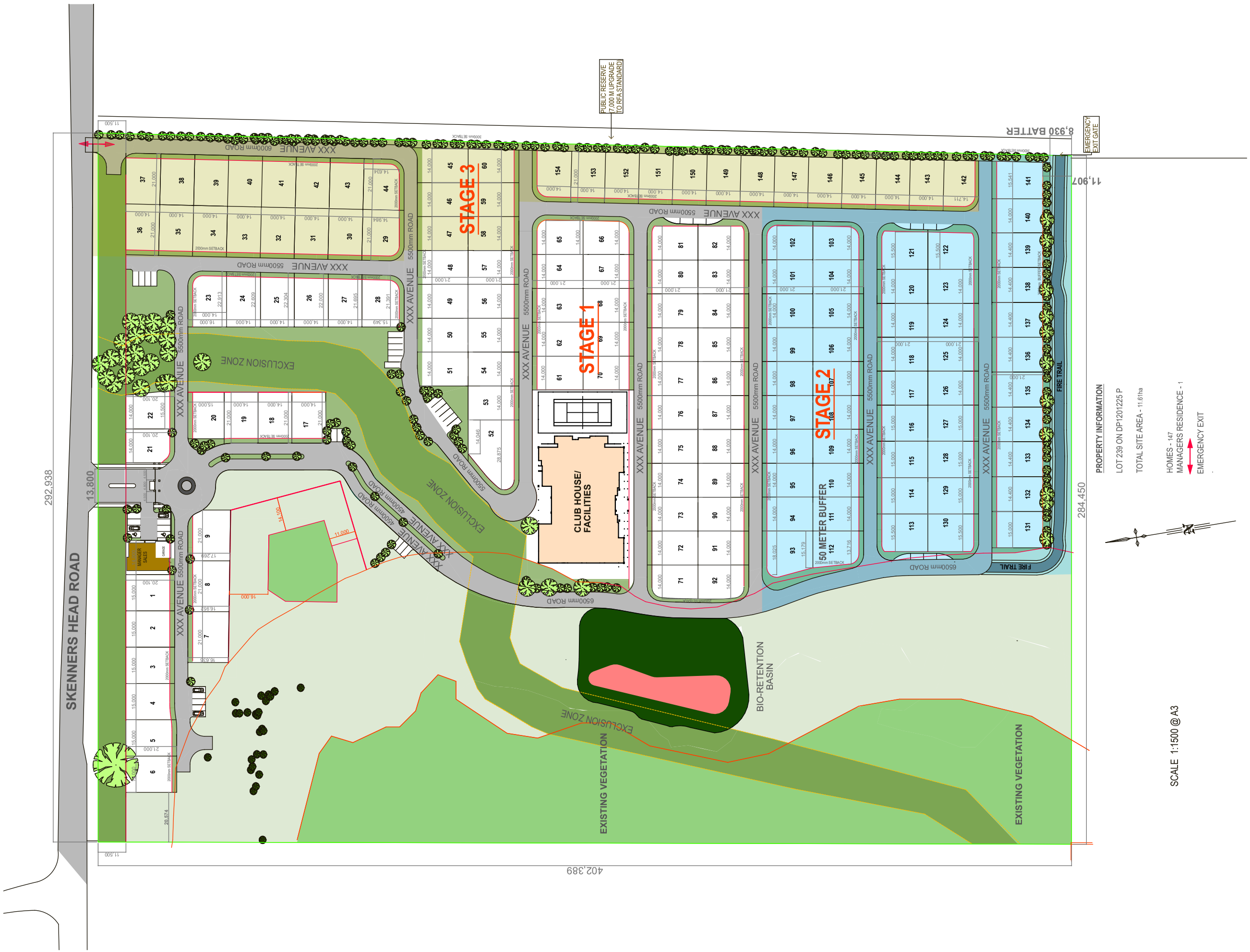
PROPERTY INFORMATION

LOT 239 ON DP1201225 P

TOTAL SITE AREA - 11.61ha

HOMES - 147
MANAGERS RESIDENCE - 1

EMERGENCY EXIT



BUILDER: GTH PROJECT NO 4 PTY LTD
WMS CHARTERED ACCOUNTANTS
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PO BOX 8087, GOLD COAST MAIL CENTRE QLD 9726
PH (07) 3804 7833
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QBCC LICENCE NUMBER: 15029129

AMENDMENTS: DATE/ ISSUE

A. 04.11.17 G. 19.03.18 M. 23.04.18
B. 06.11.17 H. 22.03.18 N. 11.05.18
C. 06.11.17 I. 28.03.18 O. 21.05.18
D. 23.02.18 J. 07.04.18
E. 24.02.18 K. 09.04.18
F. 01.03.18 L. 10.04.18

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OWNER/S _____

WITNESS _____ DATE _____

CLIENT: GemLife

SITE: 67 SKENNARS HEAD ROAD
LENNOX HEAD

MODEL: SITE PLAN STAGING PLAN	**ISSUE:** O
JOB NO.: LH-02	**SHT NO.:** 1 OF 1
ISSUE DATE: 21/05/18	**DRAWN:** FJ

GemLife
LENNOX HEAD


466
detention basin
CLUB HOUSE/ FACILITIES
EXISTING VEGETATION
DRIPLINE
TREE DRIPLINE
BIO-RETENTION BASIN
FIRE TRAIL
Surveyed edge of littoral rainforest
APZ 30 m from rainforest edge
APZ 50 m from forested wetland (Kieth 2004)
SEPP 14
Freshwater wetland (0.17 ha)
Littoral rainforest establishment (0.72 ha)
Littoral rainforest
Broad-leaved paperbark
Edge of vegetation (Kennedy Surveyors)
Forested wetland
Ecotone: planted rainforest-retained broad-leaf paperbark
Landscaping broad-leaf paperbark and rainforest plantings
0
20
40
80
Meters
1:2,000
N

TECHNICAL REPORT 8

Stormwater Management

Stormwater Management Plan
67 Skennars Head Road, Skennars Head, NSW

Living Gems
c/- Planners North

Planit
May 2018
Document No: J107-RPT03

Document Status

Version	Document type	Reviewed by	Checked by	Date Issued
1	Report	DH	AW	11-08-2016
2	Report	TV	AW	24/02/2017
3	Report	TV	AW	19/06/2017
4	Report	SA	AW	17/07/2017
5	Report	SA	AW	23/05/2018

Project Details

Project Name:	67 Skennars Head Road
Client:	Living Gems C/- Planners North
Client Project Manager:	Adrian Puljich, Steve Connelly
Authors:	Stephen Adam, Tim Veness
Planit Reference:	J107-RPT03

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ABN 99 613 049 568
Suite 9a, 80-84 Ballina Street
Lennox Head NSW 2478
(PO Box 161, Lennox Head NSW 2478)
Telephone – 02 6687 4666
admin@planitengineering.com.au

CONTENTS

EXECUTIVE SUMMARY

The purpose of this assessment is to identify the stormwater and drainage requirements to service the proposed seniors living development at 67 Skennars Head Road, Skennars Head NSW including quality treatment, flooding and sediment and erosion control.

The proposed development consists of a 147-lot (excluding the manager's residence) seniors living village has been proposed on a rural property currently containing a single dwelling and corresponding driveway, a SEPP 14 Wetland in the South West and an open paddock.

It is proposed that on-site runoff is directed to one of three discharge points. The first to the existing riparian corridor adjacent the existing culvert crossing into the subject site. The second to the riparian corridor centrally to the site via a proposed bioretention basin. Finally, the southern proposed fire trail will sheet flow to the south into the existing drainage channel running parallel to the southern boundary.
The site will utilise stormwater detention to mitigate the Q5 to Q100 storm event for storms ranging in duration from 5 minutes to 3 hours in accordance with the Northern Rivers Local Governments Stormwater Design Guidelines. The major Q100 flow will be directed along the major flow routes as shown in the DA drawings. The basin will require a volume of approximately 2200m^3 to achieve the predevelopment flows.

The subject site also contains a waterway subject to a controlled activity permit running from its northern boundary through to the SEPP 14 wetland to the west. A 20m Riparian buffer zone has been proposed to protect this existing waterway from any construction activities, re-shaping, or alteration. Conveyance of upstream stormwater through the subject site is proposed within this riparian zone. Minor retaining outside the riparian buffer zone may be required to ensure the Q100 Year ARI storm event + 300mm freeboard are fully contained.

Two scenarios were investigated in MUSIC including the existing case and the developed case. The proposed stormwater management strategy for the developed case was found to provide adequate pollutant removal efficiencies with respect to chapter 2 of BSC's 2012 Development Control Plan (DCP). This treatment train contains a basins 630m^2 bioretention footprint, a GPT for sediment pre-treatment, and a minimum of 35 Lineal meters of 0.60m wide bioretention swale.

The preliminary basin has been designed as a wet/dry bioretention/detention basin where all stormwater is either infiltrated through the filer media or discharged via the outlet culverts for stormwater events over the Q3 month. Preliminary calculations have indicated the basin will fully discharge and/or infiltrate its volume within a 24-hour period which satisfies councils requirement for the prevention of mosquitos.

Sediment and erosion shall be controlled using suitable management techniques in accordance with 'Soils and Construction Volume 1 – Managing Urban Stormwater' Landcom and includes the use of silt fences, filter bags, diversion drains, rock check dams, stabilised site access, vehicle wash down areas and three Type F sediment basins.

Based on the results of the assessment and the information provided by the relevant authorities, it was concluded that any adverse stormwater effects that are the resultant of the proposed development can be adequately mitigated in an economical and sustainable manner.

1. INTRODUCTION

1.1. BACKGROUND

A 147-lot senior living development is proposed on a rural site located at 67 Skennars Head NSW. This Stormwater Management Plan has been prepared to support the Development Application and to ensure that the development's impact is minimised.

1.2. SCOPE AND OBJECTIVES

This Stormwater Management Plan has been completed to mitigate potential worsening in hydraulic and hydrologic conditions that may be the result of the proposed residential development. The scope of this document includes: runoff quantities, stormwater quality, flooding, and sediment and erosion control. The objectives of this stormwater management plan are to:

- Define a treatment train to ensure that adverse effects in stormwater quality that are the result of the development are adequately mitigated.
- Ensure compliance with all relevant standards including Ballina Shire Council standards, Queensland Urban Drainage Manual, and 'Water by Design' Water Sensitive Urban Design standards.
- Ensure that the subject site is not adversely affected by flooding and that no adverse changes in downstream flooding behaviour are the resultant of the development.
- Ensure that there is no worsening of stormwater quality nor any reduction in the environmental values of the downstream receiving waters during the construction and operational phase of the development.

1.3. STRUCTURE

Section two contains a summary of the characteristics of the site including a development description and summary of land use. Section three contains hydrological analysis and pipe flow capacity checks. Required stormwater quality treatment is addressed in section four. In section five, A summary of the detailed flood study which has been undertaken by WBM BMT for the proposed development is provided. Finally, a sediment and erosion control strategy for the construction phase is proposed in section six.

2. SITE ASSESSMENT

2.1. SITE DESCRIPTION

The subject site (Figure 1) is located at Skennars Head, NSW within the Ballina Shire Council (BSC) local government area. The site is legally described as Lot 239 on DP1201225 and will from here on be referred to as 67 Skennars Head Road. The site has a total area of 11.6ha and is located approximately 3.2km to the south of Lennox Head Town Centre. The site currently contains a single dwelling, sheds and corresponding driveway, a SEPP 14 Wetland in the South West and open paddock for the remainder. The subject site also contains a waterway subject to a controlled activity permit running from its northern boundary through to the SEPP 14 wetland to the west. Situated parallel to the western boundary on the subject site are a nature reserve, wetlands and a bushfire buffer zone. Accordingly, the area suitable for development is approximately 7.63ha (2/3^{rds} of the total site).

Figure 1 | Proposed Development Site

2.2. DEVELOPMENT DESCRIPTION

The proposed seniors living development consists of:

- 148 residential lots: predominantly with 14m street frontages and 270m^2 in plan area including an:
  - on-site manager's residence;
  - 147 seniors living residential lots.
- Internal roads network consisting of approximately 165m of 9m wide road carriageway with intermittent median island (including entry statement with queuing length), 239m of 6.5m wide road carriageway, 135m of 6.0m wide road carriageway, 205m of 6m wide fire trail, and 1459m of 5.5m wide road carriageway;
- Visitor car parking: approximately 795m^2 in total area;
- Two truck turnarounds of 390 m^2 in total area;
- On-site clubhouse: total roof area is approximately 1690m^2;
- Tennis Court: total area is approximately 616m^2

The total roof area, hardstand area and landscaped area of the proposed development were based on the site layout seen in Appendix A1 and Appendix A2. It should be noted that only the developed part of the site (i.e. 7.63ha was considered) and the figures below are consistent with table 4.5.1 of QUDM for a high density residential development.

- Roof Area: 2.62ha (100% Impervious);
  - Seniors living dwellings (60% of lots): 2.45ha
  - Clubhouse site & Site office: 0.17ha
- Vehicle Hardstand Area (Roads & Driveways) 3.11ha (60% Impervious):
  - Roads and car parking area: 2.29ha
  - Estimated 20% of the lots: 0.82ha
- Landscaped Area: 1.90ha (25% Impervious):
  - Estimated 20% of the lots: 0.82ha
  - Designated landscaped areas: 1.02ha
  - Tennis Courts: 0.062ha

The site falls towards the south-western boundary and contains an open drain collecting runoff from an external catchment consisting of Skennars Head Road, upstream residential lots and the Skennars Head Sporting Fields. A 20m Riparian buffer zone has been proposed to protect this existing waterway from construction activities, re-shaping, or alteration (with allowance for minor shaping into culverts at proposed road crossings). Conveyance of upstream stormwater through the subject site is proposed within this riparian zone. A second open drain is located outside the subject site parallel to the southern boundary servicing an adjacent development. A copy of the rainfall intensities used for this analysis is seen below.

Table 1 | Skennars Head IFD

Duration	Average Recurrence Interval:						
	1	2	5	10	20	50	100
5 min	123	155	188	206	231	264	288
6 min	115	145	176	193	217	248	271
10 min	94.1	119	145	159	180	205	224
20 min	68.9	87.1	107	118	133	152	167
30 min	56.1	71.1	87.6	96.7	109	126	138
1 hr	38.0	48.3	60.0	66.5	75.5	87.0	95.6
2 hrs	24.6	31.5	39.5	44.0	50.2	58.2	64.2
3 hrs	18.9	24.2	30.5	34.2	39.1	45.5	50.3
6 hrs	11.9	15.3	19.6	22.1	25.4	29.8	33.1
12 hrs	7.68	9.92	12.8	14.6	16.8	19.8	22.0
24 hrs	5.14	6.65	8.65	9.83	11.4	13.4	15.0
48 hrs	3.46	4.48	5.83	6.64	7.69	9.08	10.1
72 hrs	2.64	3.43	4.47	5.1	5.91	6.99	7.82

3. STORMWATER CONVEYANCE

3.1. ONSITE DETENTION

Provision for on-site detention has been made within the development to mitigate the Q5 minor storm event in accordance with Northern Rivers Local Government DCP. The major Q100 flow will be conveyed along the major flow routes as shown in the DA drawings.

3.2. UPSTREAM CONVEYANCE

There is an existing 900mm diameter reinforced concrete pipe that currently discharges to the subject site adjacent the entrance to the Lennox Soccer Fields Car Park (as seen in Appendix A4 drawing J107-SK002 Upstream Stormwater Catchment Plan). The discharging stormwater from the pipe entering the subject site flows through an open channel waterway that has been deemed a waterway subject to a controlled activity permit. Approval to alter the waterway must be granted before any works commence on site within the 20m wide footprint of the current waterway.

In accordance with the recommendations from BSC a 20m Riparian Buffer zone has been placed over the existing waterway. This waterway will remain unaltered except for two proposed road crossings. As per the revised internal layout (Appendix A1 Drawing J107-0016) these two proposed internal roads will cross this existing waterway at an angle approximately perpendicular to the current flow. In accordance with section 7.3.1 of QUDM the two culvert crossings have been designed to convey the 10 Year ARI storm event, while major overland flow will overtop the road. Minor shaping either side of the culvert will be required to ensure flow through the culverts, prevent localised ponding and achieve suitable batters back to the proposed road.

In the interests of pollutant reduction and water sensitive urban design no untreated stormwater from the subject site will mix with the upstream water being conveyed through site. As such, all onsite stormwater will be directed to either proposed bioretention basin or proposed bioretention swale.

3.3. UPSTREAM CATCHMENT ANALYSIS

The Upstream Stormwater catchment plan (Appendix A4 drawing J107-SK002 Upstream Stormwater Catchment Plan) details the extent of the catchment area contributing to the subject site, there is an approximate area contributing to this pipe of 17.2ha with a conservative area of imperviousness assumed to be 70%. To simulate flows entering the site a DRAINS ILSAX network was modelled as seen below in Figure 2. However, due to the size of the upstream catchment the ILSAX model will over-estimate flows and was used as a preliminary guide only. For a detailed analysis of the upstream catchment and flows through the site refer to Appendix C by WBM BMT.
The following drains assumptions where made in order to determine the Q_{100} Year ARI Event flow required to be conveyed through site:

- As per section 7.3.1 of QUDM for a cross drainage culvert under a minor road, the existing pipe crossing Skennars Head Road was initially assumed to have capacity to cater for the Q_{10} year ARI event. After detailed survey by Kennedy's Surveying from the 4/04/2018 the upstream detention basin was found to have approximately 1500m^3 of detention storage. When the upstream stormwater ponds to a level of approximately 3.9m AHD the flow will overtop a ridge line in the swale in the verge of Skennars Head Road and flow east to an existing swale outside the eastern boundary of the neighbouring Big 4 Caravan Park.
- The 900mm pipe crossing under Skennars Head Road was confirmed by Kennedy Surveying to have a slope of -0.5% corresponding to a full flow of 1.76 m^3/s. The existing area of imperviousness upstream is approximately 40%. In the event of future development this figure may be as high as 70%. The existing 900mm pipe was assumed to have been designed for the current conditions.
- The Q_{100} year ARI event assumes that 1.76m^3/s will flow through the piped network and the remainder will flow overland conveyed in the swale and northern road reserve of Skennars Head Rd to the east

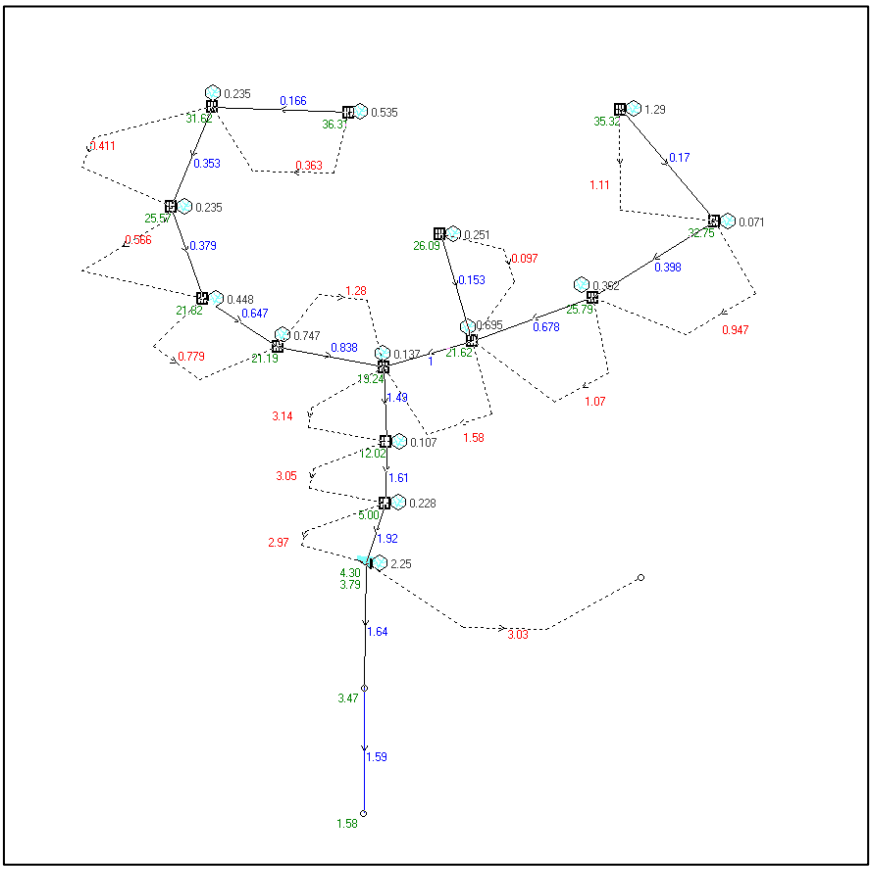

Figure 2 | Q_{10} YEAR ARI UPSTREAM EVENT

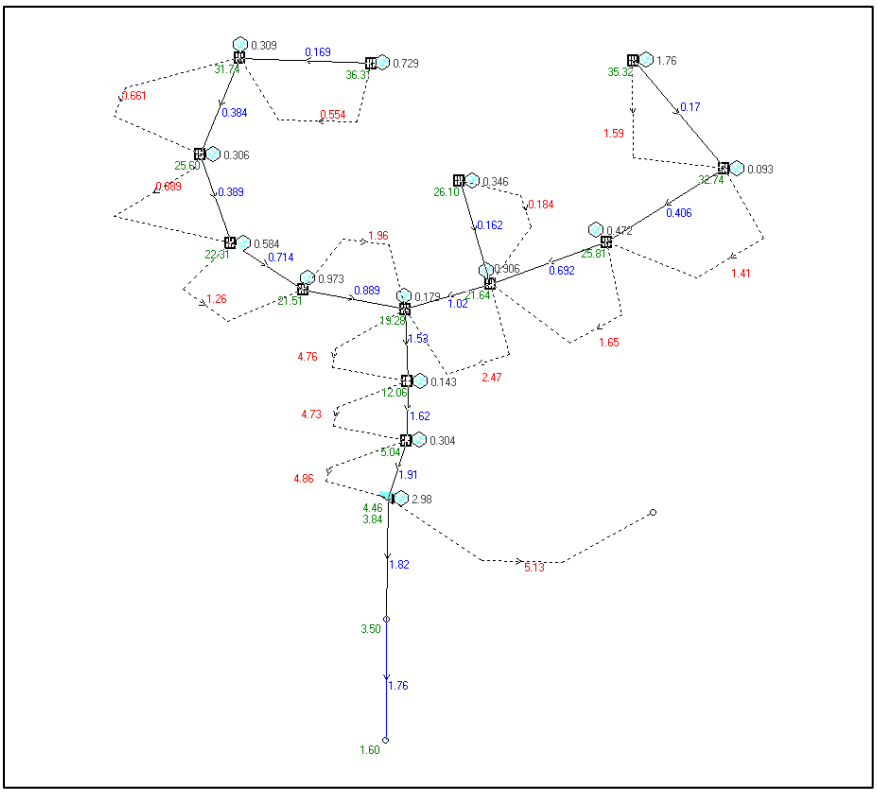

Figure 3 | Q_{100} YEAR ARI UPSTREAM EVENT

As seen in the conservative results above 1.76m^3/s must be safely conveyed through the site while maintaining a safe flow X depth velocity of less than 0.4m2/s and safe flow depths of less than 0.2m at both road crossings as per Northern Rivers Stormwater Drainage Design Manual. To achieve safe flow X depth velocities over the internal roads 1200mm by 900mm wide preliminary box culvert road crossing culverts have been proposed. The invert of the 900mm pipe crossing Skennars Head Road was modelled at an I.L of 2.87 in accordance with survey information provided by Kennedy Surveyors.

3.4. FREEBOARD

A minimum freeboard of 300mm above the Q100 Year ARI flow level needs to be achieved in the dwellings adjacent to the proposed overland flow channel. Figure 4 below demonstrates the Q100 flow level above the invert of the drainage channel. To ensure no overtopping of the banks during a Q100 Year ARI storm event a 100mm high batter may be required outside the footprint of the riparian buffer zone. The following assumptions were made when determining the capacity of the existing waterway:

Manning's n: 0.15 for a vegetated swale with bank and overbank vegetation (not grassed) with little or no vines and little or no ongoing maintenance (conservative)
Depth d: 0.80m
Longitudinal slope: 0.7%
Width a: 20m
Flow Q: 1.76 m^3/s

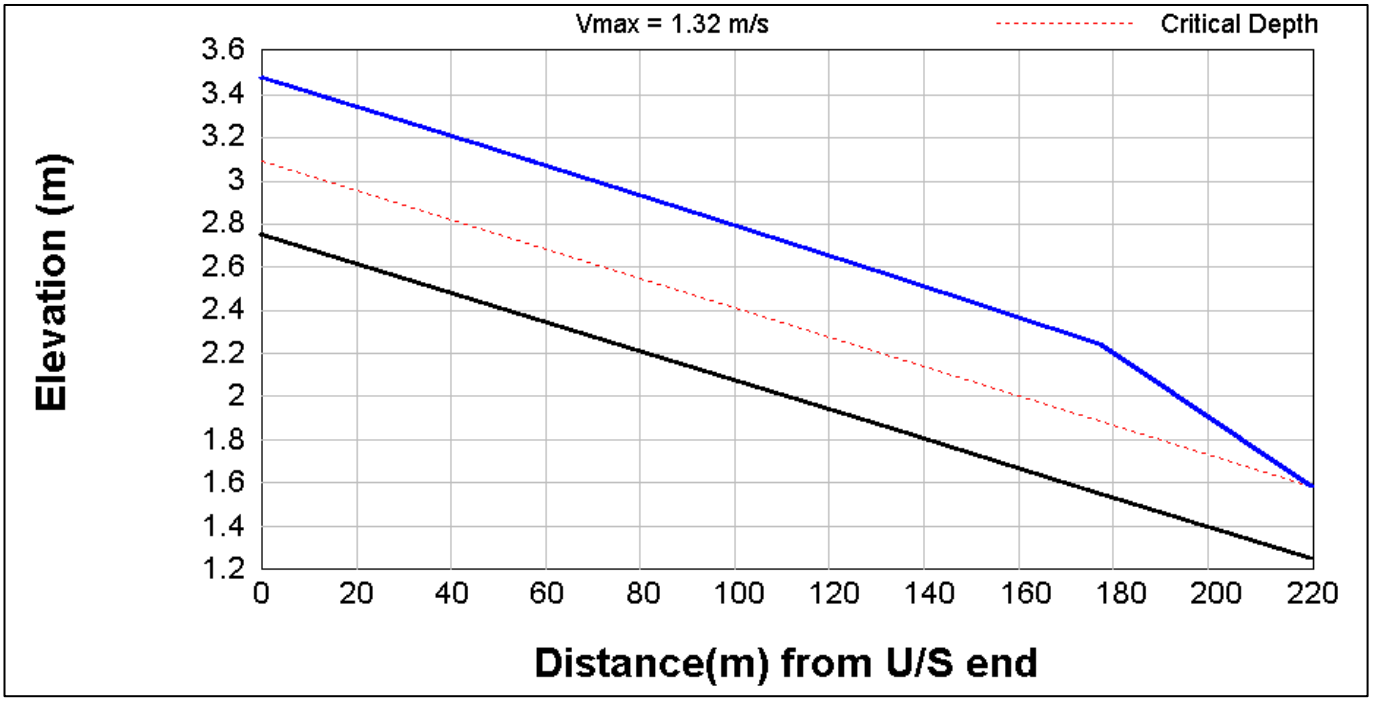

Figure 4 | Q_{100} YEAR WATERWAY LONG SECTION

3.5. INTERNAL STORMWATER DESIGN

The Drains models shown below (Figure 5 & Figure 6) were set up to provide approximate discharge rates from the subject site, provide preliminary outlet levels and gauge preliminary detention volumes required to cater for the 5, 10, 20 50 and 100 Year ARI events, for durations from 5 minutes to 3 hours as per Northern Rivers Handbook of Stormwater Design Manual condition 12.02.5. The results show flow from the basin discharge combined with flows generated upstream on the development site bypassing the basin as well as swale flows from the north east corner of the site.

The key features of the Drains analysis:

- Drains has been modelled as per Figure 5 & Figure 6
- ILSAX Model inputs per Table 2
- Times of concentration have been adopted from Friends Equation based on QUDM Table 4.6.4 which states that flat (0-1%) bushland or grassland will sheet flow for up to 200m length before forming concentrated

flow (conservative for pre-development). Preliminary pipe and channel flow times have been adopted from Figure 4.8 of QUDM.

- Pre and Post Development Catchment breakdowns per Appendix B. The roofs post development has been modelled in Drains as supplementary (impervious).
- The Rainfall-Intensity-Frequency data as per Table 1 above has been adopted.
- No extended detention depth (300mm) of the bioretention basin has been modelled for detention storage as per Water by Design Bioretention Technical Design Guideline.
- On site detention storage has been adopted within the bioretention basins. A freeboard of 300mm above the Q100 pond level has been adopted to the crown of the main access road. In large events even flow across the western embankment has been modelled to encourage thin sheet flow into the existing riparian corridor rather than concentrated channel flow.
- As per section 5.8.1 of QUDM the design of outlets from the basins have adopted a multi-level approach in order to achieve the pre-development storms for a range of events. A low flow outlet of 225mm will need to be placed at the invert of an outlet pit ~ 0.6m AHD. A high flow pipe of 400mm was designed either in an adjacent pit at an invert of 0.6m AHD or a headwall through the embankment at an invert of 1.5m AHD. A low flow and high flow weir were adopted in an effort to mimic the pre-development flows for the full range of events. However, as Northern Rivers Local Government Handbook of Stormwater Design states they are only concerned with storms from the 5 year ARI to the 100 year ARI from storms ranging from 5 minutes to 3 hours.

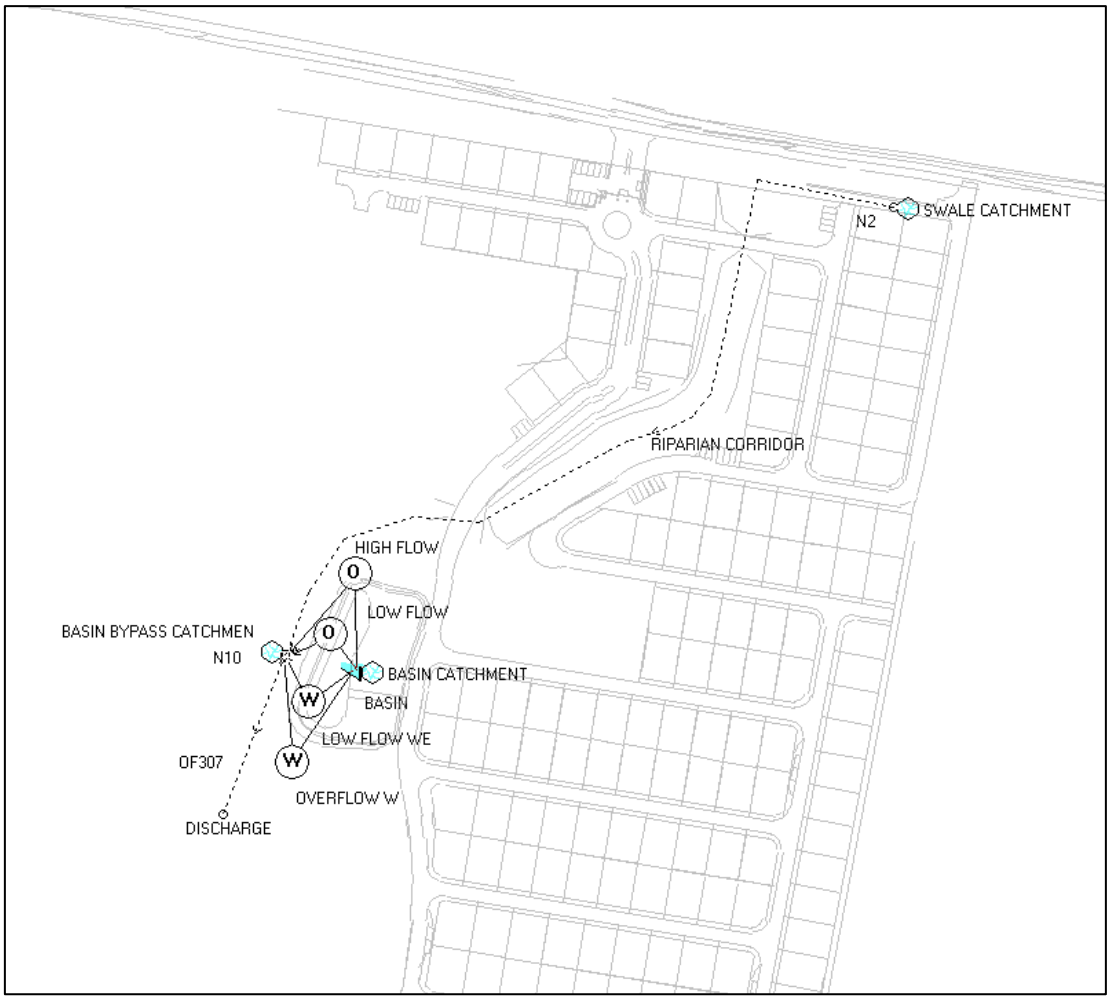

Figure 5 | DRAINS INTERNAL MODEL

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Figure 6 | Q_{100} YEAR PEAK RESULTS (PRE RIGHT vs POST LEFT)

Table 2 | ILSAX Rainfall Lose Parameters

Parameter	Input
Impervious depression storage	1mm
Supplementary depression storage	1mm
Pervious (grassed depression storage	5mm
Soil type (sand)	2.0
Antecedent Moisture Content	3.0

3.6. RESULTS

The pre vs post development peak flows can be seen in Table 3. Peak flows have been limited to pre-development flows for the developed site catchment for each event except for the 1 and 2-year events with increases of less than 0.13m^3/s. This is consistent with Northern Rivers Handbook of Stormwater Design Manual condition 12.02.5.

Table 3 | PRE VS POST DEVELOPMENT FLOWS (INCREASES IN DARK GREY)

Peak Flow from development														
Duration	Average Recurrence Interval													
	1		2		5		10		20		50		100	
	Pre m^3/s	Post m^3/s	Pre m^3/s	Post m^3/s	Pre m^3/s	Post m^3/s	Pre m^3/s	Post m^3/s	Pre m^3/s	Post m^3/s	Pre m^3/s	Post m^3/s	Pre m^3/s	Post m^3/s
5 min	0	0.07	0.11	0.08	0.23	0.09	0.29	0.09	0.38	0.10	0.49	0.11	2.11	1.97
10 min	0.04	0.08	0.20	0.09	0.39	0.10	0.49	0.11	0.63	0.15	0.81	0.24	0.58	0.11
20 min	0.12	0.09	0.33	0.11	0.58	0.19	0.72	0.27	0.92	0.45	1.19	0.59	0.95	0.32
30 min	0.10	0.10	0.33	0.15	0.65	0.33	0.84	0.45	1.10	0.62	1.44	0.86	1.39	0.71
1 hr	0.13	0.13	0.47	0.32	0.89	0.57	1.14	0.70	1.48	1.05	1.90	1.64	1.69	1.10
3 hrs	0	0.13	0.28	0.30	0.77	0.56	0.99	0.69	1.24	1.02	1.43	1.31	2.24	2.13

3.7. BASIN DESIGN

The basin floor footprint was determined on the stormwater treatment requirements detailed in section 4 below. The basin volume was determined based off the storage volume required to achieve the flows in Table 3 above. The basin will have a floor footprint of approximately 630m^2 at an R.L of 1.2m AHD and a footprint prior to the high flow weir engagement of approximately 3000m^2 at an R.L of approximately 2.4m AHD resulting in a pond depth of 1.2m in the Q100 event. A total storage volume of approximately 2200m^3 has been adopted. Batters to the north east and south have been detailed at 1:6 while due to constraints to the west the batter has been steepened to a maximum of 1:3 to prevent encroaching into the Riparian corridor exclusion zone by greater than 50%. For a detailed analysis of the basin inputs refer to the DRAINS model (available upon request).

The proposed outlet design is sufficient to ensure the detained water will discharge within the maximum 48-hour period. In addition, the stormwater that will be retained under a Q3 month storm event will fully infiltrate the bio-retention basin within several hours based on a conservative assumption for infiltration of 50mm/hr.

3.8. BASIN OUTLET

As seen in the above drains analysis the following flows are expected from each discharge point:

- Basin outlet: Q_5 = 0.61m^3/s, Q_{100} = 1.45m^3/s
- Swale outlet: Q_5 = 0.038m^3/s, Q_{100} = 0.156m^3/s

Energy dissipating aprons will be required in accordance with table 8.6.1 of QUDM and confirmed in the detailed design according to the final arrangement of the multi-level outlet.

4. STORMWATER QUALITY

4.1. METHODOLOGY

The Model for Urban Stormwater Improvement Conceptualisation (MUSIC) has been utilised as the key water quality modelling tool for this project. MUSIC is a continuous simulation water quality model used to evaluate the short and long-term performance of stormwater improvement devices that are contained in series or in parallel to form a 'treatment train'. MUSIC enables the end-user to determine if proposed systems can meet specified water quality objectives.

The MUSIC model considers suspended solids, total nitrogen and total phosphorus, which are typical components and key indicators of stormwater runoff. The key MUSIC model inputs are:

- Rainfall data set
  - Alstonville 6min (published by E-water for MUSIC modelling purposes)
- Pre-Development Catchment Area
  - 7.63ha (assumed 1% impervious in accordance with Table A2.1 of Water by Design MUSIC modelling Guidelines (2010) as specified by BSC. Boundary of future works modelled for comparison with post development catchment.
  - Run-off for rural residential parameters as seen in Table 5 & pollutant export parameters seen in Table 6
- Post Development Catchment area and percentage impervious
  - Roof: 2.62ha (100% impervious) at 60% of Lot Footprint.
  - Roads: 3.11ha (60% impervious) for all road reserves, carparks and 20% of lot Footprint.
  - Landscape area: 1.90ha (25% impervious) for remaining open spaces, and 20% of lot Footprint.
- Run-off for urban residential parameters as seen in Table 4 & pollutant export parameters seen in Table 7 Rainfall runoff parameters
  - As per Water by Design MUSIC modelling Guidelines (2010) seen in Table 4 as specified by BSC
- Pollutant event mean concentrations for source nodes
  - As per Water by Design MUSIC modelling Guidelines (2010) seen in Table 6 & Table 7 as specified by BSC

MUSIC model outputs include:
Treatment train effectiveness; these outputs are expressed in terms of pollutant reduction percentages compared to an unmitigated development scenario. Pre and post development pollutant concentrations have been presented for council's information.

4.2. WATER QUALITY OBJECTIVES

The target reductions in pollutant output were determined in accordance with chapter 2 of BSC's 2012 Development Control Plan (DCP). These objectives are presented in Table 4.

Table 4 | Stormwater Quality Objectives

Stormwater Quality Objectives	
Pollutant Source	**Reduction Compared to the Unmitigated Case**
Total Suspended Solids (TSS)	80%
Total Phosphorus (TP)	60%
Total Nitrogen (TN)	45%
Gross Pollutants (GP)	90%

4.3. MODELLED SCENARIO

The pre-development catchment was modelled as a lumped catchment under the rural residential pollutant parameters (see Table 6). The post development catchment was modelled under three split-catchments: roof, roads and landscape. All parameters for pre and post development were modelled as per section 4.1 above. All Runoff

from the roads, landscape and hardstand areas were directed into either bioretention swale, bioretention basin or both (saved for the fire trail to the south).

A Bioretention Basin was designed with a GPT (Humeguard or approved equivalent) as the means of sediment pre-treatment while the bioretention swale was designed with a grass filter strip sediment pre-treatment in accordance with Water by Design Bioretention Technical Design Guideline 2014 Table 13. A total treatment area of 670m^2 was modelled for the bioretention basin, a Humeguard GPT was modelled for pre-treatment. Refer to Figure 7 below for a schematic representation of the MUSIC model. For a detailed catchment plan with corresponding areas refer to Appendix A drawings J109-0016 & J109-0017, and Appendix B for the corresponding catchment details. While the arrangement and size of each treatment device is subject to the final detailed design the model below achieves BSC treatment objectives.

Figure 7 | MUSIC Modelling Scenario

Table 5 | Rainfall-Runoff Parameters

Rainfall-Runoff Parameters		
Parameter	TSS log10 Values	
	Urban Residential	Rural Residential
Rainfall threshold (mm)	1	1
Soil Storage Capacity (mm)	500	98
Initial Storage (% capacity)	10	10
Field Capacity (mm)	200	80
Infiltration Capacity coefficient a	211	84
Infiltration Capacity coefficient b	5	3.3
Initial Depth (mm)	50	50
Daily recharge rate (%)	28	100
Daily base flow rate (%)	27	22
Daily deep seepage rate (%)	0	0

Table 6 | Pollutant Export Parameters for Lumped Catchment

Pollutant Export Parameters for Lumped Catchment							
Landuse	Flow Type	TSS log10 Values		TP log10 Values		TN log10 Values	
		Mean	St.Dev.	Mean	St.Dev.	Mean	St.Dev.
Rural Residential	Baseflow	0.53	0.24	-1.54	0.38	-0.52	0.39
	Stormflow	2.26	0.51	-0.56	0.28	0.32	0.30

Table 7 | Pollutant Export Parameters for Split Catchment

Pollutant Export Parameters for Split Catchment								
Landuse	Flow Type	Surface Type	TSS log10 Values		TP log10 Values		TN log10 Values	
			Mean	St.Dev.	Mean	St.Dev.	Mean	St.Dev.
Urban Residential	Baseflow	Roof	0	0	0	0	0	0
		Roads	1.00	0.34	-0.97	0.31	0.20	0.20
		Landscape	1.00	0.34	-0.97	0.31	0.20	0.20
	Stormflow	Roof	1.30	0.39	-0.89	0.31	0.26	0.23
		Roads	2.43	0.39	-0.30	0.31	0.26	0.23
		Landscape	2.18	0.39	-0.47	0.31	0.26	0.23

Table 8 | MUSIC Bioretention Node

Parameter	Input
Extended Detention Depth (m) CONSTRAINED	0.3
Surface Area (m^2)	630
Filter Area (m^2)	1100
Filter Depth (m)	.5
Unlined Filter Media Parameter (m)	140
Seepage Loss (mm/hr)	100
Mean Particle Diameter (mm)	0.45
Saturated Hydraulic Conductivity (mm/hr)	200 and 50 for sensitivity
TN Content of Filter Media (mg/kg)	800
Orthophosphate Content of Filter Media (mg/kg)	55
Is Base Lined	No
Vegetated with Effective Nutrient Removal Plants	Yes

4.4. RESULTS

The effectiveness of the proposed stormwater treatment devices is presented in Table 9. As evident from the table, the proposed treatment train meets the objectives specified by BSC.

Table 9 | Treatment Train Effectiveness

Treatment Train Effectiveness						
Pollutant Source	Sources		Residual Load		% Reduction	
	Pre	Post	Pre	Post	Pre	Post
Flow (ML/yr)	63.3	98.7	63.3	97.1	0	1.62
TSS (kg/yr)	23500	18500	23500	3180	0	82.8
TP (kg/yr)	21.1	36.5	21.1	14.1	0	61.4
TN (kg/yr)	165	204	165	110	0	46.1
GP (kg/yr)	0	2110	0	41.6	0	98

To achieve these targets, a bioretention basins and bioretention swale have been proposed for a combined treatment area of 670m^2. Considering the large area of the site that is within the APZ bushfire zone and cannot contain habitable dwellings, it is believed that ample space is available for this treatment option. The bioretention base and western batters are to be planted with native shrubs, grasses and rainforest trees according to the ecological assessment. The eastern grassed portion of the basin and eastern batters has been designed as a well-maintained grass (blade length <150mm) in order to comply with bushfire asset protection requirements. Future re-use rainwater tanks and soak wells / infiltration cells can be incorporated into the lots which would further improve the treatment results.

4.5. WATER REUSE – STORMWATER HARVESTING

Stormwater is typically surface runoff which flows downstream to form a concentrated flow path and is directed or channelled into drainage systems which eventually discharge to surface waters. All rainfall runoff that is discharged via this process moves directly to an external location offsite. Opportunities exists in stormwater treatment and stormwater reuse that can save non-potable water and assist in meeting flow management and water harvesting objectives within a development.

It is possible for residences to collect both rainwater and surface runoff harvesting for reuse. Onsite stormwater reuse for the subject site could take the place of roof water tanks, or underground storage tanks (Atlantis or approved equivalent).

This is not an enforced option, but BSC encourages the use of property-based rainwater tanks and subsidies are provided for properties that install rainwater tanks. For the purpose of our DA design a conservative approach to the stormwater system has been adopted to ensure adequate capacity is provided within the bioretention basins to accommodate frequent storm events where storage capacity may not be available within these private systems.

4.6. SOAKWELLS

On site soak wells designed to capture roofwater (RELN soak well or approved equivalent) are another potential means of providing further stormwater treatment, mitigating peak flow, aiding in recharging the groundwater on-site and further reducing any potential impact the development could have on downstream properties. Again, this is not an enforced option, but takes advantage of the sites existing sandy soils and offers an alternate solution to connecting roofwater into the trunk drainage line (due to the unavailability of kerb adaptors for an inverted road).

5. FLOODING

BSC have advised that the subject site is situated within a flooding risk area (refer Figure 8). The site is zoned as Rural (RU1) according to the 2012 LEP. Based on table 3.1 in the 2012 DCP Chapter 2b – Floodplain Management, the 2100 Climate Change scenario applies when determining anticipated flood levels. The flood planning level for the subject site for a 100-year flooding event according to this scenario is 2.3mAHD (refer to Figure 9). To achieve this level, approximately 300mm-500mm of fill is to be placed across the developed area. Allowing for 500mm freeboard, the proposed floor levels are 2.8m AHD minimum. After a design surface was created WBM BMT provided a flood impact assessment of the proposed works provided in Appendix C. In summary:

"In terms of model outcomes the local catchment flood modelling initially identified impacts within the caravan site which were likely to be unacceptable. It was identified that with the augmentation of the existing culverts under Skennars Head Road to the immediate north of the site, that these issues were mitigated as flood waters previously being detained on the sports field were able to be partially drained through these culverts and the development site. In terms of modelled impacts, the 18% AEP event identifies a significant improvement in peak water levels north of the development site and within the caravan park, with a limited areas of peak flood level increases along the drainage channel to the east of the caravan park site. The 5% AEP event identifies continued improvements in peak flood levels north of the road and within the caravan park site with no areas of increased flood levels. The 1% AEP event identifies some limited areas of improvement in flooding in the caravan park site and a small area of increases in peak floods at the south east corner of the development site within the drainage channel extent.

The difference in duration mapping presented shows that the majority of the downstream areas have no significant change in inundation duration, with isolated areas along the western fringe of the wetland showing increases in duration of inundation in the range 0.5 – 5.0%.

The identified change in inundation patterns is primarily due to the provision of the additional culvert under Skennars Head Road which has allowed for additional flow to be released via this structure and pass through the development site to the wetland area

Figure 8 | Flood Prone Areas within the Vicinity of the Subject Site

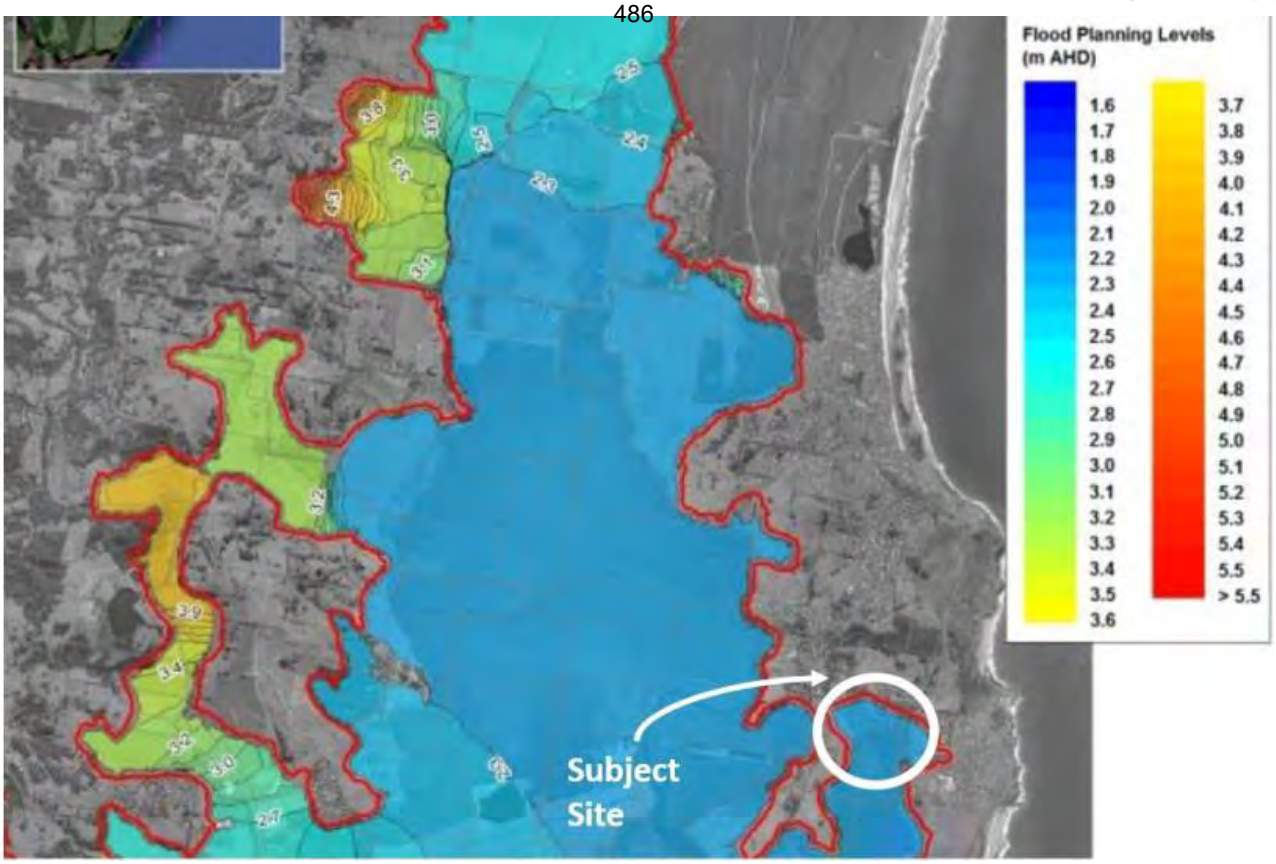


Figure 9 | Flood Planning Levels Within the Vicinity of the Subject Site

6. SEDIMENT AND EROSION CONTROL

6.1. BACKGROUND

The objective of the measures proposed in this section is to ensure that there is no worsening of stormwater quality nor any reduction in the environmental values of the downstream receiving waters as a result of construction activities on the subject site during the construction and operational phase of the development.

This objective will be achieved through the implementation of:

- Management strategies designed to minimise water pollution during construction from the development of the subject site;
- Specific construction phase controls to minimise erosion and control sediment loss;
- A monitoring and maintenance program for the construction phase;
- Defined performance criteria and actions to be taken if the criteria are not met.

6.2. SOILS

A geotechnical study has been conducted by Coffey 'Geotechnical, Acid Sulfate Soil and Phase 1 Environmental Site Assessments, Seniors Living Development, Skennars Head' on the 11 August 2016 on the subject site as part of the development application process. Sandy Silts, Sand and Sandy Clay was encountered in all boreholes to a depth of up to 5m. In accordance with the findings, is assumed that the predominant soil type on the subject site is a sand and clayey sand. As a conservative approach at the development application stage of design a worst-case approach to sediment and erosion control has been adopted and it has been assumed that the soils will contain greater than 10% dispersive soils.

6.3. SEDIMENT AND EROSION CONTROL BEST PRACTICE

In accordance with BSC requirements, the site shall implement the erosion sediment controls nominated within the Sediment and Erosion plans (Appendix A – Drawing J107-0021 & Drawing J107-0022 Sediment and Erosion Control Plans). The contractor is to obtain Erosion and Sediment Control Signage from Council to attach to the most prominent structure at the site, and to be visible at all times when entering the site for the duration of construction.

The control of stormwater quality during construction activities shall be achieved by the implementation of Erosion and Sediment Controls in accordance with the requirements of the Landcom 'Soils and Construction Volume 1 – Managing Urban Stormwater: Soils and Construction' (i.e. Blue Book). The measures are to be implemented before the commencement of any construction works and should be inspected regularly, and after heavy storm events to ensure they are achieving their desired purpose.

The measures to be used on site include:

- 1.8m high hessian fence is to be installed around the proposed property boundaries.
- Minimise the number of site access points and provide stabilised site access
  - Stabilised site access to be provided at access to shake down all vehicles entering and leaving the site, minimising the transport of sediment off-site. All vehicles must use a designated site access to enter or leave the site. (SD6-14)
- Installation of downstream sediment barriers prior to commencement of any works
  - Sediment fences are to be installed downstream of works and exposed soils to ensure contaminated run-off is filtered and sediment captured before it can make its way into the downstream receiving environment.
  - Turf Strips (SD6-13)
- Cut-off drains are to be formed at the top of batter slopes.
  - Cut-off drains will allow the discharge of water to be conveyed and directed to the most desirable points of discharge to ensure suitable sediment treatment is achieved.
  - External catchment is to be captured and redirected around the area of works and discharged at appropriate location.
- Stabilise and seed earthwork areas immediately once earthwork profiles are achieved.

    - Exposed areas on site are to be stabilised with either turf or grass seeding as construction works progress. Erosion control matting or mulching may be used as a temporary measure until permanent stabilisation is able to be undertaken if deemed required by the site engineer. (SD7-1)
- Stockpile materials in protected locations away from overland flow paths and protected by sediment fence boundaries:
    - Stockpile locations will be located in an elevated, level area nominally 5m from any water body or channel. Upslope protection measures (i.e. sandbags or equal) are to be used to divert run-off in the event of rain, and sediment fences are to be installed downstream of any erodible stockpile. At the end of each day or in the event of rain or high winds, stockpiles are to be covered and secured. Appropriate locations of stockpiles are to be determined by the site manager at the time of construction.
- Sediment fence to be used on low side of any areas of soil disturbance (e.g. road formation, house pad, soil stockpiles, etc). SD6-8.
- Rock filter dams (SD RFD-03) and gypsum filled bags, flock blocks or equivalent placed on low side of check dam spillway, are to be provided in key locations to treat stormwater run-off from the works area.
- Site is to be watered during the construction phase to minimise the generation of dust onsite.
- When wind speeds reach 35km/h, all dust generating construction activities must cease onsite.

Once the civil earthworks are complete, the site shall be re-topsoiled, seeded and turf strips installed on the downward area of the disturbed site so as to act as a surface filter of any sediments prior to reaching the sediment fences. Once 80% grass cover is achieved (or the site landscaped), the sediment fences shall be removed.

The following inspection program shall be established by the Site Contractor and monthly Check Sheet reports submitted to the Supervising Engineer:

- Daily inspection of the site Stabilised Access point and amendments as necessary
- Formal weekly inspection of erosion and sediment controls
- Inspections after 10mm rainfall events in 24 hours
- Testing of runoff after significant rainfall events to ensure a maximum discharge of 50mg/L suspended solids

In addition to the inspection details, the following information will be recorded:

- List frequency and method of removal of material from stabilised access point
- Volume of material removed from in/around sediment controls
- Location of site where material disposed
- Any repairs / additions as appropriate

A checklist is to be completed each month as per details in Appendix D –Sediment and Erosion Control Checklist.

6.4. ESC TREATMENT METHODOLOGY

During the bulk earthworks there is a potential for increased stormwater pollutants as a result of areas of exposed soils.

Some minor importation of foreign soils may be required for the purposes of roadways, driveways and possibly building pads. This imported material is likely to have higher clay content and runoff potential in the short term before any surface finish is applied.

To prevent runoff from the site to flow into the existing stormwater drainage systems, filter bags will be placed around all downstream drainage inlets. Refer to Appendix A – Drawing J107-0021 & Drawing J107-0022 Sediment and Erosion Control Plans for the proposed locations. In addition, silt fence will be installed downstream of all disturbed areas.

'Soils and Construction Volume 1 – Managing Urban Stormwater', recommends the use of sediment basins on sites with a disturbed area larger than 2500m^2. Refer to Appendix A – Drawing J107-0021 & Drawing J107-0022 Sediment

and Erosion Control Plans for the proposed locations of the sediment basins. It has been proposed that the bioretention basins will be used as temporary sediment basins during construction. The bioretention basins will be dug out to the bottom of the proposed filter layer and fitted with a temporary geotextile and turf layer to be removed post finished earthworks and seeding.

In accordance with the 'Blue Book', the following assumptions have been made for the purpose of preliminary sizing of sediment basins:

- Worst case soil condition <10% Soil Dispersive
- environmentally sensitive receiving waters
- $R_{5day,85\%}$ Considered
- The full extent of works was considered to be fully opened Earthworks

Table 10 | Sediment Basin Sizing

x	50% of settling zone capacity,
	2 months soil loss calculated by RUSLE

Total Basin Volume

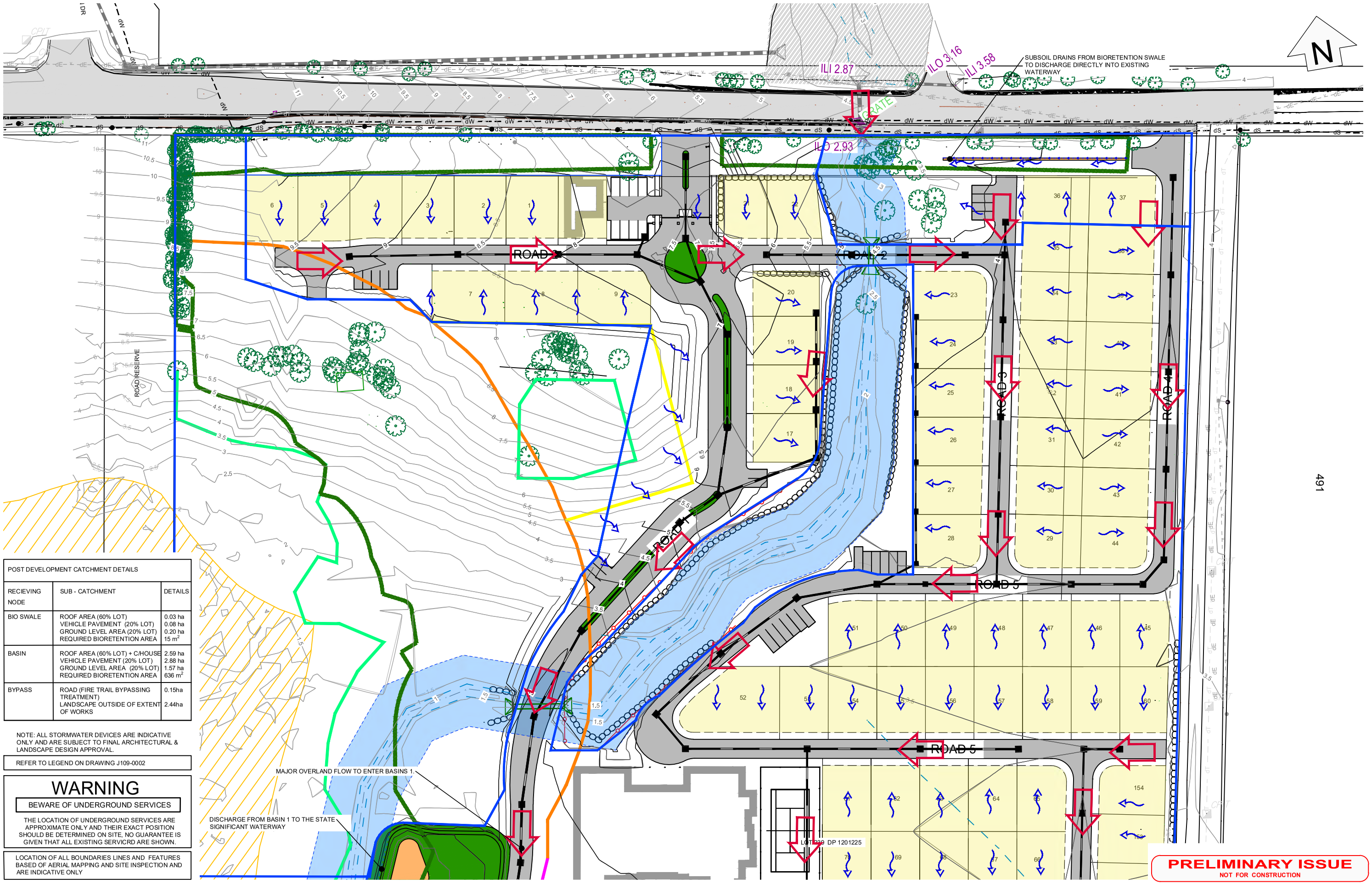
Site	C_v	$R_{x\text{-day, y-\%ile}}$	Total catchment area (ha)	Settling zone volume (m^3)	Sediment storage volume (m^3)	Total basin volume (m^3)
1	0.66	45.2	1.9	566	233	850

Based upon the above sizing and pending more detailed examination of the dispersive qualities of the soil the bioretention basins will need to be deepened to achieve the above temporary sediment basin volume above. A type F sediment basin has been proposed at this stage.

Finally, A stabilised site access point is to be established at the location nominated on the engineering plans.

APPENDIX A | CIVIL ENGINEERING PLANS

A1 – J107-0016 - STORMWATER LAYOUT PLAN SHEET 1 OF 2
A2 – J107-0017 - STORMWATER LAYOUT PLAN SHEET 1 OF 2
A3 – J107-0018 – BIORETENTION BASIN TYPICAL DETAILS
A4 – J107-SK002 – EXTERNAL CATCHMENT PLAN
A5 – J107-0021 - SEDIMENT AND EROSION CONTROL PLAN
A6 – J107-0022 - SEDIMENT AND EROSION CONTROL NOTES



POST DEVELOPMENT CATCHMENT DETAILS		
RECIEVING NODE	SUB - CATCHMENT	DETAILS
BIO SWALE	ROOF AREA (60% LOT) VEHICLE PAVEMENT (20% LOT) GROUND LEVEL AREA (20% LOT) REQUIRED BIORETENTION AREA	0.03 ha 0.08 ha 0.20 ha 15 m^2
BASIN	ROOF AREA (60% LOT) + C/HOUSE VEHICLE PAVEMENT (20% LOT) GROUND LEVEL AREA (20% LOT) REQUIRED BIORETENTION AREA	2.59 ha 2.88 ha 1.57 ha 636 m^2
BYPASS	ROAD (FIRE TRAIL BYPASSING TREATMENT) LANDSCAPE OUTSIDE OF EXTENT OF WORKS	0.15ha 2.44ha

NOTE: ALL STORMWATER DEVICES ARE INDICATIVE ONLY AND ARE SUBJECT TO FINAL ARCHITECTURAL & LANDSCAPE DESIGN APPROVAL.

REFER TO LEGEND ON DRAWING J109-0002

WARNING

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LOCATION OF ALL BOUNDARIES LINES AND FEATURES BASED OF AERIAL MAPPING AND SITE INSPECTION AND ARE INDICATIVE ONLY

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REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
B	AMENDED ROAD WIDTH & SITE NUMBERS	20/06/16	SA	SA	DH	AW
C	ISSUE FOR CLIENT REVIEW	24/06/16	SA	SA	DH	AW
D	ISSUED FOR DEVELOPMENT APPLICATION	16/09/16	SA	SA	AW	AW
E	AMENDED TO COUNCIL COMMENTS	24/02/17	SA	SA	AW	AW
F	BASIN CAPACITY INCREASED	14/06/17	SA	SA	AW	AW
G	ENTRANCE AMENDED AND LOT LAYOUT UPDATED	14/07/17	SA	SA	AW	AW
H	LOT LAYOUT AMENDED TO COUNCIL COMMENTS	23/05/18	SA	SA	AW	AW

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C/- PLANNERS NORTH
3/ 69 CENTENNIAL CIRCUIT
BYRON BAY, NSW, 4281

LOCAL GOVERNMENT AUTHORITY:
BALLINA SHIRE COUNCIL

PROJECT:
67 SKENNARS HEAD ROAD

DRAWING TITLE:
STORMWATER DRAINAGE PLAN
SHEET 1 OF 2

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
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100mm AT ORIGINAL SIZE

491

100mm AT ORIGINAL SIZE

OUTLET WITH WATER DISSIPATING ROCKS TO DISCHARGE INTO THE BASIN 1

DISCHARGE FROM BASIN 1 TO THE STATE SIGNIFICANT WATERWAY

BASIN 1 PROPOSED RL1.2

SEDIMENT TREATMENT FOR BASIN 1 NOMINATED AS 2 BY GROSS POLLUTANT TRAPS WITH FLOW ENTERING AT 2 LOCATION TO AID IN EVENLY DISTRIBUTING FLOWS TO THE VEGETATED SURFACE

MAJOR OVERLAND FLOW DETAINED IN BASIN 1

LOT 239 DP 1201225

FLOW FROM CAR PARK INTO SW

N

ROAD 6

ROAD 1

ROAD 7

ROAD 8

ROAD 8

ROAD 1

EXIT 2

ILO 2.05 ⌀300MM

ILI 1.64 ⌀ 500MM

ILO 1.65 ⌀ 500MM

ILI 1.44 ⌀ 500MM

ILI 1.23 ⌀ 500MM

LOT 240 DP 1201225

LOT 38 DP 830277

492

NOTE: ALL STORMWATER DEVICES ARE INDICATIVE ONLY AND ARE SUBJECT TO FINAL ARCHITECTURAL & LANDSCAPE DESIGN APPROVAL.

REFER TO LEGEND ON DRAWING J109-0002

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C	ISSUE FOR CLIENT REVIEW	24/06/16	SA	SA	DH	AW
D	ISSUED FOR DEVELOPMENT APPLICATION	16/09/16	SA	SA	AW	AW
E	AMENDED TO COUNCIL COMMENTS	24/02/17	SA	SA	AW	AW
F	ENTRANCE AMENDED AND LOT LAYOUT UPDATED	14/07/17	SA	SA	AW	AW
G	LOT LAYOUT AMENDED TO COUNCIL COMMENTS	23/05/18	SA	SA	AW	AW

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3/ 69 CENTENNIAL CIRCUIT
BYRON BAY, NSW, 4281

LOCAL GOVERNMENT AUTHORITY:
BALLINA SHIRE COUNCIL

PROJECT:
67 SKENNARS HEAD ROAD

DRAWING TITLE:
STORMWATER DRAINAGE PLAN
SHEET 2 OF 2

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
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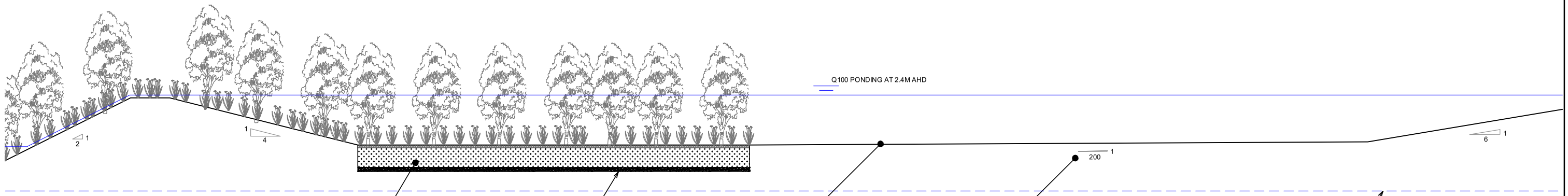

BIORETENTION BASIN TYPICAL CROSS SECTION

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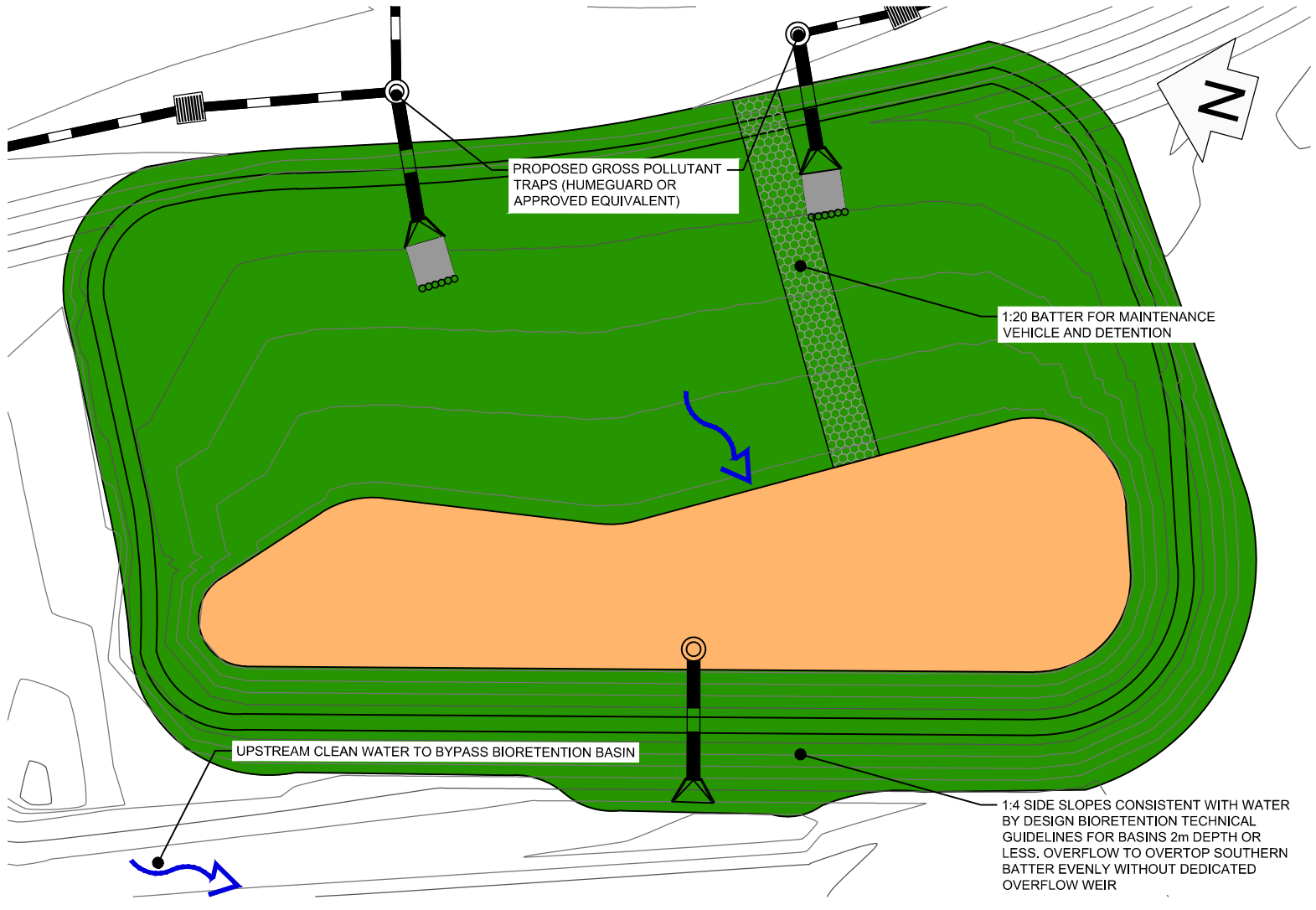
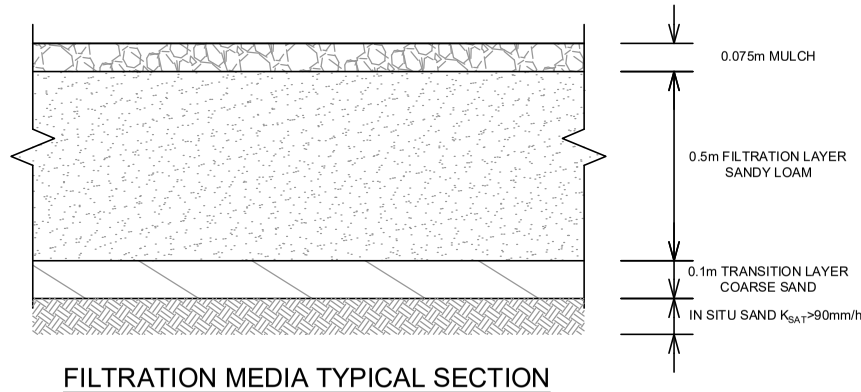


TYPICAL SUB-SURFACE DRAINAGE LAYOUT

SCALE: 1:100 @ A1, 1 :200 @ A3

REFER TO LEGEND ON DRAWING J109-0002



FILTRATION MEDIA TYPICAL SECTION

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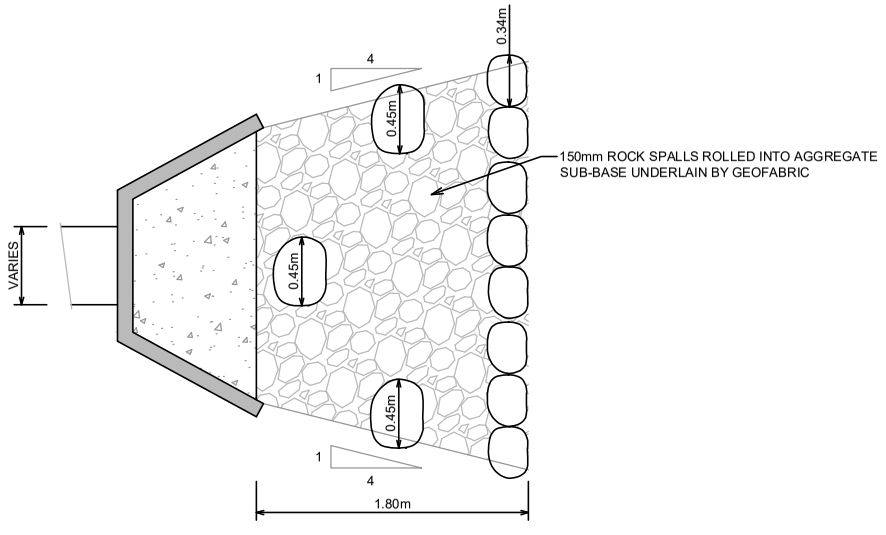

BASIN INLET SCOUR PROTECTION - PLAN

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D	ISSUED FOR DEVELOPMENT APPLICATION	16/09/16	SA	SA	AW	AW
E	AMENDED TO COUNCIL COMMENTS	24/02/17	SA	SA	AW	AW
F	ENTRANCE AMENDED AND LOT LAYOUT UPDATED	14/07/17	SA	SA	AW	AW
G	LOT LAYOUT AMENDED TO COUNCIL COMMENTS	10/04/18	SA	SA	AW	AW

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LOCAL GOVERNMENT AUTHORITY: BALLINA SHIRE COUNCIL

PROJECT: 67 SKENNARS HEAD ROAD
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A1	J107	0018	G

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100mm AT ORIGINAL SIZE

N

494

UPSTREAM CATCHMENT 17.2ha
70% IMPERVIOUS

ASSUMED STORMWATER PONDS
UPSTREAM FOR ~ 1500m^3 OF DETENTION
Q10 PIPE FLOW TO SITE 2.17m^3/S.
Q10 OVERLAND FLOW TO SITE 2.42m^3/S
Q100 PIPE FLOW TO SITE 2.29m^3/S.
Q100 OVERLAND FLOW TO SITE 5.22m^3/S

HENDERSON DR

SKENNARS HEAD RD

ROAD RESERVE

REFER TO LEGEND ON DRAWING J109-0002

WARNING

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PROJECT:
67 SKENNARS HEAD ROAD

DRAWING TITLE:
EXTERNAL CATCHMENT PLAN

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
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100mm AT ORIGINAL SIZE

GENERAL NOTES

G.1. ALL WORK IS TO BE IN ACCORDANCE WITH THE PLAN AND THE "BLUE BOOK" SEDIMENT CONTROL BOOKS.

G.2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE IMPLEMENTATION OF THE EROSION AND SEDIMENT CONTROL PLAN.

G.3. THE CONTRACTOR SHALL INFORM ALL STAFF AND SUB-CONTRACTORS OF THEIR OBLIGATIONS UNDER THE EROSION AND SEDIMENT CONTROL PLAN.

G.4. CONTROL MEASURES SHALL BE IN PLACE PRIOR TO EACH SITE DISTURBANCE.

G.5. SITE DISTURBANCE SHALL BE STAGED WHERE POSSIBLE AND RESTRICTED TO THE WORKS ZONE.

G.6. ALL WORKS ARE TO BE INSPECTED, AND MAINTAINED WHERE NECESSARY, ON A WEEKLY BASIS AND AFTER EACH RAIN EVENT.

G.7. ADEQUATE MEASURES SHALL BE TAKEN TO PREVENT DUST FROM AFFECTING THE AMENITY OF THE NEIGHBOURHOOD DURING CONSTRUCTION. IN PARTICULAR, THE FOLLOWING MEASURES MUST BE ADOPTED:

(1) EARTHWORKS AND SCHEDULING ACTIVITIES SHALL BE MANAGED TO COINCIDE WITH THE NEXT STAGE OF DEVELOPMENT TO MINIMISE THE AMOUNT OF TIME THE SITE IS LEFT CUT OR EXPOSED;

(2) ALL MATERIALS SHALL BE STORED OR STOCKPILED IN SUITABLE LOCATIONS;

(3) THE SURFACE SHOULD BE DAMPENED SLIGHTLY TO PREVENT DUST FROM BECOMING AIRBORNE BUT SHOULD NOT BE WET TO THE EXTENT THAT RUN-OFF OCCURS;

(4) ALL VEHICLES CARRYING SPOIL OR RUBBLE TO OR FROM THE SITE SHALL AT ALL TIMES BE COVERED TO PREVENT THE ESCAPE OF DUST OR OTHER MATERIAL;

(5) ALL EQUIPMENT WHEELS SHALL BE WASHED BEFORE EXITING THE SITE USING MANUAL OR AUTOMATED SPRAYERS AND DRIVE - THROUGH WASHING BAYS;

(6) GATES SHALL BE CLOSED BETWEEN VEHICLE MOVEMENTS AND SHALL BE FITTED WITH SHADE CLOTH; AND

(7) CLEANING OF FOOTPATHS AND ROADWAYS SHALL BE CARRIED OUT REGULARLY.

G.8. FAILURE TO IMPLEMENT ANY PART OF THE PLAN WILL CONSTITUTE A HOLD POINT.

REVEGETATION

R.1 REVEGETATION SHALL BE ON-GOING AND PROGRESSIVE.

R.3 WHERE ANY BREAK IN OPERATIONS, OR WHERE WORK IS CEASED IN AN AREA FOR LONGER THAN 4 WEEKS, THE EXPOSED AREAS SHALL BE STABILISED (eg. TEMPORARY TOPSOILING AND SEEDING WITH AN APPROPRIATE COVERCROP, MULCHES, BLANKETS/ MATTINGS).

R.4 SEED SELECTION AND RATE TO BE APPROVED BY SUPERINTENDENT PRIOR TO APPLICATION.

R.5 THE CONTRACTOR SHALL PROVIDE SUITABLE SEED BED PREPARATION PRIOR TO THE SOWING OF VEGETATION SEED SPECIES.

R.6 REVEGETATION WORKS SHALL BE MAINTAINED/ENHANCED (eg RESEEDING, FERTILISING, WATERING) UNTIL A MINIMUM OF 70% GROUND COVER IS ESTABLISHED.

EROSION CONTROL

E.1 STORMWATER DRAINAGE AND CULVERTS NEED TO BE INSTALLED EARLY TO CATER FOR RAIN RUNOFF.

E.2 SOIL MATERIAL STOCKPILES SHALL BE LOCATED AWAY FROM DEPRESSION FLOWLINES.

E.3 BARRIER OR SIMILAR FENCING IS TO BE USED TO PROTECT NO-GO AREAS.

E.4 SITE ACCESS SHALL INCLUDE A SOIL RETENTION SYSTEM (eg VEHICLE SHAKEDOWN GRID)

E.5 TEMPORARY DIVERSION DRAINS/BANKS (AT 3% SLOPE) ARE TO BE SUCCESSIVELY INSTALLED DOWNSLOPE (eg ROAD FORMATIONS) PRIOR TO ANY BREAKS IN CONSTRUCTION (eg WEEKENDS). SEDIMENT TRAPS ARE TO BE PLACED AT THEIR OUTLETS.

E.6 ALL DIVERSION BANKS SHALL BE STABILISED.

E.7 NO MORE THAN 150m OF TRENCHING TO BE OPEN AT ANY ONE TIME.

SEDIMENT CONTROL

S.1 THE NEED FOR SEDIMENT CONTROL MEANS THAT EROSION CONTROL HAS NOT BEEN ACHIEVED.

S.2 SEDIMENT FENCING IS TO BE INSTALLED TO THE MANUFACTURERS SPECIFICATIONS AND:

(A) BE SPACED SUCCESSIVELY DOWNSLOPE NO GREATER THAN 50m APART AND APPROXIMATELY AT EVERY 1m FALL IN GROUNDSLOPE.

(B) BE INSTALLED TO THE CONTOUR

(C) HAVE THE ENDS TURNED UPSLOPE 500mm WHERE APPROPRIATE TO CREATE STORAGE.

S.3 SEDIMENT TRAPS SHALL BE INSTALLED IN ACCORDANCE WITH PLAN DETAILS. THEY WILL:

(A) BE AS LARGE AS PRACTICAL

(B) BE CONSTRUCTED TO SUIT EXPECTED FLOW CONDITIONS.

(C) BE LOCATED APPROXIMATELY EVERY 1m FALL IN GROUNDSLOPE.

(D) PROVIDE FOR SAFE OVERFLOW.

S.4 SEDIMENT CONTROLS ARE TO BE LOCATED AS CLOSE TO DISTURBED AREAS AS PRACTICAL.

S.5 TRAPPED SEDIMENT TO BE REMOVED TO AN APPROPRIATE NOMINATED LOCATION.

S.6 TEMPORARY CONTROL MEASURES SHALL REMAIN IN PLACE UNTIL CATCHMENT THEY ARE SERVING IS STABILISED (FOR GRASS THIS WILL MEAN 70% GROUNDCOVER).

S.7 PROVIDE SEDIMENT BAGS IN KERB AND GUTTER UPSTREAM OF EXISTING KERB INLET PITS UNTIL DISTURBED AREAS ARE ADEQUATELY STABILISED.

S.8 PRIOR TO APPROVAL OF STORMWATER PIPES AND PITS, PREVENT RUNOFF DRAINING INTO PIPE SYSTEM BY SAND BAGGING AND DIVERSION TO OTHER CONTROL MEASURES.

S.9 ON COMPLETION OF PITS, CONSTRUCT SEDIMENT TRAPS IN ACCORDANCE WITH DETAILS UNTIL EARTHWORK ZONES ARE STABILISED WITH GRASS COVER.

NOTE: THIS DRAWINGS IS PROVIDED AS A GUIDE ONLY AND IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE ADEQUATE EROSION AND SEDIMENT CONTROL OF THE SITE DURING ALL PHASES OF WORKS TO THE SATISFACTION OF THE SUPERINTENDENT AND LOCAL COUNCIL

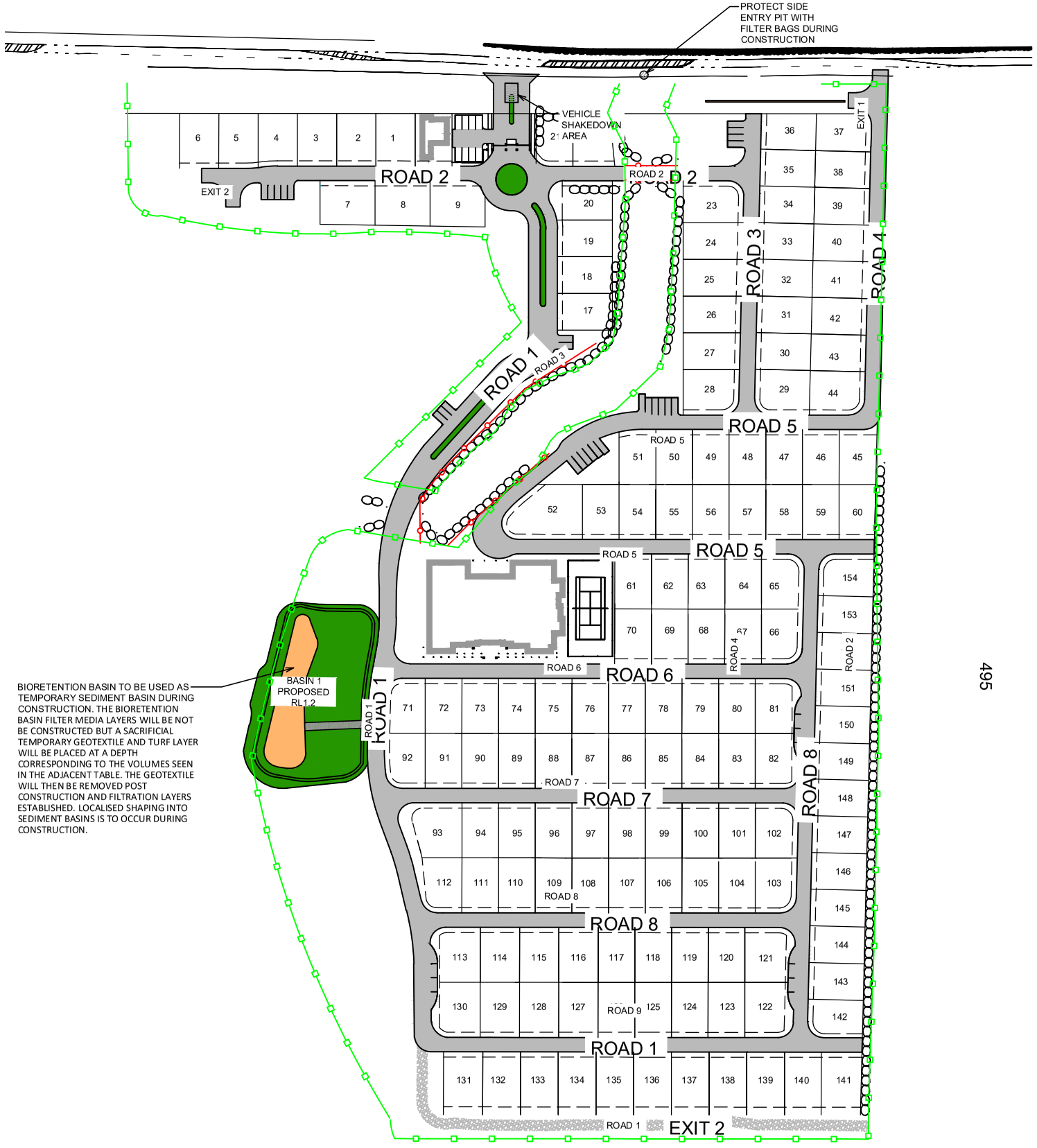
REFER TO LEGEND ON DRAWING J109-0002

WARNING

BEWARE OF UNDERGROUND SERVICES

THE LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE DETERMINED ON SITE, NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICRD ARE SHOWN.

LOCATION OF ALL BOUNDARIES LINES AND FEATURES BASED OF AERIAL MAPPING AND SITE INSPECTION AND ARE INDICATIVE ONLY



495

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
B	AMENDED ROAD WIDTH & SITE NUMBERS	20/06/16	SA	SA	DH	AW
C	ISSUE FOR CLIENT REVIEW	24/06/16	SA	SA	DH	AW
D	ISSUED FOR DEVELOPMENT APPLICATION	16/09/16	SA	SA	AW	AW
E	AMENDED TO COUNCIL COMMENTS	24/02/17	SA	SA	AW	AW
F	BASIN CAPACITY INCREASED	14/06/17	SA	SA	AW	AW
G	ENTRANCE AMENDED AND LOT LAYOUT UPDATED	14/07/17	SA	SA	AW	AW
H	LOT LAYOUT AMENDED TO COUNCIL COMMENTS	23/05/18	SA	SA	AW	AW

SCALES:
0 10 20 40 60
Full Size 1:1000 ; Half Size 1:2000
Scale (m)
DO NOT SCALE FROM DRAWING

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DESIGN BY: S.ADAM
APPROVED BY:
DATE:
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PLANIT ENGINEERING
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LIVING GEMS
C/- PLANNERS NORTH
3/ 69 CENTENNIAL CIRCUIT
BYRON BAY, NSW, 4281

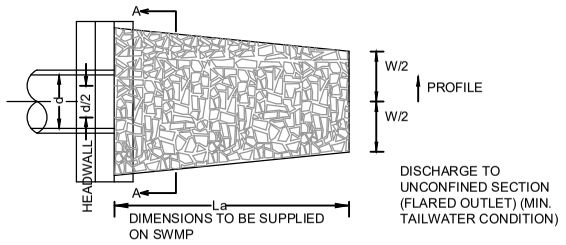
LOCAL GOVERNMENT AUTHORITY:
BALLINA SHIRE COUNCIL

PROJECT:
67 SKENNARS HEAD ROAD

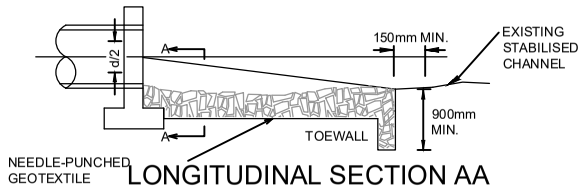
DRAWING TITLE:
EROSION AND SEDIMENT CONTROL LAYOUT PLAN

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	0021	H

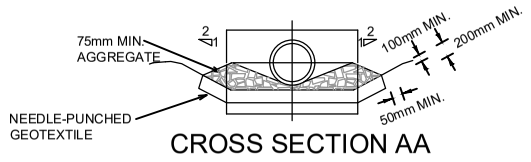
CAD FILE: T:\J107 - 67 SKENNARS HEAD ROAD - DA\6 - CAD\J107-0021.DWG PLOTTED BY: STEPHENA PLOT DATE: 23/05/2018 2:16:40 PM



PLAN VIEW



LONGITUDINAL SECTION AA



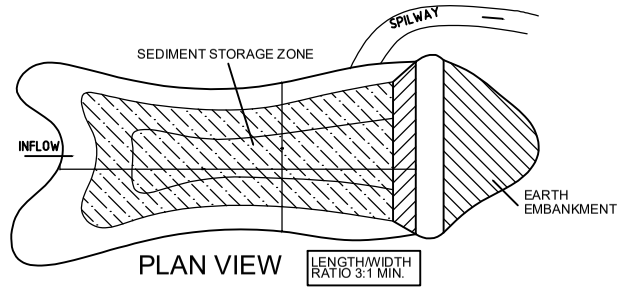
CROSS SECTION AA

ENERGY DISSIPATER

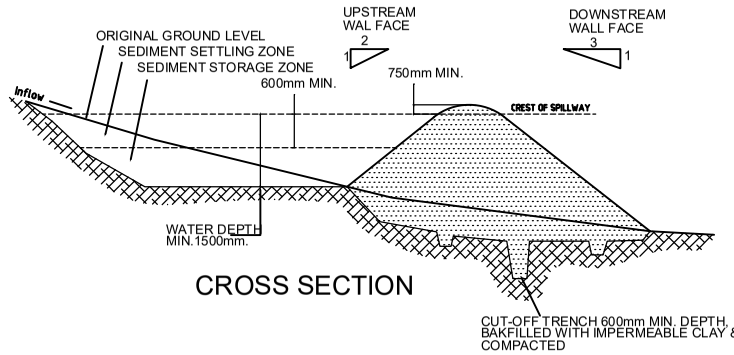
NOT TO SCALE

CONSTRUCTION NOTES

1. COMPACT THE SUBGRADE FILL TO THE DENSITY OF THE SURROUNDING UNDISTURBED MATERIAL.
2. PREPARE A SMOOTH, EVEN FOUNDATION FOR THE STRUCTURE THAT WILL ENSURE THAT THE NEEDLE-PUNCHED GEOTEXTILE DOES NOT SUSTAIN SERIOUS DAMAGE WHEN COVERED WITH ROCK.
3. SHOULD ANY MINOR DAMAGE TO THE GEOTEXTILE OCCUR, REPAIR IT BEFORE SPREADING ANY AGGREGATE. FOR REPAIRS, PATCH ONE PIECE OF FABRIC OVER THE DAMAGE, MAKING SURE THAT ALL JOINTS AND PATCHES OVERLAP MORE THAN 300mm.
4. LAY ROCK FOLLOWING THE DRAWING, ACCORDING TO TABLE 5.2 OF LANDCOM (2004) AND WITH MIN. DIAMETER OF 75mm.
5. ENSURE THAT ANY CONCRETE OR RIPRAP USED FOR THE ENERGY DISSIPATER OR THE OUTLET PROTECTION CONFORMS TO THE GRADING LIMITS SPECIFIED ON THE SWMP.



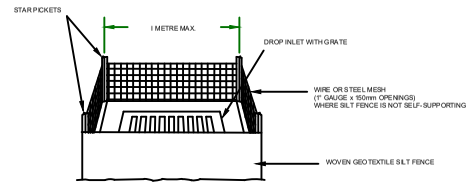
PLAN VIEW



CROSS SECTION

SILT FENCE TO GRATED DROP INLET PIT

NOT TO SCALE

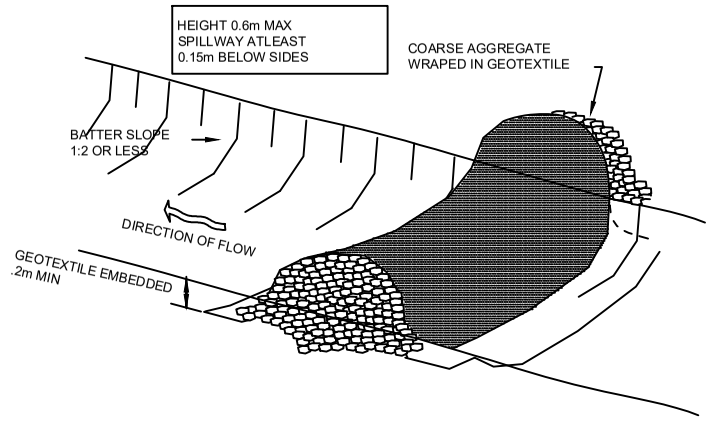


SILT FENCE TO GRATED DROP INLET PIT

NOT TO SCALE

CONSTRUCTION NOTES:

1. FABRICATE A SEDIMENT BARRIER MADE FROM GEOTEXTILE OR STRAW BALES
2. SUPPORT GEOTEXTILE WITH MESH TIED TO POSTS AT 1 METRE CENTRES.
3. DO NOT COVER INLET WITH GEOTEXTILE



CONSTRUCTION NOTES

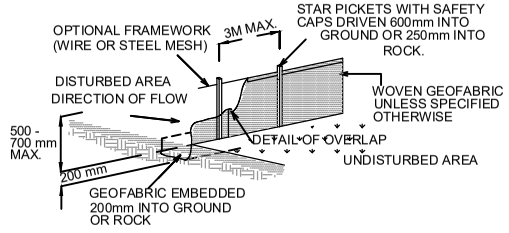
1. TRENCH STRUCTURE 200mm INTO GROUND SURFACE WHEREVER THE STRUCTURE CONTACTS THE GULLY BASE. FILL TRENCHES TO 100mm ABOVE GROUND SURFACE TO REDUCE RISK OF UNDERCUTTING.
2. ENSURE HEIGHT OF SPILLWAY IS LESS THAN 1m ABOVE THE GULLY FLOOR.

TOPSOIL STOCKPILE

NOT TO SCALE

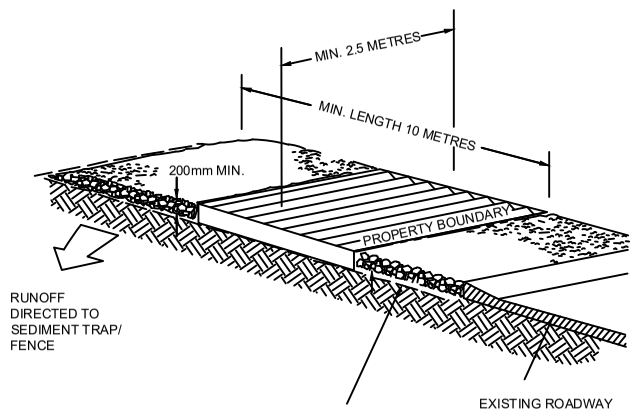
CONSTRUCTION NOTES

1. WHERE POSSIBLE LOCATE STOCKPILE AT LEAST 5m FROM EXISTING VEGETATION, CONCENTRATED WATER FLOWS, ROADS AND HAZARD AREAS.
2. CONSTRUCT ON THE CONTOUR AS A LOW, FLAT, ELONGATED MOUND.
3. WHERE THERE IS SUFFICIENT AREA TOPSOIL STOCKPILE SHALL BE LESS THAN 2m IN HEIGHT.
4. REHABILITATE IN ACCORDANCE WITH THE SWMP/ESCP.
5. CONSTRUCT EARTH BANK (STANDARD DRAWING 5-5) ON THE UPSLOPE SIDE TO DIVERT RUNOFF AROUND THE STOCKPILE AND A SEDIMENT FENCE (STANDARD DRAWING 6-8) 1 TO 2m DOWNSLOPE OF STOCKPILE.



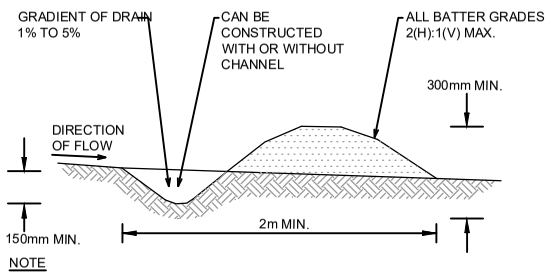
SEDIMENT FENCE

NOT TO SCALE



ROCK CHECK DAMS

NOT TO SCALE



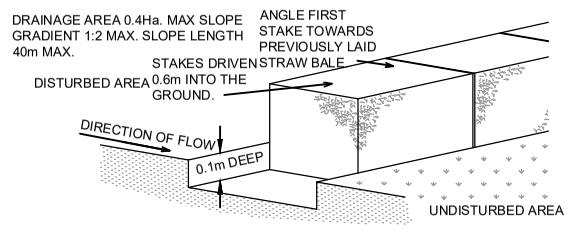
NOTE
ONLY TO BE USED AS TEMPORARY BANK WHERE MAX. UPSLOPE LENGTH IS 80m.

EARTH BANK (LOW FLOW)

NOT TO SCALE

CONSTRUCTION NOTES

1. CONSTRUCT WITH GRADIENT OF 1% TO 5%.
2. AVOID REMOVING TREES AND SHRUBS IF POSSIBLE.
3. DRAINS TO BE CIRCULAR, PARABOLIC OR TRAPEZOIDAL CROSS SECTION NOT V-SHAPED.
4. EARTH BANKS TO BE ADEQUATELY COMPACTED IN ORDER TO PREVENT FAILURE.
5. PERMANENT OR TEMPORARY STABILISATION OF THE EARTH BANK TO BE COMPLETED WITHIN 10 DAYS OF CONSTRUCTION.
6. ALL OUTLETS FROM DISTURBED LANDS ARE TO FEED INTO A SEDIMENT BASIN OR SIMILAR.
7. DISCHARGE RUNOFF COLLECTED FROM UNDISTURBED LANDS ONTO EITHER A STABILISED OR AN UNDISTURBED DISPOSAL SITE WITHIN THE SAME SUBCATCHMENT AREA FROM WHICH THE WATER ORIGINATED.
8. COMPACT BANK WITH A SUITABLE IMPLEMENT IN SITUATIONS WHERE THEY ARE REQUIRED TO FUNCTION FOR MORE THAN FIVE DAYS.
9. EARTH BANKS TO BE FREE OF PROJECTIONS OR OTHER IRREGULARITIES THAT WILL IMPEDE NORMAL FLOW.



STRAW BALE SEDIMENT FILTER

NOT TO SCALE

CONSTRUCTION NOTES

1. COMPACT SUBGRADE
2. COVER WITH NEEDLE PUNCHED GEOTEXTILE.
3. CONSTRUCT 200mm THICK PAD OVER GEOTEXTILE USING ROADBASE OR 30mm AGGREGATE. MINIMUM LENGTH OF 10m AND MINIMUM WIDTH OF 2.5m.GEOTEXTILE MAY BE A WOVEN OR NEEDLE PUNCHED PRODUCT WITH A MINIMUM CBR BURST STRENGTH (AS3706.4-90) of 2500 N.
4. CONSTRUCT HUMP IMMEDIATELY WITHIN BOUNDARY TO DIVERT WATER TO A SEDIMENT FENCE OR OTHER SEDIMENT TRAP.

SHAKE DOWN AREA

NOT TO SCALE

PRELIMINARY ISSUE
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REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
A	75% ISSUE FOR CLIENT REVIEW	15/06/16	SA	SA	DH	AW
B	AMENDED ROAD WIDTH & SITE NUMBERS	20/06/16	SA	SA	DH	AW
C	ISSUE FOR CLIENT REVIEW	24/06/16	SA	SA	DH	AW

SCALES:

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DESIGN BY: S.ADAM
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DATE:

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LOCAL GOVERNMENT AUTHORITY: BALLINA SHIRE COUNCIL

PROJECT: 67 SKENNARS HEAD ROAD

DRAWING TITLE: EROSION AND SEDIMENT NOTES

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	0022	C

CAD FILE: T:\J107 - 67 SKENNARS HEAD ROAD - DA\6 - CAD\J107-0022.DWG PLOTTED BY: STEPHENA PLOT DATE: 23/05/2018 2:17:00 PM

100mm AT ORIGINAL SIZE

APPENDIX B | CATCHMENT BREAKDOWN TABLES

Pre-development table

Catchment	Area (m2)	Developed Type	Treatment method / basin number	Forest Catchment (Lumped)	Rural Catchment (Lumped)	Supplementray Catchment (Impervious Compacted Road Base & Roof))	Pervious Catchment (Grass and Forest)	Drains Percent Imperv %	Material type	Travel Length (m)	Fall	Hortons Roughness (n)	Average Surface Slope %	Tc from Friends Equation (min)	Tc from channel flow (min)	Tc Total (min)
LPD-A	99566	Rural Residential	No treatment. Sheet flow into concentrated channel flow	7010	92556	594	98972	1	Dense Grass (Conservative)	150	1.40	0.060	0.93	35	4	39
Total	99566															

Post-development table

Catchment	Area (m2)	Developed Type	Treatment method / basin number	Forest Catch (Lumped)	Road (Split)	Road Imperv %	Ground Level (Split)	Ground Level Imperv %	Roof (Split)	Roof Imperv %	Paved Catch Imperv	Supp Catch Imperv	Pervious Catch	Drains Imperv %	Material type	Travel Length (m)	Fall	Hortons Roughness (n)	Average Surface Slope %	Tc from Friends Equation (min)	Tc from channel flow (min)	Tc Total (min)
DISCHARGE VIA BASIN	70500	Urban Res	GPT into Bioretention Basin	N/A	28820	60	15760	25	25920	100	26800	21325	22675	68	Well Maintained Grass (Conservative)	20	0.2	0.035	1.00	10	13	23
DISCHARGE VIA SWALE	3100	Urban Res	Bioretention swale	N/A	800	60	2000	15	300	100	N/A	1080	2020	35	Well Maintained Grass (Conservative)	14	0.2	0.035	1.43	8	1	9
DISCHARGE VIA BASIN BYPASS	25966	Rural Res	Bypass	7010	1500	70	17456	0	N/A	N/A	N/A	1050	24616	4	Dense Grass (Conservative)	72	0.5	0.060	0.69	29	9	38
Total	99566																					

APPENDIX C | WBM BMT'S: 67 SKENNARS ROAD, LOCAL CATCHMENT DESIGN STORM AND LONG-TERM INUNDATION ASSESSMENT

NOTE
REFER TO TECHNICAL REPORT 10
TO VIEW THIS REPORT.

APPENDIX D | SEDIMENT AND EROSION CONTROL CHECKLIST

Stormwater, and Erosion Sediment Control Maintenance Checklist

Swale Maintenance			
Inspection frequency:	weekly during construction	**Date of visit:**	
Location:			
Description:			
Site visit by:			

Inspection Items	Y	N	Action required (details)
Debris present within swale?			(Remove by hand and dispose appropriately)
Swale vegetation depleted			(Reseed and maintain untill established)
Swale vegetation in excess to grasses only (i.e. Trees, etc)			(Remove excess vegetation and dispose appropriately)
Excess Sediment within Swale?			(Remove by hand and dispose appropriately)
Swale formation compromised?			(Reshape swale and make good)

Comments: Inspection frequency should be adjusted depending upon observations

Rock Filter Dam			
Inspection frequency:	weekly during construction	**Date of visit:**	
Location:			
Description:			
Site visit by:			

Inspection Items	Y	N	Action required (details)
Debris present ?			(Remove by hand and dispose appropriately)
Rock filter dam formation, filter material and weir compromised?			(repair and make good)
Gypsum filled bag (of flock block damaged or depleted?			(Replace)
Excess Sediment upstream of Rock filter dam?			(Remove by hand and dispose appropriately)

Comments: Inspection frequency should be adjusted depending upon observations

Sediment Fence			
Inspection frequency:	weekly during construction	**Date of visit:**	
Location:			
Description:			
Site visit by:			

Inspection Items	Y	N	Action required (details)
Sediment Fence comprimised			(Repair or reinstall if necessary)
Excess Sediment within Swale?			(Remove by hand and dispose appropriately)

Comments: Inspection frequency should be adjusted depending upon observations

Stabilised Site Access			
Inspection frequency:	Daily during construction	**Date of visit:**	
Location:			
Description:			
Site visit by:			

Inspection Items	Y	N	Action required (details)
Excesive Sediment build up?			(Remove sediment)
Stabilised site access in poor repair?			(repair or replace)
Sediment tracking onto road from site?			(inspect stabilised site access and repair, replace, modify as necessary)

Comments: Inspection frequency should be adjusted depending upon observations

APPENDIX E | HUMEGUARD GPT DETAILS

HumeGard® GPT
Technical manual

Issue 4

Contents

enviro DEVELOPMENT™ PROFESSIONAL

HumeGard® GPT

The HumeGard® system is a Gross Pollutant Trap (GPT) that is specifically designed to remove gross pollutants and coarse sediments ≥ 150 microns, from stormwater runoff. A wide range of models are available to provide solutions for normal and super-critical flow conditions.

The patented HumeGard® GPT incorporates a unique floating boom and bypass chamber to enable the continued capture of floating material, even during peak flows. The configuration also prevents re-suspension and release of trapped materials during subsequent storm events.

The HumeGard® GPT is designed for residential and commercial developments where litter and sediment are the target pollutants. It is particularly useful in retrofit applications or drainage systems on flat grades where low head loss requirements are critical, and in high backwater situations.

The value of the HumeGard® GPT has proven it to be one of the most successful treatment devices in Australia today:

- **The system provides high performance with negligible head loss**
  The HumeGard® GPT has a head loss 'k' factor of 0.2, important for retrofit and surcharging systems.
- **It captures and stores a large volume of pollutants**
  For pollutant export rates reported by Australia Runoff Quality (1 m^3/hectare/year), the HumeGard® GPT is sized for maintenance intervals up to annual durations.
- **It uses independently proven technology**
  The system was developed and tested by Swinburne University of Technology, Australia, in 1998, to demonstrate compliance with operational criteria from the Victorian EPA.
- **It has low operational velocities**
  Flow velocity in the storage chamber is <0.2 m/s to ensure the comb self-cleans and improves settling of coarse sediment.
- **It retains floating material even in bypass**
  All GPTs bypass at high flows. The patented floating boom will capture and retain floating materials even when bypass occurs.
- **It provides cost effective treatment for litter and coarse sediments**
  The system's large capacity and long maintenance intervals reduces the overall lifecycle costs in comparison with other treatment measures.
- **It can reduce the footprint of the stormwater treatment train**
  Installation of a HumeGard® GPT prior to vegetated treatment measures can assist in reducing their overall footprint.
- **It maximises above ground land use**
  The HumeGard® GPT is a fully trafficable solution, so it can be installed under pavements and hardstands to maximise land use on constrained sites.
- **It is easy to maintain**
  Cleanout of the HumeGard® GPT can be performed safely and effectively from the surface using a vacuum truck.
- **It is made from quality componentry**
  All internal metal components are made from 304 stainless steel or fibreglass, and the system undergoes rigorous quality control prior to dispatch.

System operation

The HumeGard® GPT utilises the processes of physical screening and floatation/sedimentation to separate the litter and coarse sediment from stormwater runoff. It incorporates an upper bypass chamber with a floating boom that diverts treatable flows into a lower treatment chamber for settling and capturing coarse pollutants from the flow.

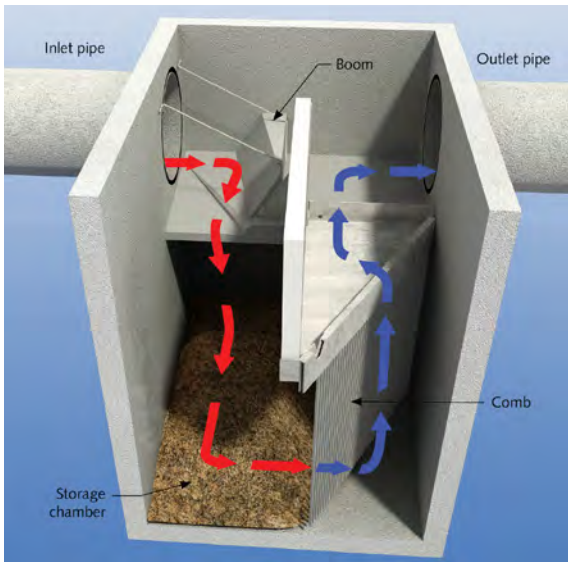
Bypass chamber

1. Stormwater flows into the inlet (boom) area of the bypass chamber (refer to Figure 1).
2. During flows up to and including the design treatment flowrate, the angled boom directs the total flow into the storage/treatment chamber.
3. During higher flow conditions, the angled boom continues to direct all floating litter from the bypass chamber into the storage/treatment chamber. The inlet area of the bypass chamber floor is angled towards the treatment chamber to ensure the bed load sediment material continues to be directed into the storage chamber even when the boom is floating.
4. At peak flows, the boom remains semi-submerged and enables excess flow to pass underneath, regulating the flow into the storage/treatment chamber. This ensures that higher flows, which could otherwise scour and re-suspend previously trapped materials, are not forced into the storage/treatment chamber. The floating boom bypass ensures previously trapped floating materials are retained. Each HumeGard® GPT is designed to achieve an operating velocity below 0.2 m/s through the storage chamber to ensure the settling of coarse sediment and keep the comb clean.

Treatment chamber

1. Once diverted into the treatment chamber, the flow continues underneath the internal baffle wall, passes through the stainless steel comb and flows over the flow controlling weir to the outlet.
2. Pollutants with a specific gravity less than water (S.G.<1) remain floating on the water surface in the storage/treatment chamber. Sediment and other materials heavier than water (S.G.>1) settle to the bottom of the chamber. The design and depth of the chamber minimises turbulent eddy currents and prevents re-suspension of settled material. The comb prevents any neutrally buoyant litter in the treatment chamber from escaping under the baffle wall.

Figure 1 – Operation during design flow conditions



Independent verification testing

Laboratory and field testing of the HumeGard® GPT for hydraulic performance and litter capture was conducted in Australia by Swinburne University of Technology, during 1996 and 1998.

Laboratory and field testing (Waste Management Council of Victoria 1998, Trinh 2007, Woods 2005, Swinburne University of Technology 2000) has proven the performance outlined in Table 1 below.

Further field testing was conducted by the University of the Sunshine Coast from 2013 to 2015, including a minimum of 15 qualifying storm events, to determine TSS, TP and TN removal efficiencies, which are also outlined in Table 1 below.

Table 1 – HumeGard® GPT performance summary

Pollutant	Removal efficiency	Details
Gross pollutants (litter, vegetation)	90%	Annually
TSS	49%	Annually (including bypass)
Hydrocarbons	90%	In an emergency spill event
TP	40%	Particulate-bound
TN	26%	Particulate-bound

Notes:

1. Nutrient removal is influenced by individual catchment characteristics and partitioning between dissolved and particulate nitrogen.
2. For further details on performance testing contact Humes.
3. Gross pollutant traps are not specifically designed to capture hydrocarbons, though may do so during emergency spill events. When this occurs, maintenance is required immediately.
4. The unique design of the HumeGard® floating boom allows it to be modified to treat higher flows and capture more gross pollutants and sediment on request.

System options

A wide range of sizes are available to suit catchment pollutant generation rates and Water Quality Objectives (WQO). Table 2 below presents the standard model dimensions and total pollutant capacities. We recommend that designers contact Humes Water Solutions for detailed sizing on each project and for advice with larger units.

Pollutant export rates detailed in Australian Runoff Quality (Engineers Australia 2006) suggests that a typical urban catchment will produce 1 m^3/hectare/year of gross pollutants and sediment. Humes Water Solutions advises that this be taken into account when selecting an appropriate model.

Table 2 – HumeGard® model range and dimensions

HumeGard® model	Pipe diameter or box culvert width (mm)	Treatment flow rate (L/s)	Total pollutant capacity (m^3)	Length (mm)	Width (mm)	Height (mm)
HG12	300	85	3	2,000	1,758	2,500
HG12A	375	100	3	2,000	1,758	2,500
HG15	450	130	3	2,000	1,758	2,500
HG15A	525	150	3	2,000	1,758	2,500
HG18	600	600	3	2,100	2,100	2,115
HG24	600 - 750	1,050	8	2,500	2,700	2,740
HG27	750 - 900	1,110	7	2,500	3,000	2,715
HG30	750 - 825	1,330	12	2,500	3,350	3,365
HG30A	900	1,160	11	2,500	3,350	3,365
HG35	900	1,540	12	2,500	3,850	3,390
HG35A	1,050	1,370	11	2,500	3,850	3,390
HG40	900	1,910	16	2,850	4,350	3,390
HG40A	1,050	1,750	14	2,850	4,350	3,390
HG40B	1,200	1,580	12	2,850	4,350	3,390
HG45	1,200	1,960	19	2,900	4,900	3,915
HG45A	1,350	1,780	19	3,200	4,900	3,915
HG50 and above	Custom					

Notes:

1. The unique design of the HumeGard® floating boom allows it to be modified to treat a wide range of flowrates. Contact Humes for details on the model to suit your project.
2. HumeGard® can be modified to suit a box culvert, larger pipe or skewed outlet. Please contact your Humes Water Solutions Manager.
3. HumeGard® should be sized for either pipe diameter or treatment flow rate.
4. Units listed are standard configurations. Custom units can be provided to meet specific project requirements.
5. For confirmation of HumeGard® sizing or to discuss project specific requirements please contact your Humes Water Solutions Manager.
6. Refer to current Humes Terms and Conditions of Sale.
7. Australian Rainfall Quality recommend a pollutant export rate for a typical residential catchment is up to 1m^3/ha/yr of mixed waste and sediment.
8. HumeGard® can be modified to suit typical tail-water effects from downstream areas such as basins. Please contact Humes for design advice.
9. HumeGard® can be modified to suit high groundwater conditions. Please contact Humes for design advice.

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Variants

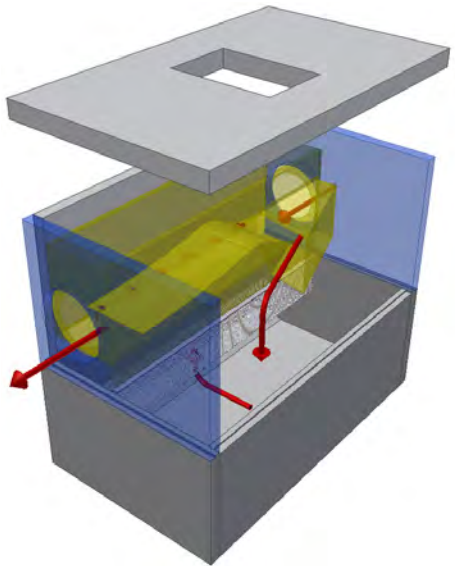
A number of additional innovations have been made to the HumeGard® GPT to facilitate their effective operation in a wider range of applications:

- Super-critical HumeGard® GPT – designed to operate under supercritical flow conditions in steep, high velocity drainage networks.
- Angled HumeGard® GPT – designed to replace a 45° or 90° junction in a drainage network.
- Dual outlet HumeGard® GPT – designed to divert the treatment flow to downstream natural Water Sensitive Urban Design (WSUD) elements such as wetlands and bio-retention whilst bypassing excess flows through a second outlet.

- **Super-critical HumeGard® GPT**
  The super-critical HumeGard® GPT (refer to Figure 2) was borne out of the original HumeGard® GPT, with modifications to deliver even greater performance under super-critical flow conditions. This model replaces the floating boom with a broad-crested weir that diverts the treatment flows into the treatment chamber under super-critical flow (Fr>1) conditions without creating hydraulic jumps and adversely impacting on performance.

  Flow into the treatment chamber passes through a stainless steel screen at a velocity <0.2 m/s and exits the device via a slot beneath the broad-crested weir (refer to the red arrows in Figure 2). The inserts in these models are manufactured from fibreglass for increased durability. The stainless steel screen can be shaped with a curved profile upon request. When the treatment flow rate is exceeded, the excess flow bypasses over the broad-crested weir to the outlet. This maintains the treatment flow into the chamber but protects against scour of captured material.

Figure 2 – Super-critical HumeGard® GPT



- **Angled HumeGard® GPT**
  The angled HumeGard® GPT (refer to Figure 3), was developed to facilitate the replacement of junction pits while still providing the treatment capabilities of the original HumeGard® device. These units simply alter the outlet location to allow for a change of pipe direction of 45° or 90°. The Angled HumeGard® GPT can be supplied in any of the standard unit sizes, however, the designer must allow for a minor head loss factor 'k' of 1.3 instead of 0.2 (which applies to the standard HumeGard® GPT design).

- **Dual Outlet HumeGard® GPT**
  The Dual Outlet HumeGard® GPT has been designed to operate as a diversion structure upstream of natural WSUD options such as constructed wetlands, ponds, lakes, and bio-retention systems.

  The units are designed such that one outlet conveys the treated flow into the natural WSUD measure and the standard outlet bypasses the excess flow around the downstream system (refer to Figure 4). Dual Outlet HumeGard® units are available in the same sizes as the standard HumeGard® units (refer Table 2 on page 4).

Figure 3 – Angled HumeGard® GPT

Figure 4 – Dual Outlet HumeGard® GPT

Inundation/tidal applications

The boom of the HumeGard® GPT enables the capture of floating pollutants even at peak flows, often when other fixed weir devices are in bypass mode. This unique feature also makes the HumeGard® GPT ideal for applications that are subject to both tidal and tail water effects.

In tidal applications the floating boom effectively traps the floating pollutants and prevents the loss of the gross pollutants from the system. In fixed weir devices, previously trapped floating litter may be backwashed out of the GPTs during the rising phase, to later bypass the GPT during the falling phase of the tide. As this happens twice daily, spring tides could quickly empty devices relying upon a fixed weir.

Marine grade 316 stainless steel is used for all internals in devices installed in tidal applications. In acidic/aggressive environments, these may also be epoxy-coated. Contact Humes Water Solutions for specific designs to suit these applications.

A plinth can also be added to the false floor under the boom to ensure sediment loads are captured during inundation.

Design information

To design a system suitable for your project it is necessary to review the configuration of the stormwater system, the location and purpose of other stormwater management (WSUD) controls, the catchment area and the hydrology.

Configuration of the stormwater system

The configuration of the stormwater system is important since the HumeGard® GPT operates with an "in-line", 45° or 90° alignment. Inlet pipe grades between 0.5% and 5% are recommended for at least five pipe diameters upstream of the HumeGard® GPT. The pipe grade and flow velocity will determine whether a super-critical unit is required.

Location in the stormwater system

Depending upon the site, the GPT can be oriented to have the treatment chamber on the left or right side of the pipe to suit constraints. Humes Water Solutions can work closely with stormwater designers to select the appropriate location and orientation for their system.

Catchment area

Research presented in Australian Runoff Quality (Engineers Australia 2006) concluded that roughly 1 m^3/hectare/year of gross pollutants and sediment could be expected from a typical residential catchment. Therefore, GPTs designed for an annual maintenance interval should have a pollutant storage capacity roughly equal to the number of hectares of catchment it treats (e.g. 10 hectare catchment = 10 m^3 pollutant storage).

Sizing HumeGard® GPTs

The large storage volumes of the HumeGard® GPT enables more pollutants to be captured before maintenance is required, which greatly reduces its lifecycle costs. In accordance with accepted hydraulic principles the larger volumes in the HumeGard® GPT results in lower velocities through the device, minimising scour and re-suspension of sediment.

Humes Water Solutions has developed a design request form (see page 30) for stormwater designers to complete and return to obtain a detailed design of the appropriate device.

MUSIC/pollutant export model inputs

Many local authorities utilise MUSIC or other pollutant export models to assist in stormwater treatment train selection, and recommend generic inputs for GPTs. Considering these against the independent research results, the following conservative removal efficiencies (refer to Table 3 below) are recommended for the HumeGard® GPT on an annual basis (i.e. no bypass).

Table 3 – MUSIC inputs for HumeGard® GPTs

Pollutant	Removal efficiency
Gross pollutants (litter, vegetation)	90%
TSS	49%
TP	40%
TN	26%

System installation

Top:
Preparing the aggregate base (Step 2)

Middle:
Installing the main bypass chamber (Step 4)

Bottom:
Placing the main chamber lid (Step 7)

The installation of the HumeGard® unit should conform to the local authority's specifications for stormwater pit construction. Detailed installation instructions are dispatched with each unit.

The HumeGard® unit is installed as follows:

1. Prepare the excavation according to plans.
2. Prepare the compacted aggregate base.
3. Install the main treatment chamber section.
4. Install the main bypass chamber section/s (if required).
5. Fit the stainless steel comb (if required).
6. Connect the inlet and outlet pipes.
7. Place the main chamber lid.
8. Install the frame and access covers.
9. Backfill to specified requirements.

System maintenance

The design of the HumeGard® GPT means that maintenance is best performed by vacuum trucks which avoids entry into the unit.

Additional access covers can be designed upon request.

A typical maintenance procedure includes:

1. Remove access covers.
2. With a vacuum hose, remove the floating litter from the treatment chamber.
3. Determine the depth of water and sediment layers.
4. Insert sluice gate into the upstream manhole.
5. Decant water from the treatment chamber into the upstream manhole until the sediment layer is exposed.
6. Remove the sediment layer with the vacuum hose; jet with a high pressure hose if required.
7. Remove sluice gate from the upstream manhole and allow water to return to the HumeGard® GPT.
8. Replace access covers.

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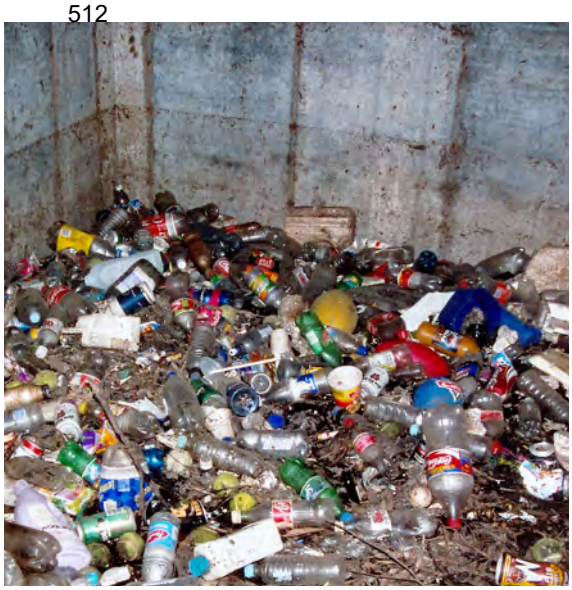


Left:
Floating litter captured in the treatment chamber

FAQs

- **Can the boom become stuck?**
  The boom weighs up to 80 kg. Unless there is a large branch, car wheel, or other large item carried through the drainage network, the mass of the boom will ensure it returns to the floor.
- **Will the gross pollutants bypass when the boom floats?**
  All treatment measures are designed to treat a specific flow. Once this is exceeded, any entrained pollutants in the flow will bypass the treatment chamber. Often this is less than 5% of the annual load. A significant quantity of gross pollutants are buoyant when entering a GPT and, unlike fixed weir systems which bypass these floatable items, the HumeGard® boom provides continuous treatment of them, even in bypass.
- **Will the retention of water in the treatment chamber lead to the release of nutrients as pollutants break down?**
  Over time, captured organic materials will breakdown and release nutrients in all treatment measures whether natural or manufactured. As part of a treatment train, downstream vegetated measures can remove the small proportion of nutrients released during dry weather flows. A regular maintenance program will reduce the amount of breakdown occurring.
- **What is the design life of a HumeGard® GPT?**
  The entire product is designed to last a minimum of 50 years.
- **Why is the HumeGard® GPT larger than other GPTs?**
  The design of the HumeGard® GPT is to ensure a velocity through the treatment chamber <0.2 m/s to ensure the comb self-cleans. From engineering principles, a larger cross-sectional area is required to reduce the loading rate. As proven by Stokes Law, lower chamber velocities mean smaller sediment particles can be captured.
- **Why would I use a HumeGard® GPT upstream of a biofilter?**
  Using a HumeGard® GPT upstream of a biofilter acts as a sediment forebay and removes litter, containing it to a confined location for easy removal by a vacuum truck. This protects the biofilter, lengthens its lifespan and reduces the ongoing maintenance costs.

References

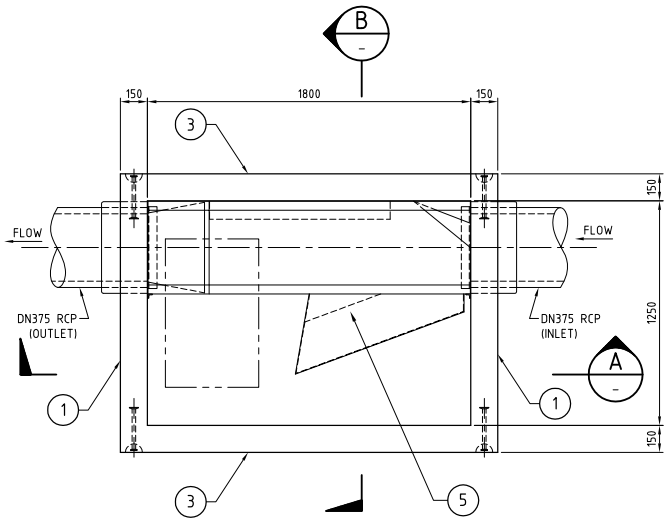
- Waste Management Council of Victoria (1998) “Inline Litter Separator: Installation and Monitoring Project”, EcoRecycle, Victoria.
- Trinh, N. An Investigation into the Trapping Efficiencies of Gross Pollutant Traps. Thesis. Brisbane, Queensland: Queensland University of Technology, 2007.
- Woods, S. Performance Evaluation of an In-Line Separator. Masters Thesis. Melbourne, Victoria: Swinburne University of Technology, 2005.
- Swinburne University of Technology (2000) “HumeGard® In-line Litter Separator Sediment Capture Testing”, School of Engineering and Science.
- Engineers Australia (2006) “Australian Runoff Quality”.
- Lucke, T. 2015, Characterisation of Water Quality Improvement Processes by GPTs at University of the Sunshine Coast (Humegard HG27 Monitoring Program), School of Science and Engineering, University of the Sunshine Coast, QLD, Australia.

Appendix

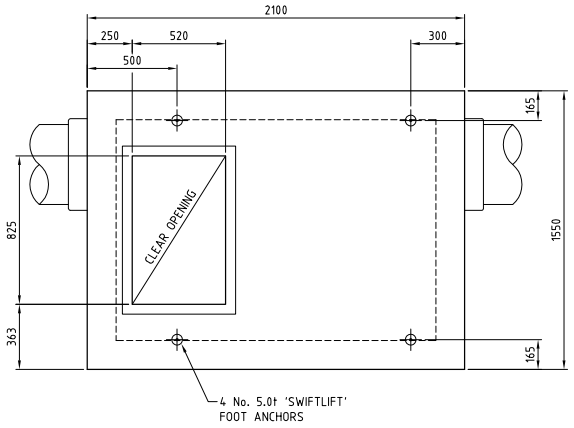
HumeGard® GPT technical drawings

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
2	GENERAL REVISION, REISSUED FOR MANUFACTURE	MZ	——	RM

ITEM No	DWG DESCRIPTIONS	DWG No
1	END WALL	HG12-20
2	BASE SLAB	HG12-21
3	SIDE WALL	HG12-22
4	PRECAST LID	HG12-07
5	GRP INSERT ASSEMBLY DETAILS	HG12A/L-08



PLAN VIEW (LID REMOVED)
SCALE 1:20

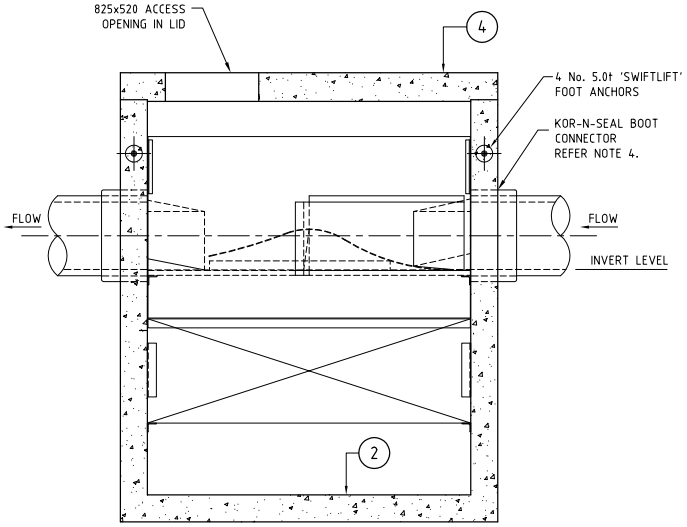


PLAN ON LID
SCALE 1:20

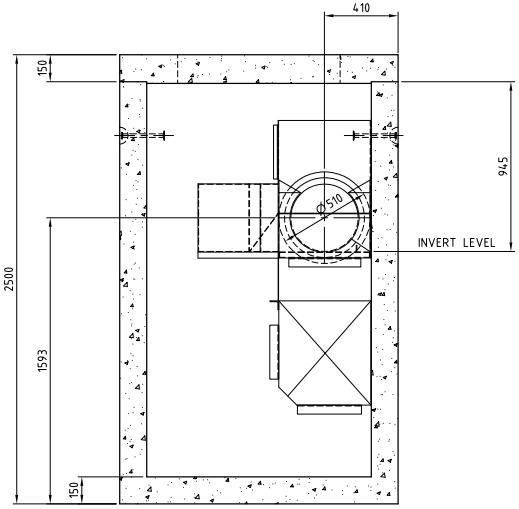
NOTES

1. GRP INSERT MANUFACTURED FROM 5mm GRP.
2. ALL CONCRETE COMPONENTS TO BE HANDLED VIA CAST-IN SWIFTLIFT ANCHORS AT ALL TIMES.
3. UNIT MASS: CHAMBER (ASSEMBLED) = 7.0t (WITHOUT LID) LID = 1.2t
4. KOR-N-SEAL BOOT CONNECTOR P/N = S106-20WP
5. SEE DRAWING HG-CAST 2 FOR CASTING SEQUENCE

515



SECTION A
SCALE 1:20



SECTION B
SCALE 1:20

DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH M1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

Humes TECHNICAL SERVICES BRISBANE, QUEENSLAND

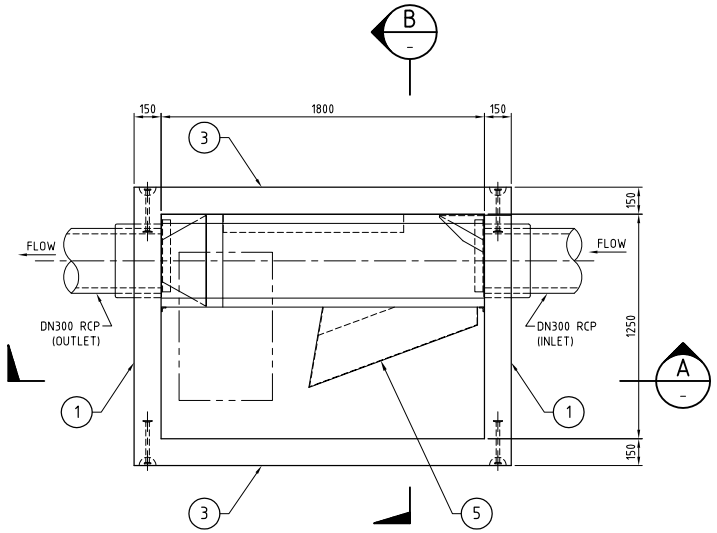
DSN.	WST	02-09-10
DWN.	MZ	02-09-10
CKD.	RM	——
APP.	WST	——

HUMES WATER SOLUTIONS
STANDARD HUMEGARD
HUMEGARD HG12A/L
DN375/DN375 RCP
GENERAL ASSEMBLY

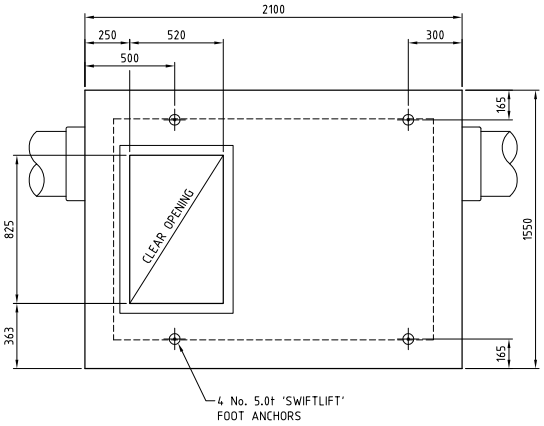
SUPERSEDES	PLOT SCALE	SIZE	DRG. NO.	ISSUE
HG12A/L-01 ISSUE 1	1:1	A2	HG12A/L-01	2

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
2	GENERAL REVISION	MZ	——	RM

ITEM No	DRAWING DESCRIPTIONS	DWG No
1	END WALL	HG12-20
2	BASE SLAB	HG12-21
3	SIDE WALL	HG12-22
4	PRECAST LID	HG12-07
5	GRP INSERT ASSEMBLY DETAILS	HG12/L-08



PLAN VIEW (LID REMOVED)
SCALE 1:20



PLAN ON LID
SCALE 1:20

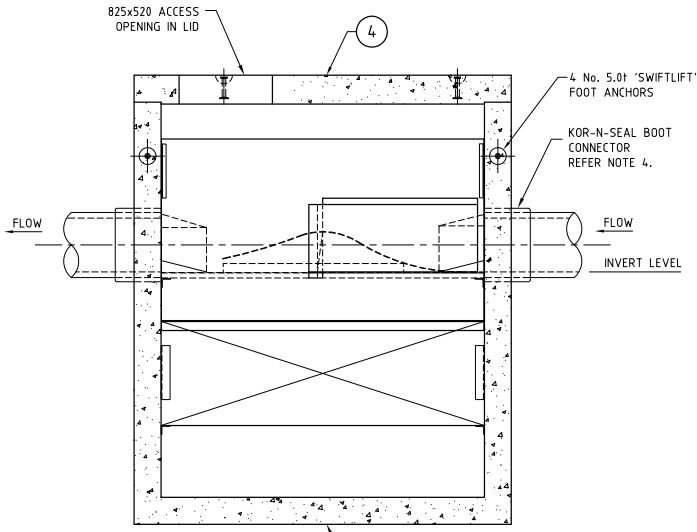
NOTES

1. GRP INSERT MANUFACTURED FROM 5mm GRP.
2. ALL CONCRETE COMPONENTS TO BE HANDLED VIA CAST-IN SWIFTLIFT ANCHORS AT ALL TIMES.
3. UNIT MASS: CHAMBER (ASSEMBLED) = 7.0t (WITHOUT LID)
   LID = 1.2t
4. KOR-N-SEAL BOOT CONNECTOR P/N = S106-16WP

. SEE DRAWING HG-CAST 2 FOR CASTING SEQUENCE

DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH M1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.



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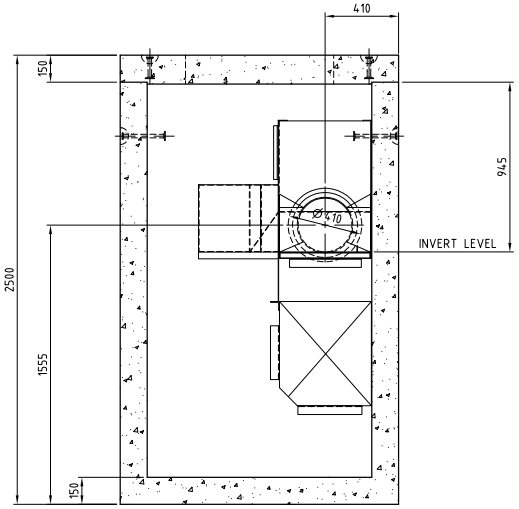
SCALE 1:20



SECTION B
SCALE 1:20

Humes TECHNICAL SERVICES BRISBANE, QUEENSLAND

Holcim (Australia) Pty Ltd ABN 87 099 732 297

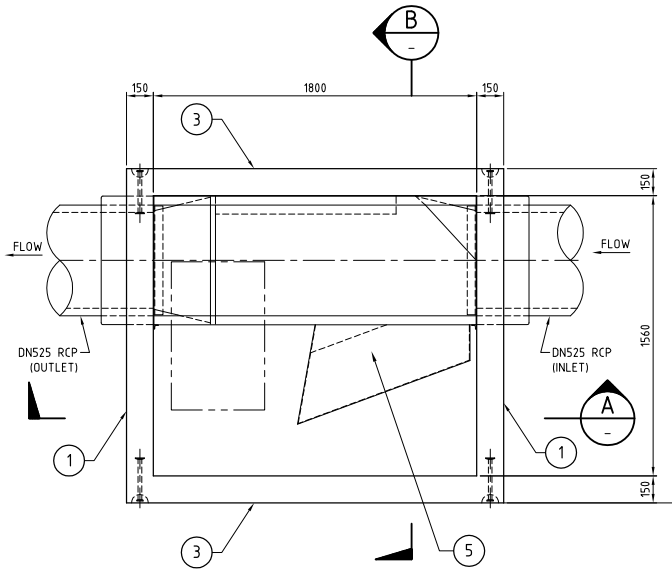
DSN.	WST	14-03-07
DWN.	MZ	14-03-07
CKD.	RM	——
APP.	WST	——

HUMES WATER SOLUTIONS
STANDARD HUMEGARD
HUMEGARD HG12/L
DN300/DN300 RCP
GENERAL ASSEMBLY

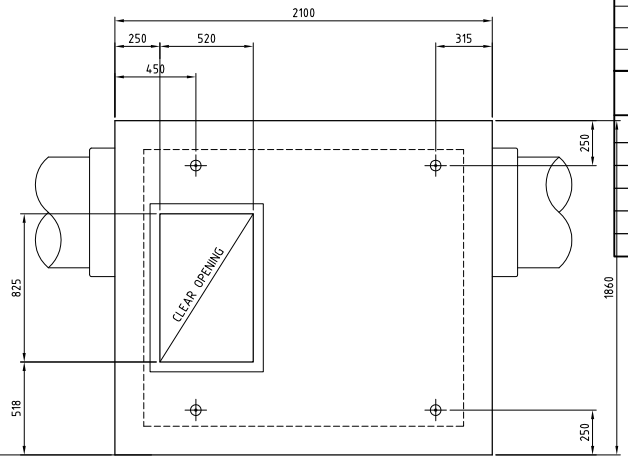
SUPERSEDES	PLOT SCALE	SIZE	DRG. NO.	ISSUE
HG12/L-01 REV 1	1:1	A2	HG12/L-01	2

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
2	GENERAL REVISION	MZ	——	RM

ITEM No	DWG DESCRIPTIONS	DWG No
1	END WALL	HG15-20
2	BASE SLAB	HG15-21
3	SIDE WALL	HG15-22
4	PRECAST LID	HG15-07
5	GRP INSERT ASSEMBLY DETAILS	HG15A/L-08



PLAN VIEW (LID REMOVED)
SCALE 1:20



PLAN ON LID
SCALE 1:20

NOTES

1. GRP INSERT MANUFACTURED FROM 5mm .
2. ALL CONCRETE COMPONENTS TO BE HANDLED VIA CAST-IN SWIFTLIFT ANCHORS AT ALL TIMES.
3. UNIT MASS: CHAMBER (ASSEMBLED) = 7.7t (WITHOUT LID)
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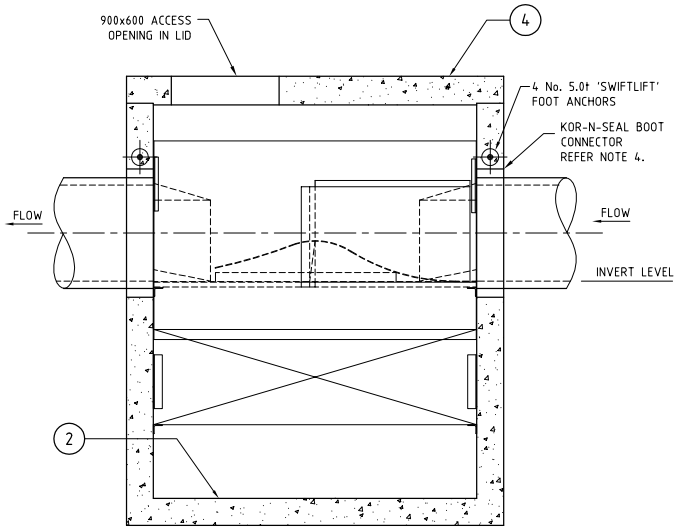
4. KOR-N-SEAL BOOT CONNECTOR P/N = S206-28
5. SEE DRAWING HG-CAST 2 FOR CASTING SEQUENCE.

517



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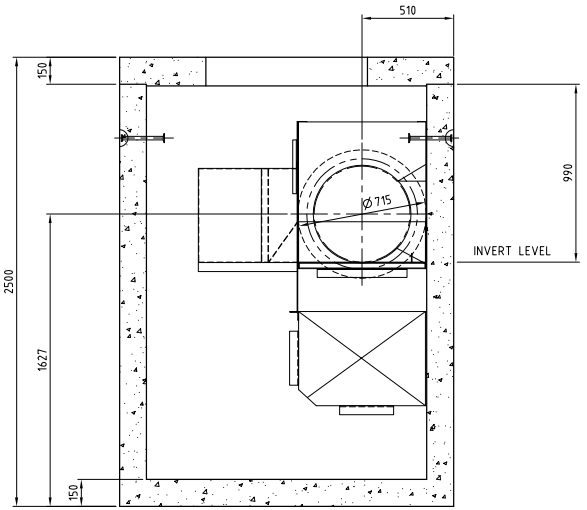


SECTION B
SCALE 1:20

DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

Humes TECHNICAL SERVICES BRISBANE, QUEENSLAND

Holcim (Australia) Pty Ltd ABN 87 099 732 297

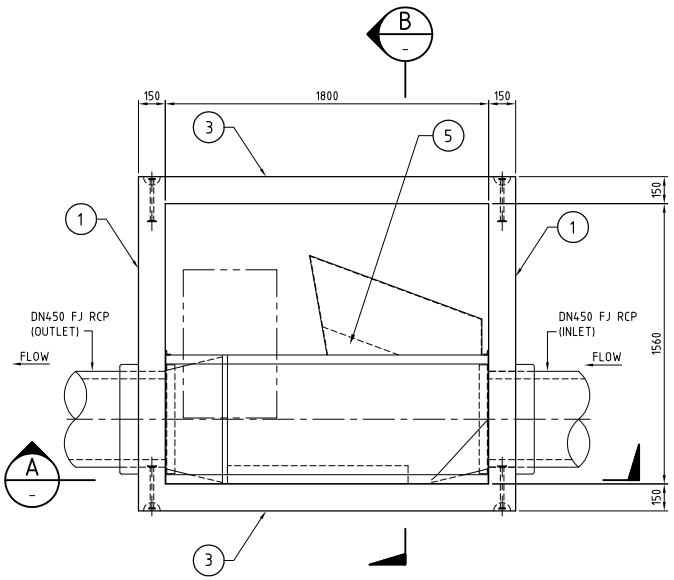
DSN.	WST	07-09-10
DWN.	MZ	07-09-10
CKD.	RM	——
APP.	WST	——

HUMES WATER SOLUTIONS
STANDARD HUMEGARD
HUMEGARD HG15A/L
DN525/DN525 RCP
GENERAL ASSEMBLY

SUPERSEDES	PLOT SCALE	SIZE	DRG. NO.	ISSUE
HG15A/L-01 ISSUE 1	1:1	A2	HG15A/L-01	2

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
2	GENERAL REVISION	MZ	——	DFW

ITEM No	DWG DESCRIPTIONS	DWG No
1	END WALL	HG15-20
2	BASE SLAB	HG15-21
3	SIDE WALL	HG15-22
4	PRECAST LID	HG15-07
5	GRP INSERT ASSEMBLY DETAILS	HG15/R-08



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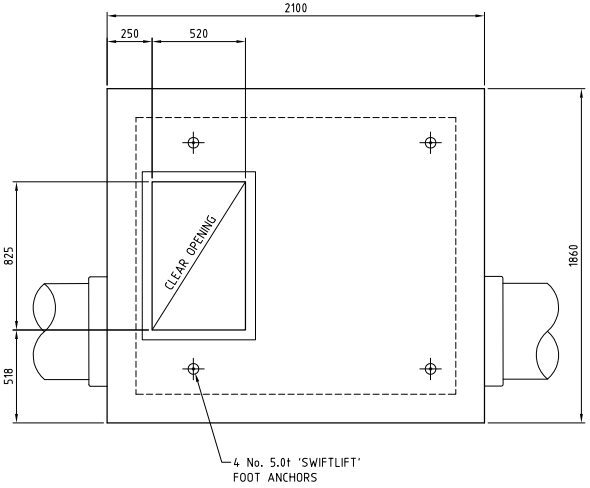

PLAN ON LID
SCALE 1:20

NOTES

1. GRP INSERT MANUFACTURED FROM 5mm GRP.
2. ALL CONCRETE COMPONENTS TO BE HANDLED VIA CAST-IN SWIFTLIFT ANCHORS AT ALL TIMES.
3. UNIT MASS: CHAMBER (ASSEMBLED) = 7.7t (WITHOUT LID)
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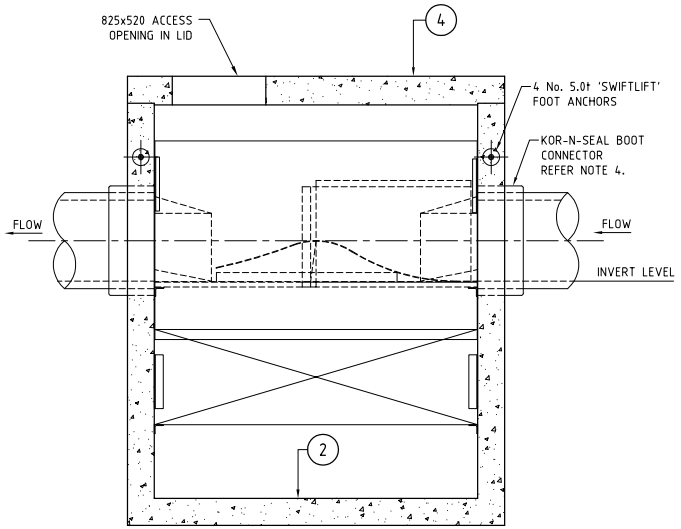
518



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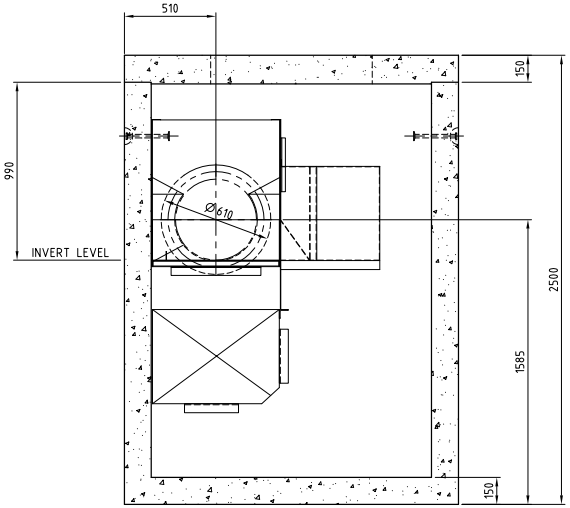

SECTION B
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DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH M1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

Humes TECHNICAL (DESIGN) SERVICES BRISBANE, QUEENSLAND

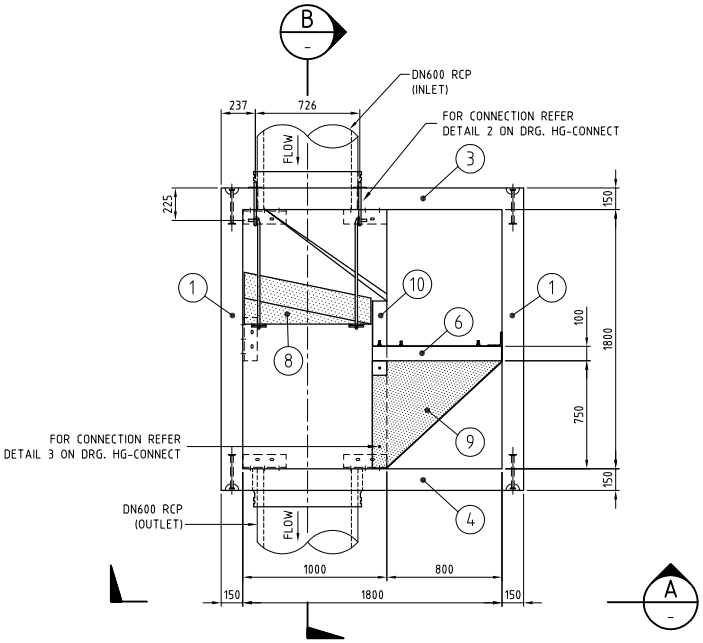
DSN.	DFW	10-07-08
DWN.	MZ	10-07-08
CKD.	DFW	——
APP.	WST	——

HUMES
STANDARD DRAWING
HUMEGARD HG15/R
DN450/DN450 FJ RCP
GENERAL ASSEMBLY

SUPERSEDES	PLOT SCALE	SIZE	DRG. NO.	ISSUE
HG15/R-01 REV 1	1:1	A2	HG15/R-01	2

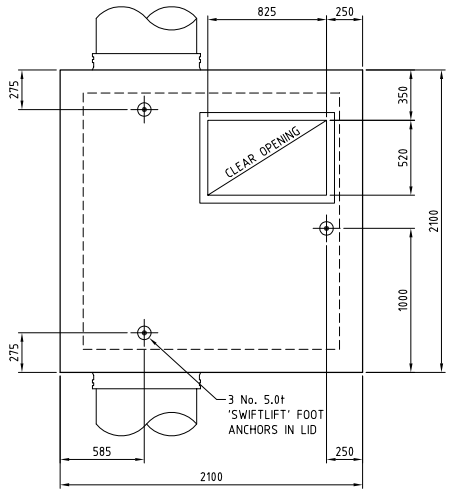
ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
3	REFERENCE DWG No. REVISED - REISSUED FOR MANUFACTURE	MZ	24-11-10	RM

ITEM No	DRAWING DESCRIPTION	DWG No
1	END WALL	HG18-02
2	BASE SLAB	HG18-03
3, 4	SIDE WALL	HG18-04
5	FALSE FLOOR	HG18/L-05
6	CONCRETE BAFFLE WALL	HG18/L-05
7	PRECAST LID	HG18/L-06
8	FLOATING BOOM	HG18/L-07
9	WEIR	HG18/L-08
10	BAFFLE SIDE WALL	HG18/L-09
11	COMB	HG18/L-10



PLAN VIEW (LID REMOVED)

SCALE 1:25



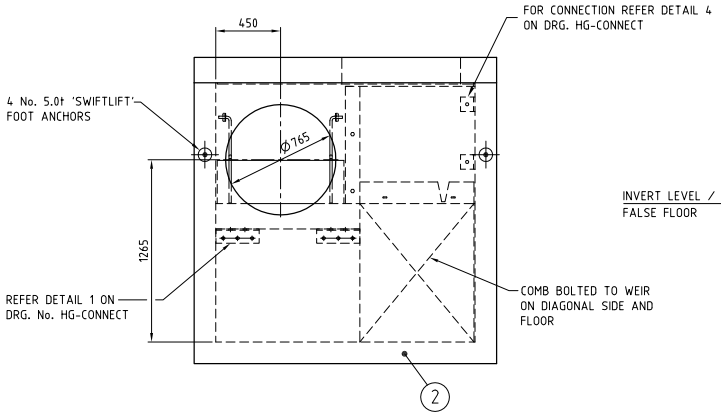
PLAN ON LID

SCALE 1:25

NOTES:

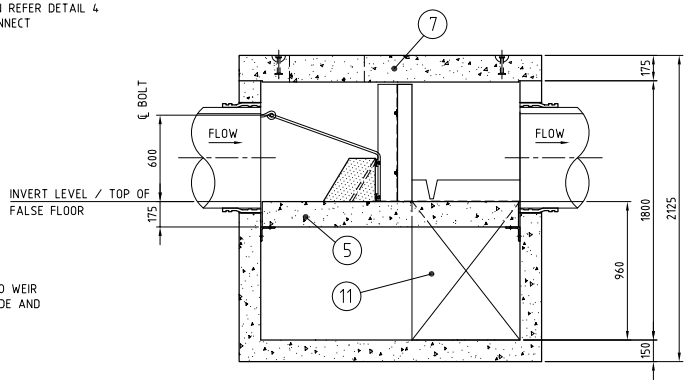
1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF COMPLETE UNIT = 7.8 t (WITHOUT LID).
   MASS OF LID = 1.9 t
6. KOR-N-SEAL BOOT CONNECTOR P/N = S206-30L (INLET & OUTLET)

519



VIEW A

SCALE 1:25



SECTION B

SCALE 1:25

DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

Humes TECHNICAL SERVICES BRISBANE, QUEENSLAND

Holcim (Australia) Pty Ltd ABN 87 099 732 297

DSN.	WST	24-11-10
DWN.	MZ	24-11-10
CKD.	RM	24-11-10
APP.	WST	24-11-10

HUMES WATER SOLUTIONS

STANDARD HUMEGARD

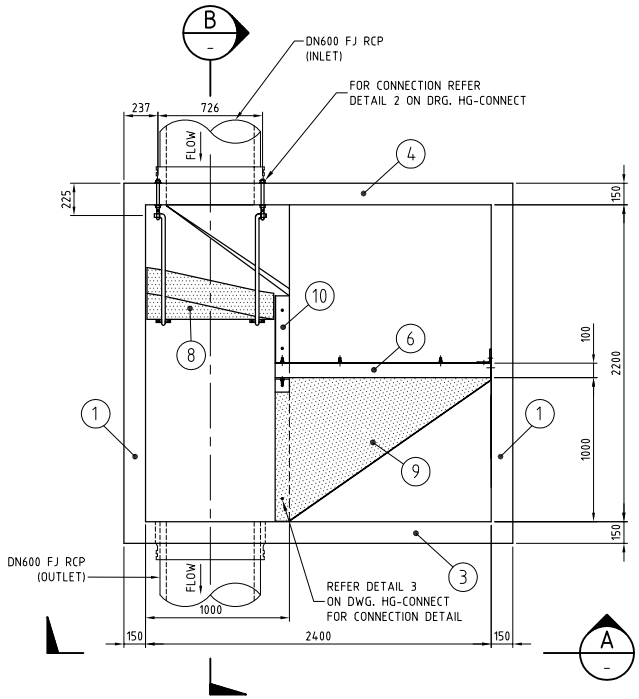
HUMEGARD HG18/L DN600/DN600 RCP

GENERAL ASSEMBLY

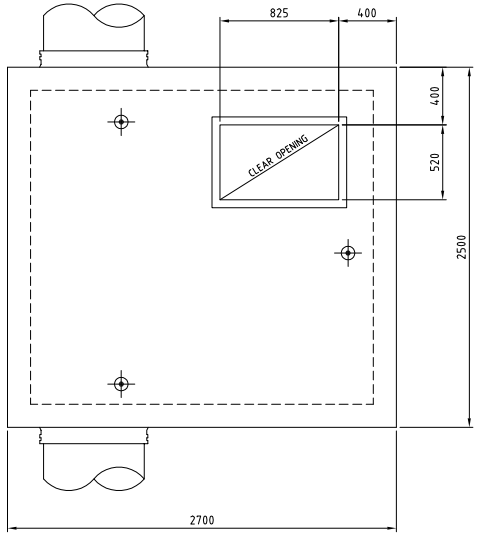
SUPERSEDES	PLOT SCALE	SIZE	DRG. NO.	ISSUE
HG18/L-01 REV. 2	1:1	A2	HG18/L-01	3

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
1	GENERAL REVISION - ISSUED FOR MANUFACTURE	MZ	12-03-07	DFW

ITEM No	DWG DESCRIPTIONS	DWG No
1	END WALL	HG24/L-02
2	BASE SLAB	HG24/L-03
3, 4	SIDE WALL	HG24/L-04
5	FALSE FLOOR	HG24/L-05
6	CONCRETE BAFFLE WALL	HG24/L-05
7	PRECAST LID	HG24/L-06
8	FLOATING BOOM	HG24/L-07
9	WEIR	HG24/L-08
10	BAFFLE SIDE WALL	HG24/L-09
11	COMB	HG24/L-10
	SITE LAYOUT	HG24/L-11



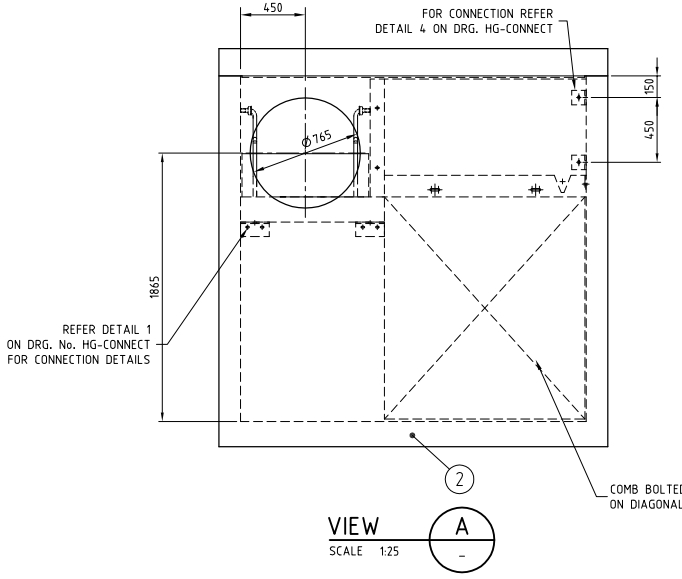
PLAN VIEW (LID REMOVED)
SCALE 1:25



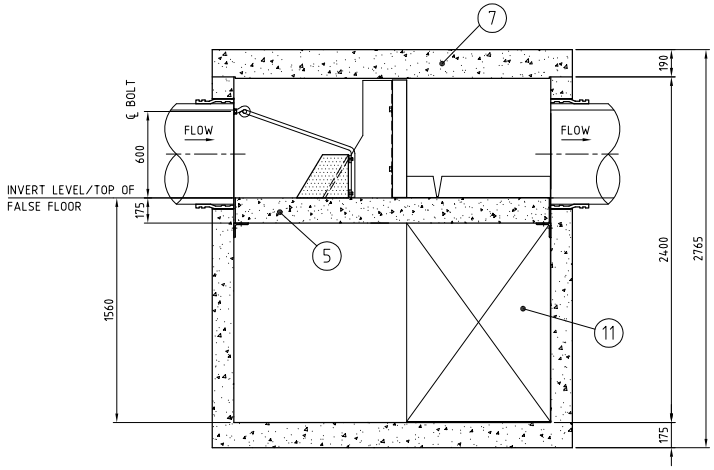
PLAN ON LID
SCALE 1:25

NOTES:

1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF COMPLETE UNIT = 13.0 t (WITHOUT LID).
   MASS OF LID = 3.2 t
6. KOR-N-SEAL BOOT CONNECTOR P/N = S206-30L (INLET & OUTLET)



VIEW A
SCALE 1:25



SECTION B
SCALE 1:25

DESIGN BASIS

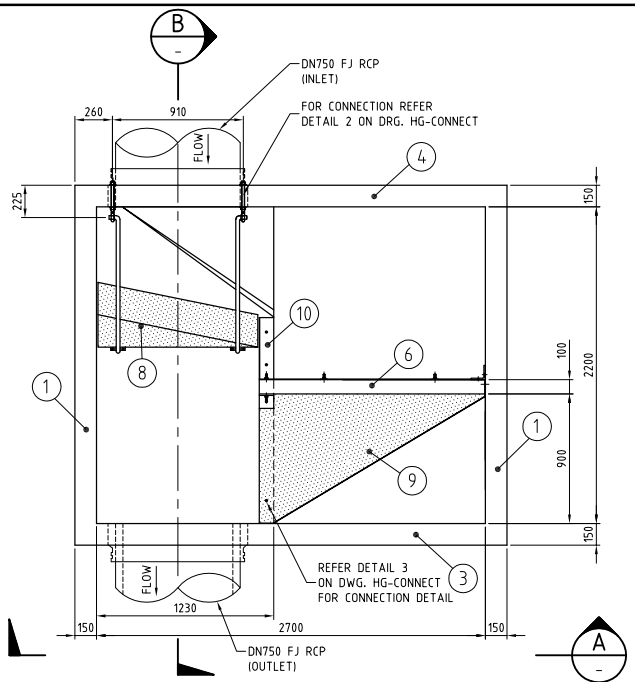
1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

Humes TECHNICAL (DESIGN) SERVICES BRISBANE, QUEENSLAND

DSN.	DFW	12-03-07
DWN.	MZ	12-03-07
CKD.	DFW	12-03-07
APP.	DFW	12-03-07

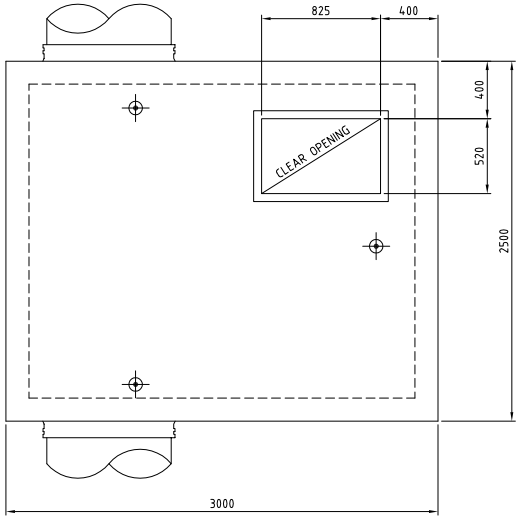
HUMES
STANDARD DRAWING
HUMEGARD HG24/L
DN600/DN600 FJ RCP
GENERAL ASSEMBLY

SUPERSEDES	PLOT SCALE	SIZE	DRG. NO.	ISSUE
HG24/L-01 REV. 0	1:1	A2	HG24/L-01	1



PLAN VIEW (LID REMOVED)

SCALE 1:25



PLAN ON LID

SCALE 1:25

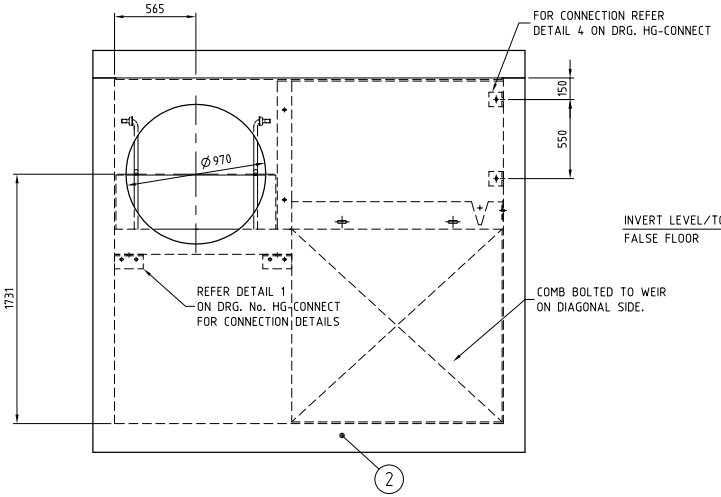
ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
1	GENERAL REVISION - REISSUED FOR MANUFACTURE	MZ	12-03-07	DFW

ITEM No	DWG DESCRIPTIONS	DWG No
1	END WALL	HG27/L-02
2	BASE SLAB	HG27/L-03
3, 4	SIDE WALL	HG27/L-04
5	FALSE FLOOR	HG27/L-05
6	CONCRETE BAFFLE WALL	HG27/L-05
7	PRECAST LID	HG27/L-06
8	FLOATING BOOM	HG27/L-07
9	WEIR	HG27/L-08
10	BAFFLE SIDE WALL	HG27/L-09
11	COMB	HG27/L-10
	SITE LAYOUT	HG27/L-11

NOTES:

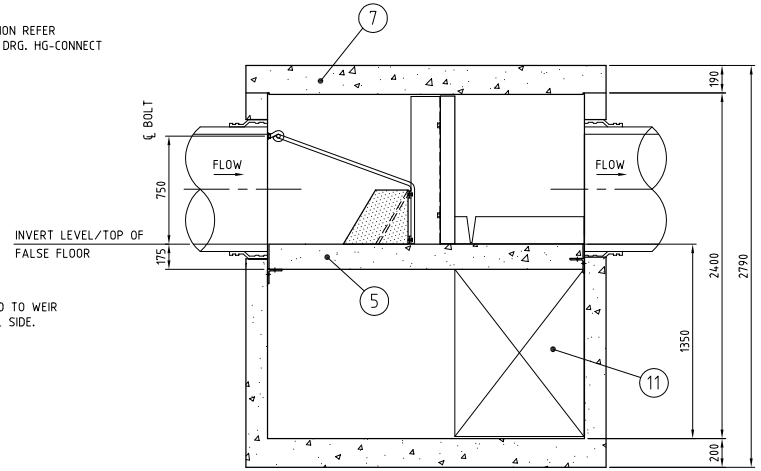
1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF COMPLETE UNIT = 14.4 t (WITHOUT LID).
   MASS OF LID = 3.6 t
6. KOR-N-SEAL BOOT CONNECTOR P/N = S206-38 (INLET & OUTLET)

52 t



VIEW A

SCALE 1:25



SECTION B

SCALE 1:25

DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

Humes TECHNICAL (DESIGN) SERVICES BRISBANE, QUEENSLAND

DSN.	DFW	12-03-07
DWN.	MZ	12-03-07
CKD.	DFW	12-03-07
APP.	SG	12-03-07

SUPERSEDES HG27/L-01 REV. 0

HUMES

STANDARD DRAWING

HUMEGARD HG27/L

DN750/DN750 FJ RCP

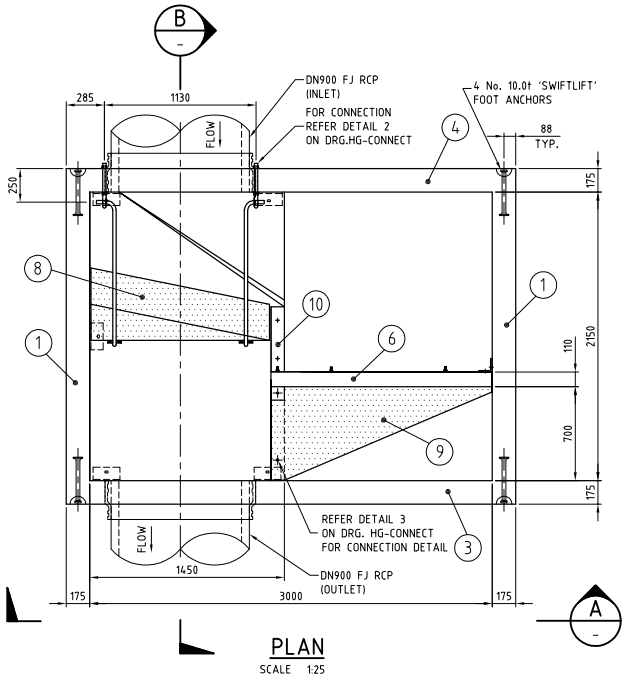
GENERAL ASSEMBLY

PLOT SCALE	SIZE	DRG. NO.	ISSUE
1:1	A2	HG27/L-01	2

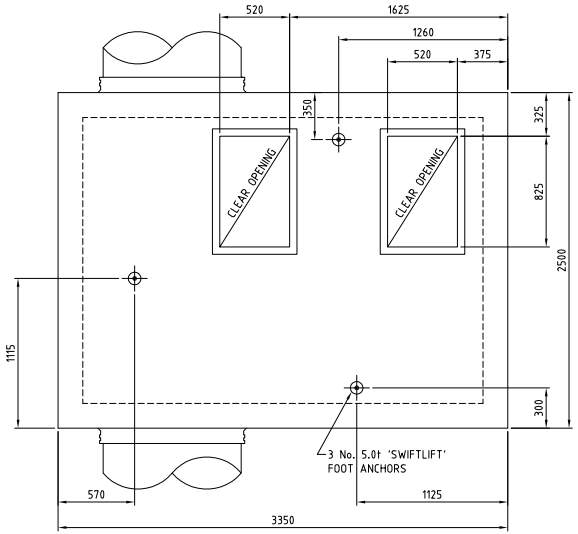
ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
2	REFERENCE DWG No. REVISED, REISSUED FOR MANUFACTURE	MZ	——	RM

ITEM No.	DRAWING DESCRIPTION	DWG No.
1	END WALL	HG30A-02 (2)
2	BASE SLAB	HG30-04
3, 4	SIDE WALL	HG30A-05
5	FALSE FLOOR	HG30A/L-07
6	CONCRETE BAFFLE WALL	HG30A/L-07
7	PRECAST LID	HG30A/L-08
8	FLOATING BOOM	HG30A/L-09
9	WEIR	HG30A/L-10
10	BAFFLE SIDE WALL	HG30A/L-11
11	COMB	HG30A/L-12
	CONNECTION DETAILS	HG-CONNECT
	CASTING SEQUENCE	HG-CAST

(2)



PLAN
SCALE 1:25



PLAN ON LID
SCALE 1:25

NOTES:

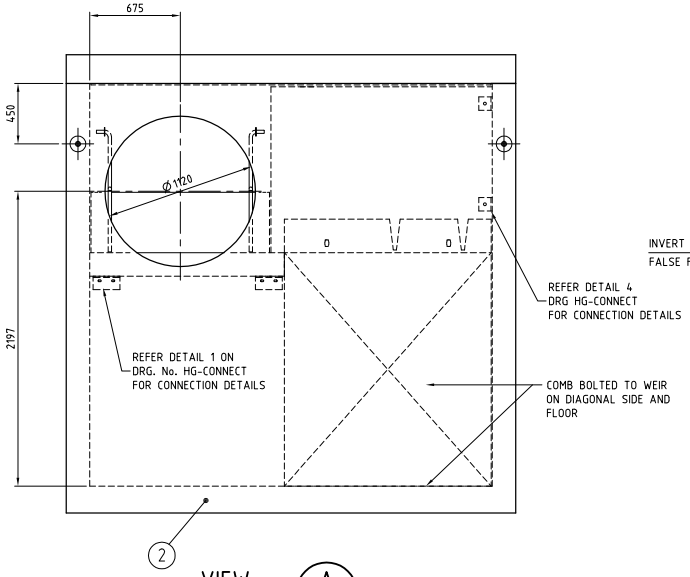
1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF COMPLETE UNIT = 20.2 t (WITHOUT LID).
   MASS OF LID = 4.3 t
   (SELF WEIGHT CONCRETE @ 2500 kg/m3)
6. KOR-N-SEAL BOOT CONNECTOR P/N = S206-44 (INLET & OUTLET)

522

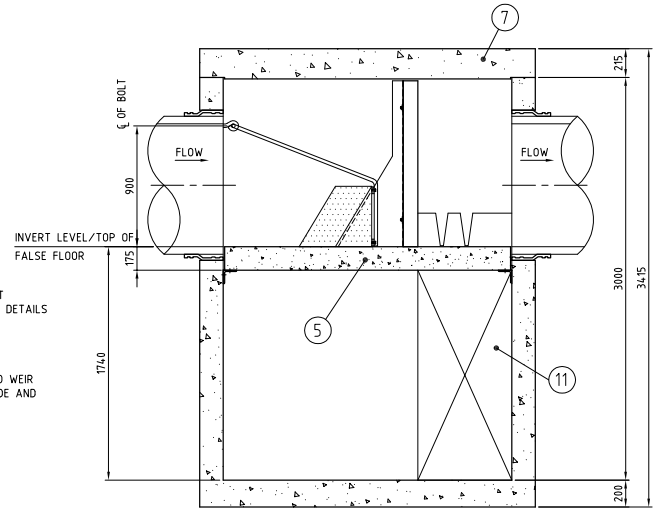
DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

SITE LIFT:
LID - 3 No. 5 t SWIFTLIFT FOOT ANCHORS
HUMEGARD UNIT - 4 No. 10 t SWIFTLIFT FOOT ANCHORS



VIEW A
SCALE 1:25



SECTION B
SCALE 1:25

Humes TECHNICAL (DESIGN) SERVICES BRISBANE, QUEENSLAND

CEMEX Australia Pty Limited ABN 87 099 732 297

DSN.	DFW	06-08-08
DWN.	MZ	06-08-08
CKD.	DFW	——
APP.	WST	——

SUPERSEDES HG30A/L-01 REV 1

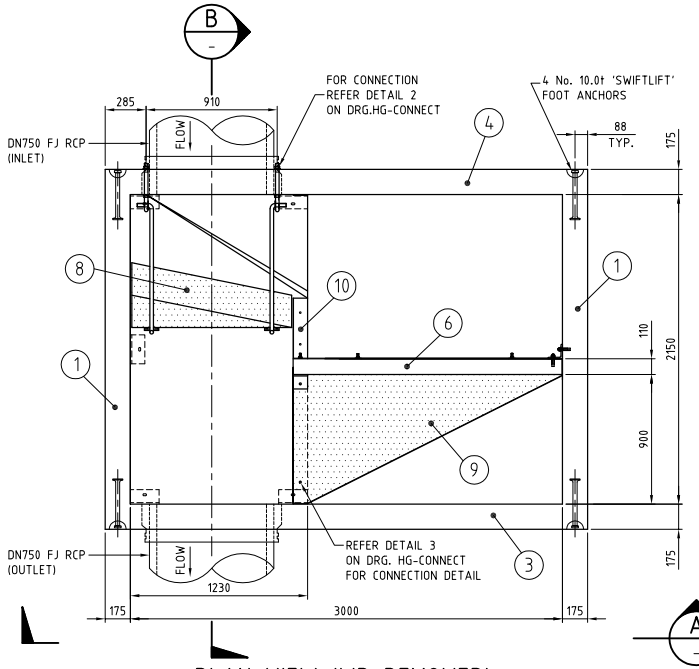
HUMES WATER SOLUTIONS
STANDARD HUMEGARD
HUMEGARD HG30A/L
DN900/DN900 FJ RCP
GENERAL ASSEMBLY

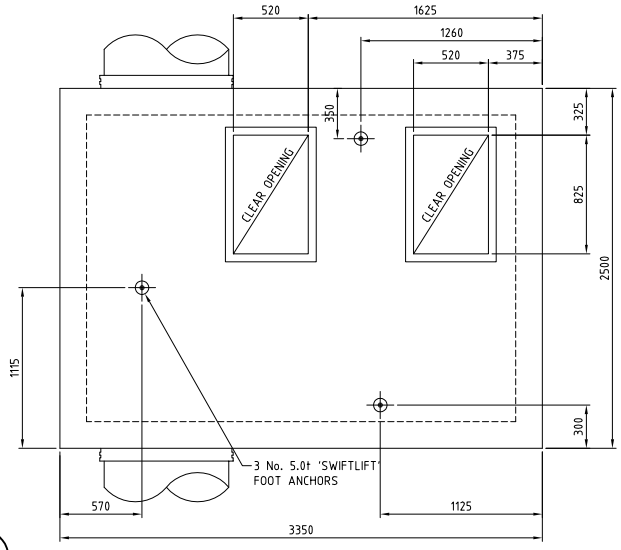
PLOT SCALE	SIZE	DRG. NO.	ISSUE
1:1	A2	HG30A/L-01	2

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
2	REFERENCE DWG No. REVISED, REISSUED FOR MANUFACTURE	MZ	——	RM

ITEM No.	DRAWING DESCRIPTION	DWG No.
1	END WALL	HG30-02
2	BASE SLAB	HG30-04
3, 4	SIDE WALL	HG30-05
5	FALSE FLOOR	HG30/L-07
6	CONCRETE BAFFLE WALL	HG30/L-07
7	PRECAST LID	HG30-08
8	FLOATING BOOM	HG30/L-09
9	WEIR	HG30/L-10
10	BAFFLE SIDE WALL	HG30/L-11
11	COMB	HG30/L-12
	CONNECTION DETAILS	HG-CONNECT
	CASTING SEQUENCE	HG-CAST

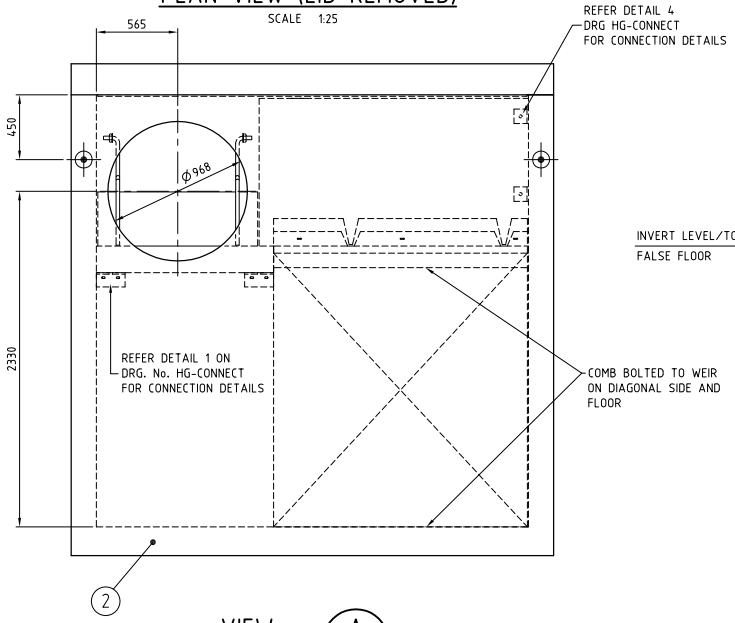
2





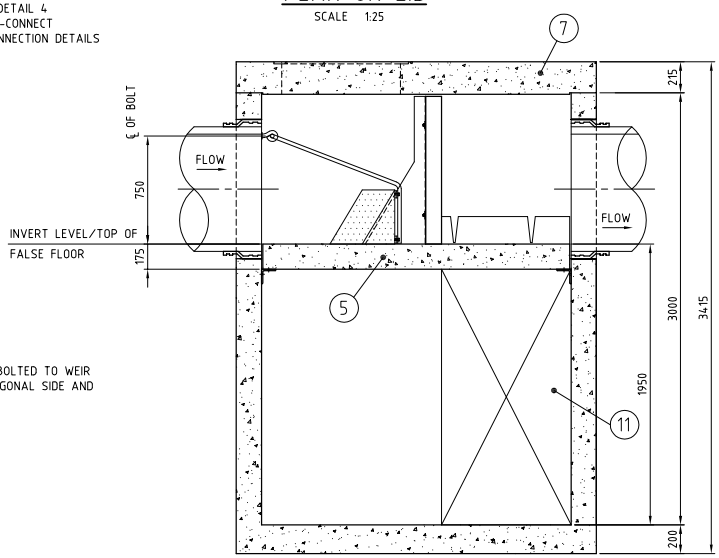
PLAN VIEW (LID REMOVED)

SCALE 1:25



PLAN ON LID

SCALE 1:25



VIEW A

SCALE 1:25

SECTION B

SCALE 1:25

NOTES:

1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF COMPLETE UNIT = 20.3 t (WITHOUT LID).
   MASS OF LID = 4.3 t
   (SELF WEIGHT CONCRETE @ 2500 kg/m3) 523
6. KOR-N-SEAL BOOT CONNECTOR P/N = S206-38 (INLET & OUTLET)

DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

SITE LIFT:
LID - 3 No. 5 t SWIFTLIFT FOOT ANCHORS
HUMEGARD UNIT - 4 No. 10 t SWIFTLIFT FOOT ANCHORS

Humes TECHNICAL (DESIGN) SERVICES BRISBANE, QUEENSLAND

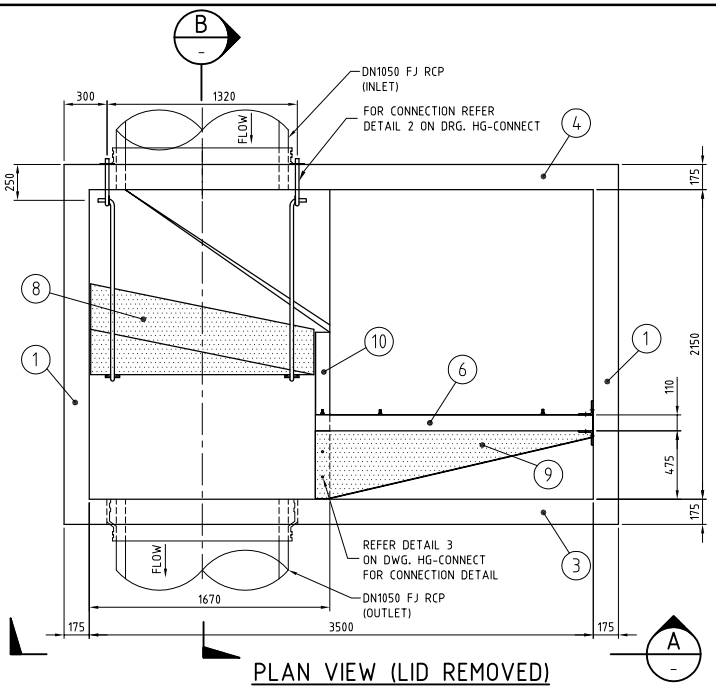
DSN.	DFW	12-03-07
DWN.	MZ	12-03-07
CKD.	DFW	12-03-07
APP.	DFW	12-03-07

HUMES WATER SOLUTIONS

STANDARD HUMEGARD HUMEGARD HG30/L DN750/DN750 FJ RCP

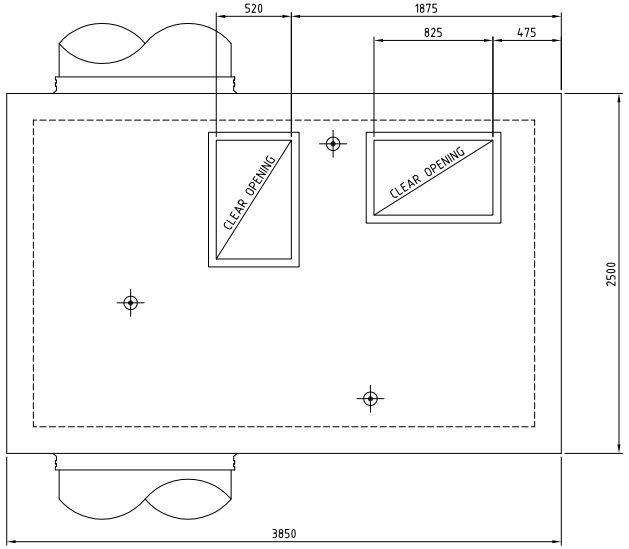
GENERAL ASSEMBLY

SUPERSEDES	PLOT SCALE	SIZE	DRG. NO.	ISSUE
HG30/L-01 REV 1	1:1	A2	HG30/L-01	2



PLAN VIEW (LID REMOVED)

SCALE 1:25



PLAN ON LID

SCALE 1:25

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
1	GENERAL REVISION, REISSUED FOR MANUFACTURE	MZ	12-03-07	DFW

ITEM No	DWG DESCRIPTIONS	DWG No
1	END WALL	HG35A/L-02
2	BASE SLAB	HG35A/L-04
3, 4	SIDE WALL	HG35A/L-05
5	FALSE FLOOR	HG35A/L-07
6	CONCRETE BAFFLE WALL	HG35A/L-07
7	PRECAST LID	HG35A/L-08
8	FLOATING BOOM	HG35A/L-09
9	WEIR	HG35A/L-10
10	BAFFLE SIDE WALL	HG35A/L-11
11	COMB	HG35A/L-12
	SITE LAYOUT	HG35A/L-13

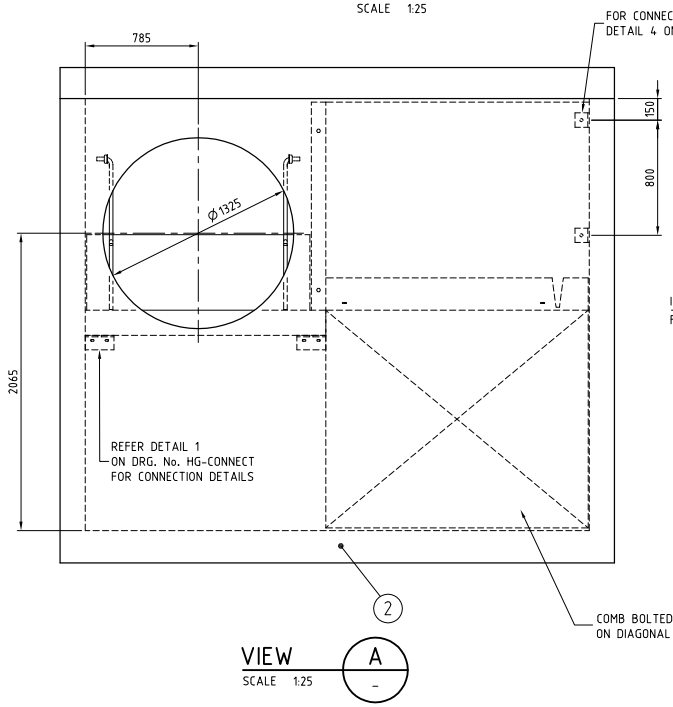
NOTES:

1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF COMPLETE UNIT = 22.9 t (WITHOUT LID).
   MASS OF LID = 5.0 t
6. KOR-N-SEAL BOOT CONNECTOR P/N = S206-52 (INLET & OUTLET)

524

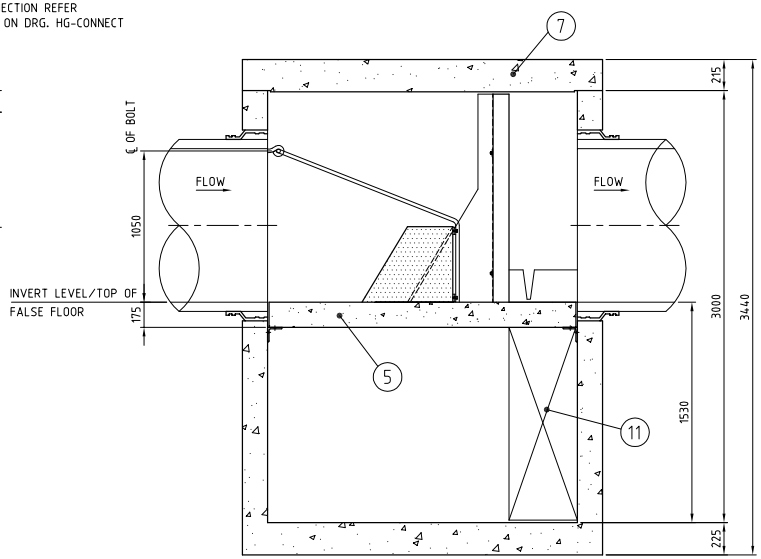
DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.



VIEW A

SCALE 1:25



SECTION B

SCALE 1:25

Humes TECHNICAL (DESIGN) SERVICES BRISBANE, QUEENSLAND

Rinker Australia Pty Limited ABN 87 099 732 297

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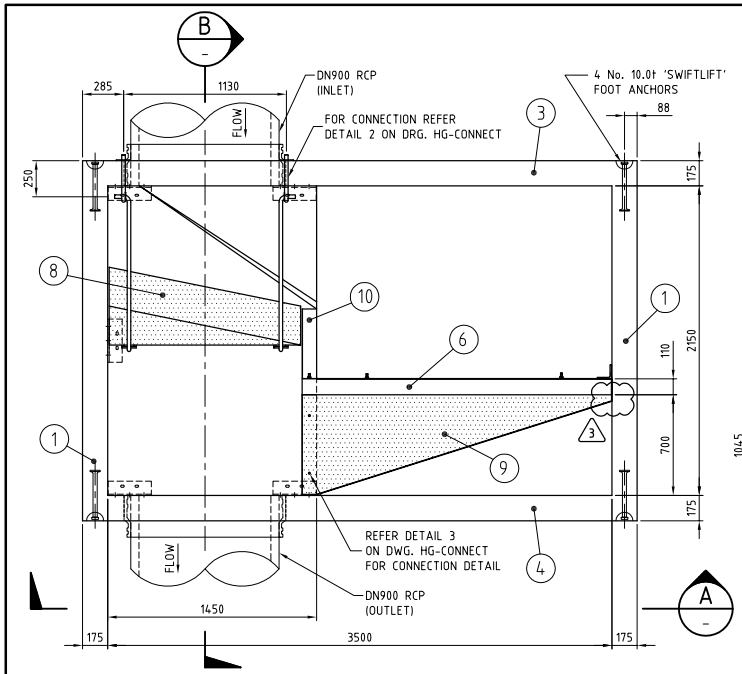
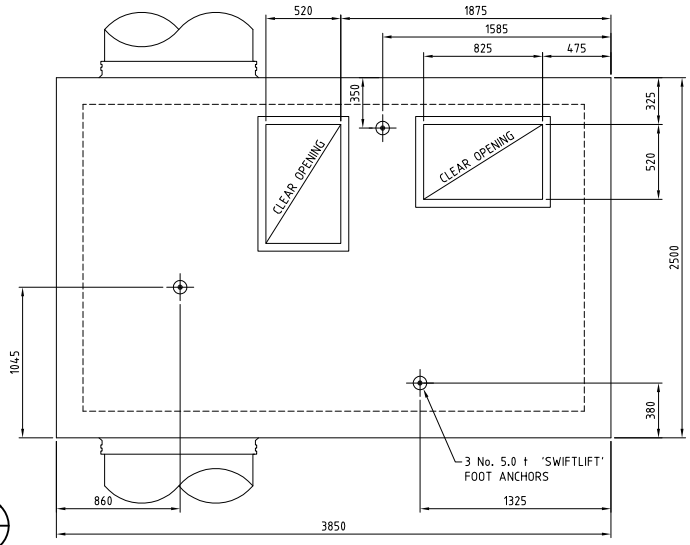
DSN.	DFW	12-03-07
DWN.	MZ	12-03-07
CKD.	DFW	12-03-07
APP.	DFW	12-03-07

HUMES
STANDARD DRAWING
HUMEGARD HG35A/L
DN1050/DN1050 FJ RCP
GENERAL ASSEMBLY

SUPERSEDES	PLOT SCALE	SIZE	DRG. NO.	ISSUE
HG35A/L-01 REV 0	1:1	A2	HG35A/L-01	1





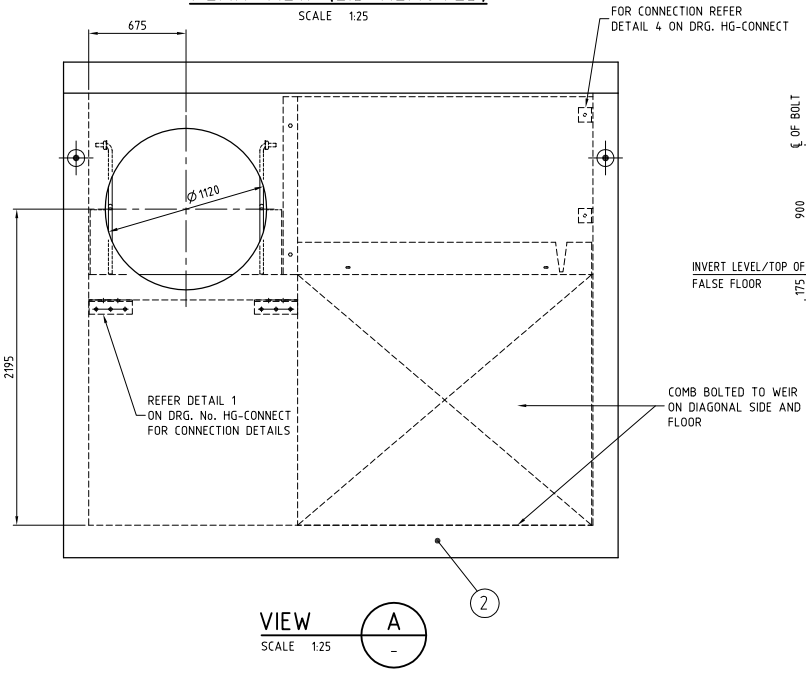
ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
3	REFERENCE DWG No. REVISED, BRACKET REMOVED, REISSUED FOR MANUFACTURE	MZ	——	RM

ITEM No.	DRAWING DESCRIPTION	DWG No.
1	END WALL	HG35-02 3
2	BASE SLAB	HG35-04
3, 4	SIDE WALL	HG35-05
5	FALSE FLOOR	HG35/L-07
6	CONCRETE BAFFLE WALL	HG35/L-07
7	PRECAST LID	HG35-08 3
8	FLOATING BOOM	HG35/L-09
9	WEIR	HG35/L-10
10	BAFFLE SIDE WALL	HG35/L-11
11	COMB	HG35/L-12
	CONNECTION DETAILS	HG-CONNECT
	CASTING SEQUENCE	HG-CAST

3

PLAN VIEW (LID REMOVED)

SCALE 1:25

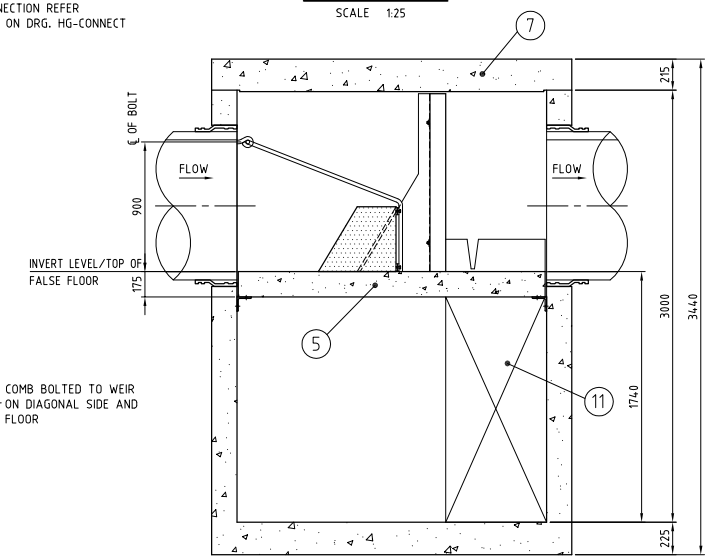


VIEW A

SCALE 1:25

PLAN ON LID

SCALE 1:25



SECTION B

SCALE 1:25

NOTES:

1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF COMPLETE UNIT = 22.8 t (WITHOUT LID).
   MASS OF LID = 5.0 t
   (SELF WEIGHT CONCRETE @ 2500 kg/m3
6. KOR-N-SEAL BOOT CONNECTOR P/N = S206-44

525

DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

SITE LIFT:
LID - 3 No. 5 t SWIFTLIFT FOOT ANCHORS
HUMEGARD UNIT - 4 No. 10 t SWIFTLIFT FOOT ANCHORS

Humes TECHNICAL SERVICES BRISBANE, QUEENSLAND

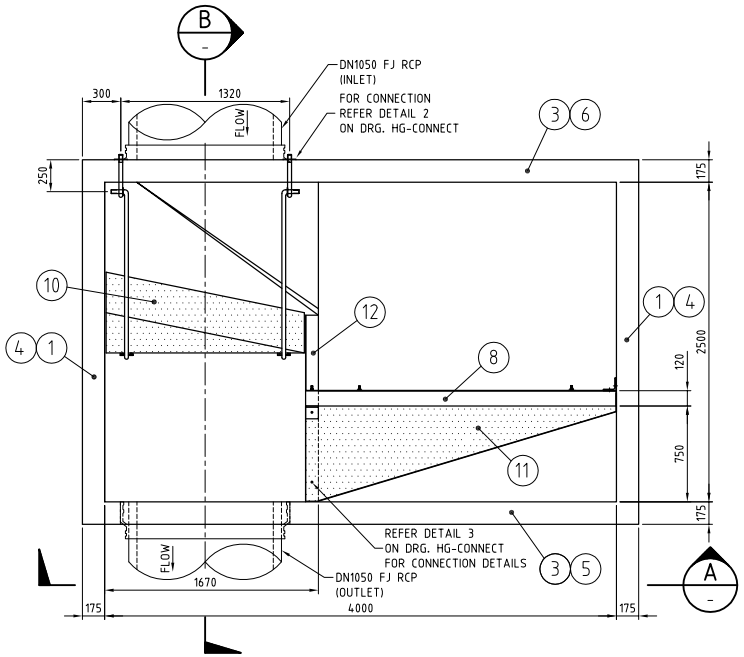
DSN.	WST	25-11-10
DWN.	MZ	25-11-10
CKD.	RM	——
APP.	WST	——

HUMES WATER SOLUTIONS
STANDARD HUMEGARD
HUMEGARD HG35/L
DN900/DN900 FJ RCP
GENERAL ASSEMBLY

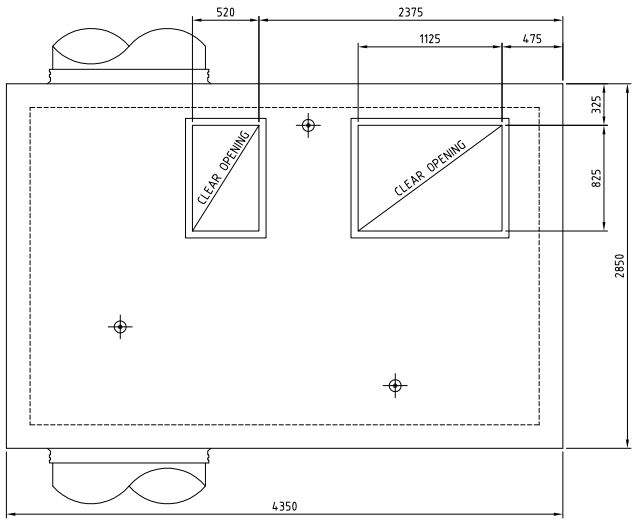
SUPERSEDES	PLOT SCALE	SIZE	DRG. NO.	ISSUE
HG35/L-01 REV 2	1:1	A2	HG35/L-01	3

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
0	ISSUED FOR MANUFACTURE	MZ	12-03-07	DFW
1	GENERAL REVISION	MZ	——	DFW

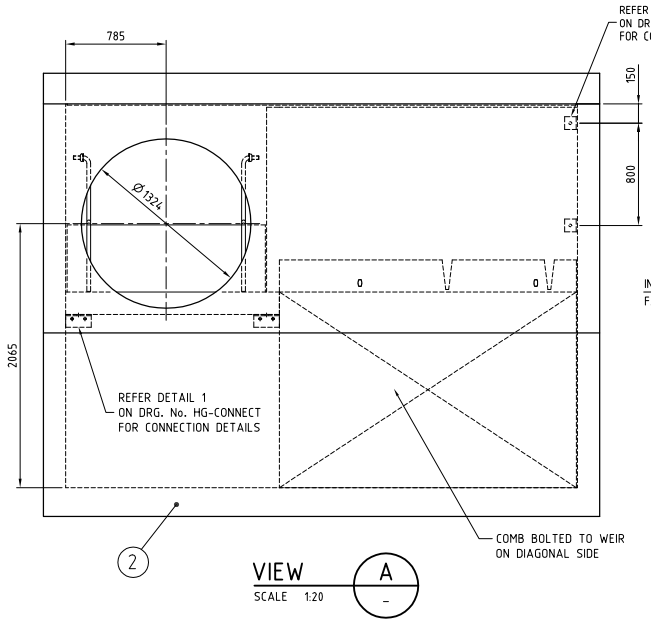
ITEM No	DWG DESCRIPTIONS	DWG No
1	END WALL - BOTTOM UNIT	HG40B/L-02
2	BASE SLAB	HG40B/L-04
3	SIDE WALL - BOTTOM UNIT	HG40B/L-05
4	END WALL - TOP UNIT	HG40B/L-03
5,6	SIDE WALL - TOP UNIT	HG40B/L-06
7	FALSE FLOOR	HG40B/L-07
8	CONCRETE BAFFLE WALL	HG40B/L-07
9	PRECAST LID	HG40B/L-08
10	FLOATING BOOM	HG40B/L-09
11	WEIR	HG40B/L-10
12	BAFFLE SIDE WALL	HG40B/L-11
13	COMB	HG40B/L-12



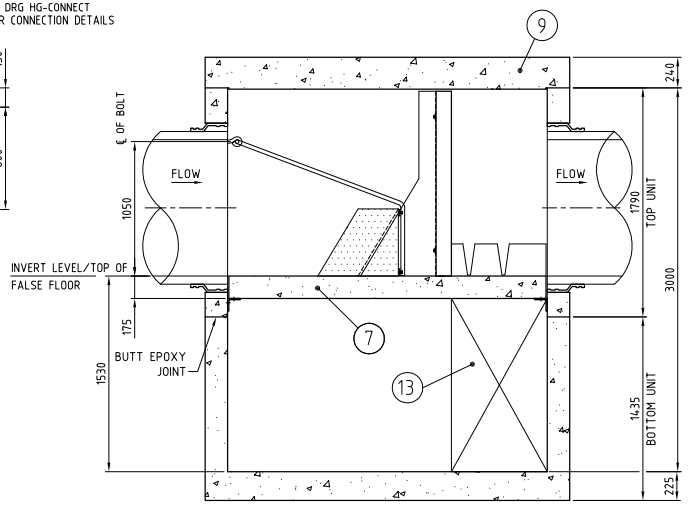
PLAN VIEW (LID REMOVED)
SCALE 1:20



PLAN ON LID
SCALE 1:20



VIEW
SCALE 1:20



SECTION
SCALE 1:20

526

NOTES:

1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF BOTTOM UNIT = 14.8 t
   MASS OF TOP UNIT = 12.9 t
   MASS OF LID = 7.0 t
6. KOR-N-SEAL BOOT CONNECTOR P/N = S206-44 (INLET & OUTLET)

DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

Humes
TECHNICAL (DESIGN) SERVICES
BRISBANE, QUEENSLAND

DSN.	DFW	12-03-07
DWN.	MZ	12-03-07
CKD.	DFW	12-03-07
APP.	DFW	12-03-07

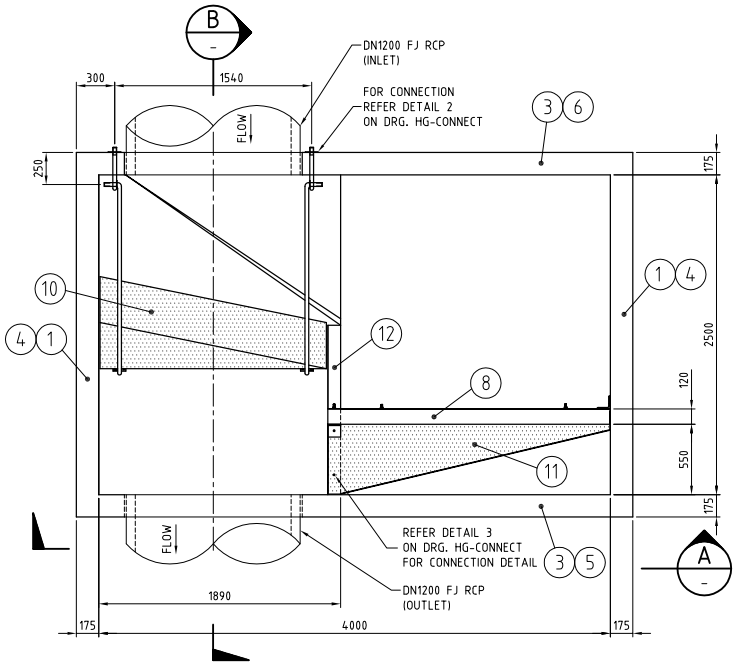
SUPERSEDES

HUMES
STANDARD DRAWING
HUMEGARD HG40A/L
DN1050/DN1050 FJ RCP
GENERAL ASSEMBLY

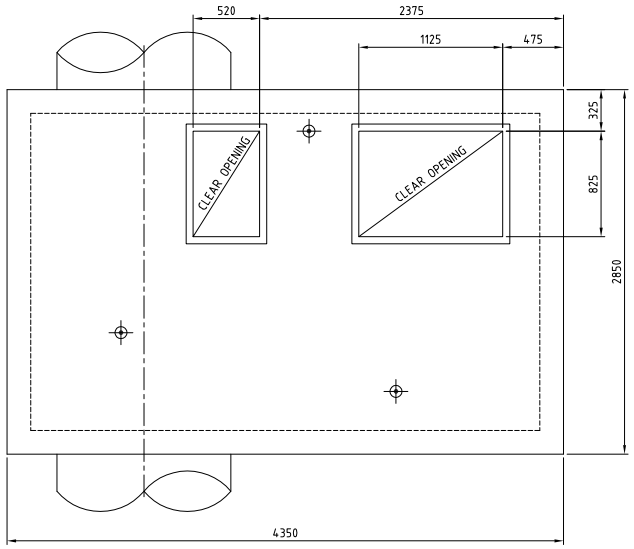
PLOT SCALE	SIZE	DRG. NO.	ISSUE
1:1	A1	HG40A/L-01	1

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
0	ISSUED FOR MANUFACTURE	MZ	12-03-07	DFW
1	GENERAL REVISION	MZ	——	DFW

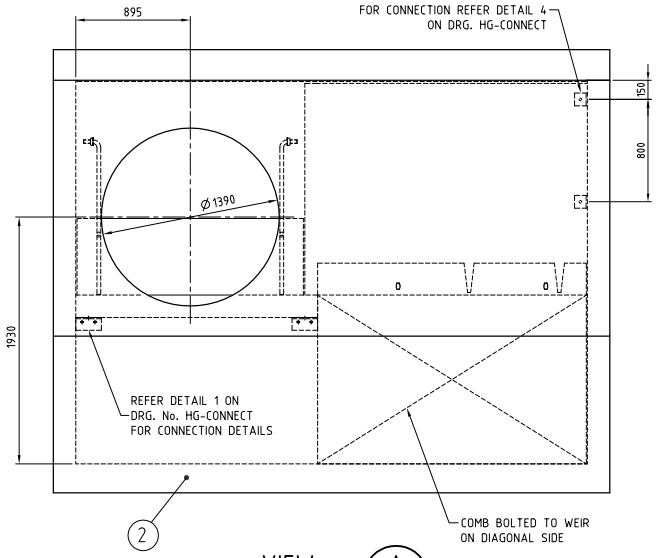
ITEM No	DWG DESCRIPTIONS	DWG No
1	END WALL - BOTTOM UNIT	HG40B/L-02
2	BASE SLAB	HG40B/L-04
3	SIDE WALL - BOTTOM UNIT	HG40B/L-05
4	END WALL - TOP UNIT	HG40B/L-03
5,6	SIDE WALL - TOP UNIT	HG40B/L-06
7	FALSE FLOOR	HG40B/L-07
8	CONCRETE BAFFLE WALL	HG40B/L-07
9	PRECAST LID	HG40B/L-08
10	FLOATING BOOM	HG40B/L-09
11	WEIR	HG40B/L-10
12	BAFFLE SIDE WALL	HG40B/L-11
13	COMB	HG40B/L-12



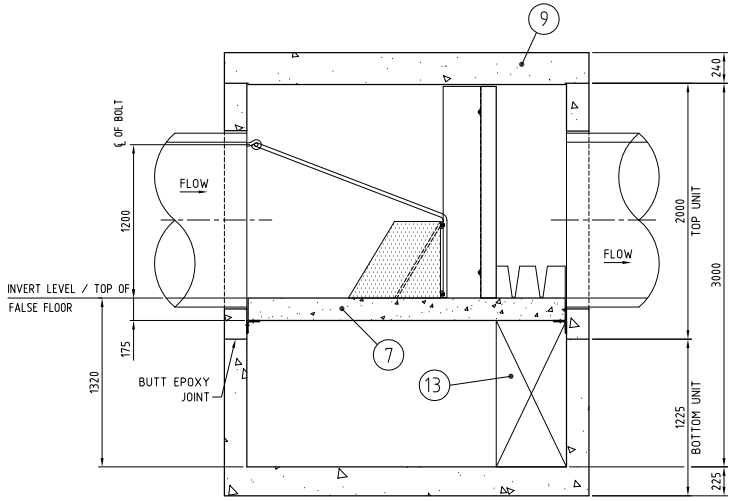
PLAN VIEW (LID REMOVED)
SCALE 1:20



PLAN ON LID
SCALE 1:20



VIEW A
SCALE 1:20



SECTION B
SCALE 1:20

527

NOTES:

1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF BOTTOM UNIT = 13.4 t
   MASS OF TOP UNIT = 14.4 t
   MASS OF LID = 7.0 t
6. PIPE HOLE SIZE ALLOWS FOR PIPE MORTAR CONNECTION.

DESIGN BASIS

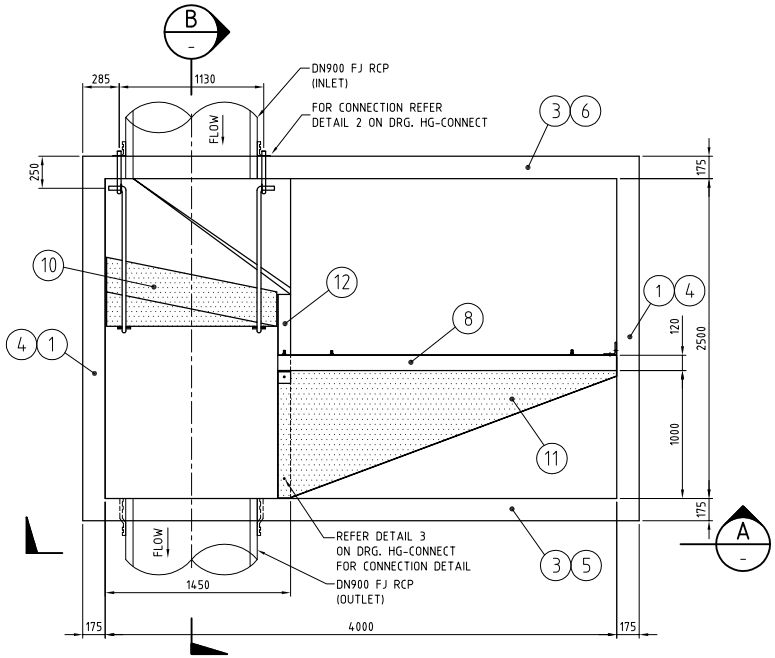
1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

Humes
TECHNICAL (DESIGN) SERVICES
BRISBANE, QUEENSLAND

DSN.	DFW	12-03-07
DWN.	MZ	12-03-07
CKD.	DFW	12-03-07
APP.	DFW	12-03-07

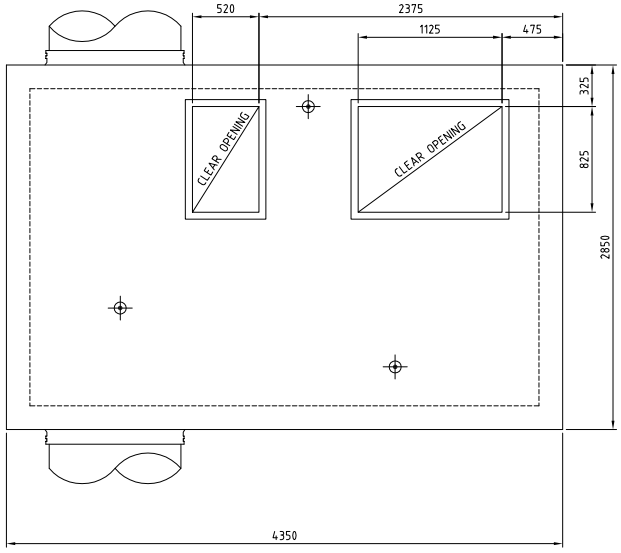
HUMES
STANDARD DRAWING
HUMEGARD HG40B/L
DN1200/DN1200 FJ RCP
GENERAL ASSEMBLY

SUPERSEDES HG40B/L-01 REV. C
PLOT SCALE 1:1
SIZE A1
DRG. NO. HG40B/L-01
ISSUE 1



PLAN VIEW (LID REMOVED)

SCALE 1:20



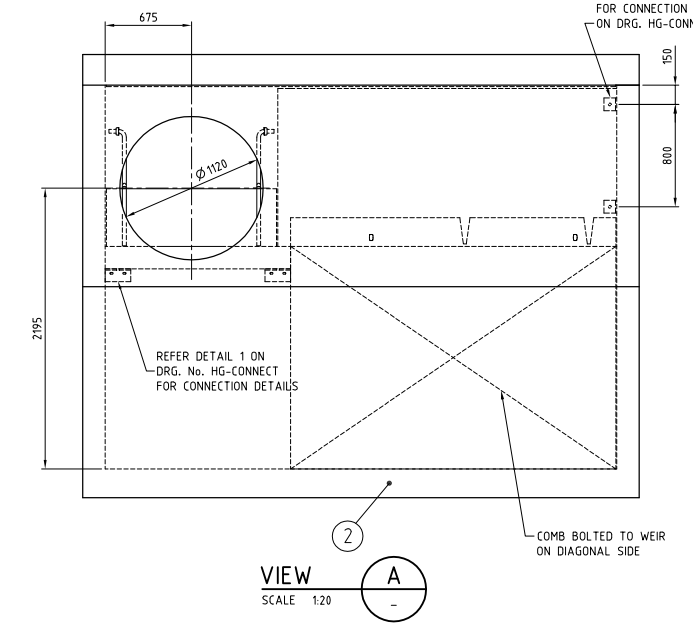
PLAN ON LID

SCALE 1:20

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
1	GENERAL REVISION - REISSUED FOR MANUFACTURE	MZ	12-03-07	DFW
2	ITEM NUMBERS REVISED, REISSUED FOR MANUFACTURE	MZ	——	DFW

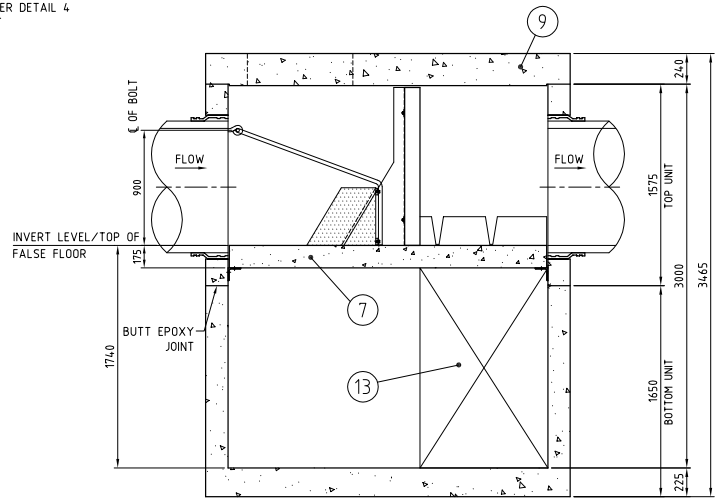
ITEM No	DWG DESCRIPTIONS	DWG No
1	END WALL - BOTTOM UNIT	HG40B/L-02
2	BASE SLAB	HG40B/L-04
3	SIDE WALL - BOTTOM UNIT	HG40B/L-05
4	END WALL - TOP UNIT	HG40B/L-03
5,6	SIDE WALL - TOP UNIT	HG40B/L-06
7	FALSE FLOOR	HG40B/L-07
8	CONCRETE BAFFLE WALL	HG40B/L-07
9	PRECAST LID	HG40B/L-08
10	FLOATING BOOM	HG40B/L-09
11	WEIR	HG40B/L-10
12	BAFFLE SIDE WALL	HG40B/L-11
13	COMB	HG40B/L-12

528



VIEW A

SCALE 1:20



SECTION B

SCALE 1:20

NOTES:

1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF BOTTOM UNIT = 16.2 t
   MASS OF TOP UNIT = 11.6 t
   MASS OF LID = 7.0 t
6. KOR-N-SEAL BOOT CONNECTOR P/N = S206-44 (INLET & OUTLET)

DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

Humes

TECHNICAL (DESIGN) SERVICES
BRISBANE, QUEENSLAND

DSN.	DFW	12-03-07
DWN.	MZ	12-03-07
CKD.	DFW	12-03-07
APP.	DFW	12-03-07

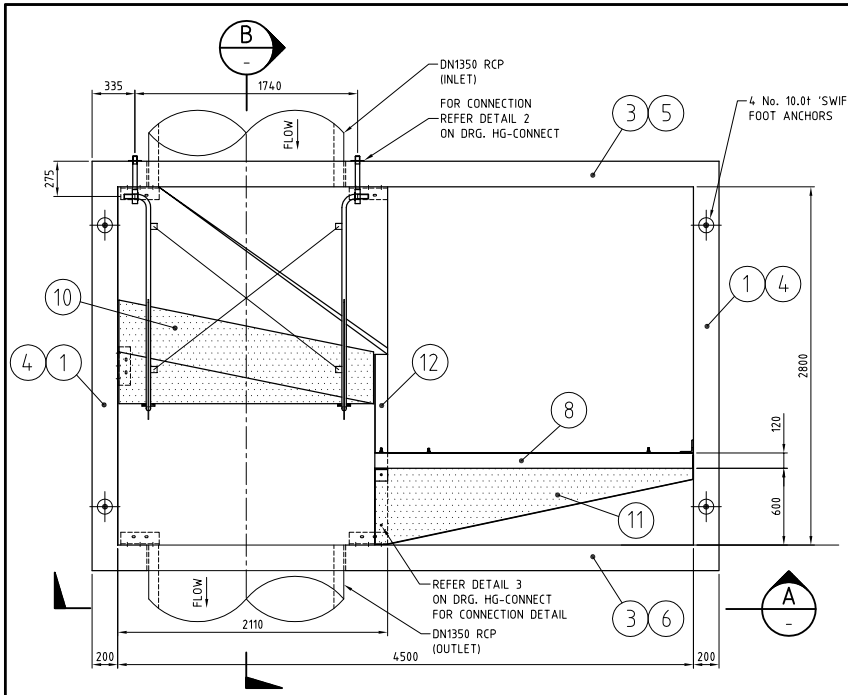
SUPERSEDES HG40/L-01 REV. 1

HUMES
STANDARD DRAWING
HUMEGARD HG40/L
DN900/DN900 FJ RCP
GENERAL ASSEMBLY

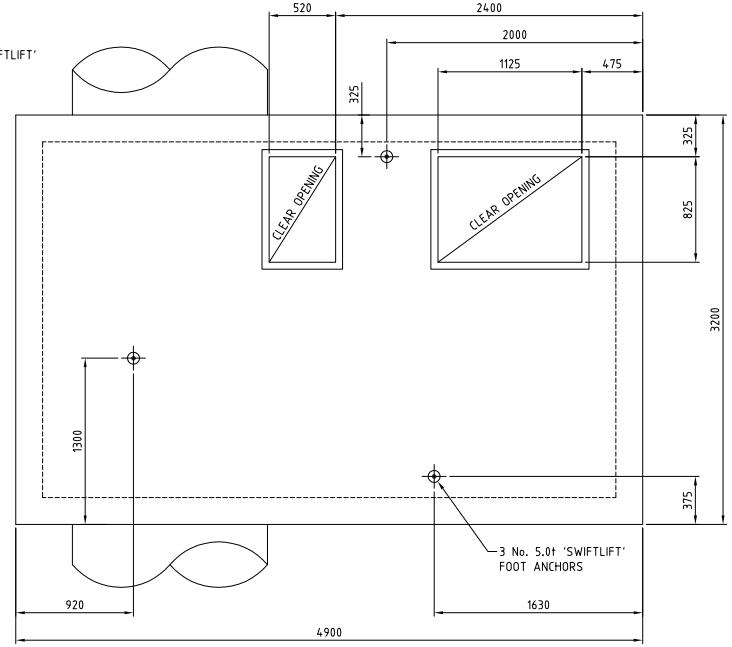
PLOT SCALE	SIZE	DRG. NO.	ISSUE
1:1	A1	HG40/L-01	2

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
1	GENERAL REVISION, REISSUED FOR MANUFACTURE	MZ	15-12-10	RM

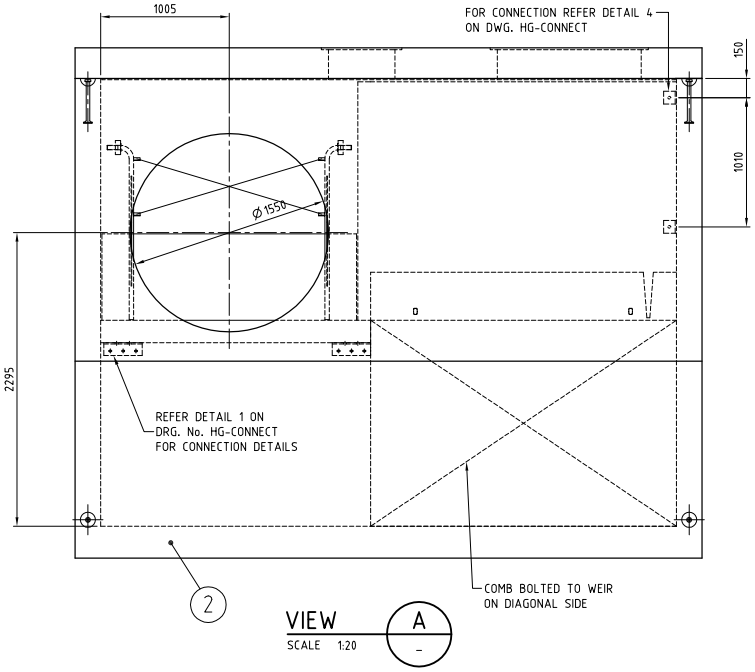
ITEM No	DWG DESCRIPTIONS	DWG No
1	END WALL - BOTTOM UNIT	HG45A-02
2	BASE SLAB	HG45A-04
3	SIDE WALL - BOTTOM UNIT	HG45A-05
4	END WALL - TOP UNIT	HG45A-03
5,6	SIDE WALL - TOP UNIT	HG45A-06
7	FALSE FLOOR	HG45A/L-07
8	CONCRETE BAFFLE WALL	HG45A/L-07
9	PRECAST LID	HG45A/L-08
10	FLOATING BOOM	HG45A/L-09
11	WEIR	HG45A/L-10
12	BAFFLE SIDE WALL	HG45A/L-11
13	COMB	HG45A/L-12



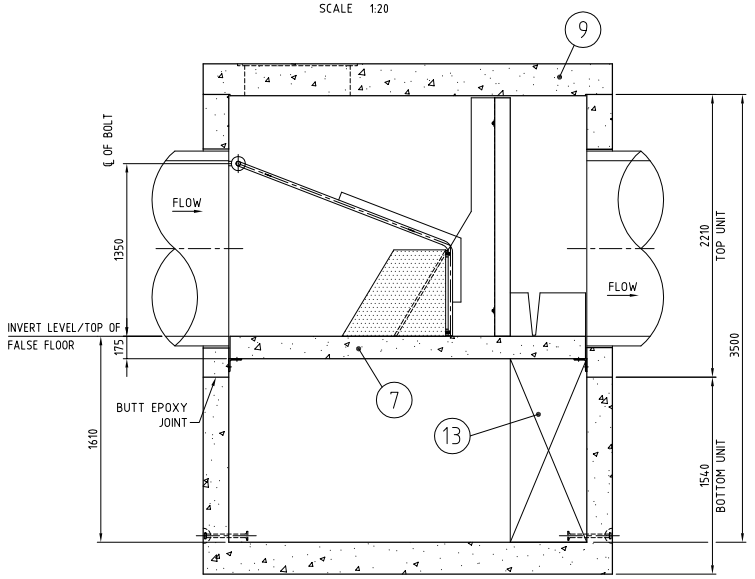
PLAN VIEW (LID REMOVED)
SCALE 1:20



PLAN ON LID
SCALE 1:20



VIEW A
SCALE 1:20



SECTION B
SCALE 1:20

529

NOTES:

1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF BOTTOM UNIT = 20.7 t
   MASS OF TOP UNIT = 19.7 t
   MASS OF LID = 9.1 t
6. PIPE HOLE SIZE ALLOWS FOR PIPE MORTAR CONNECTION.

DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

Humes
TECHNICAL SERVICES
BRISBANE, QUEENSLAND

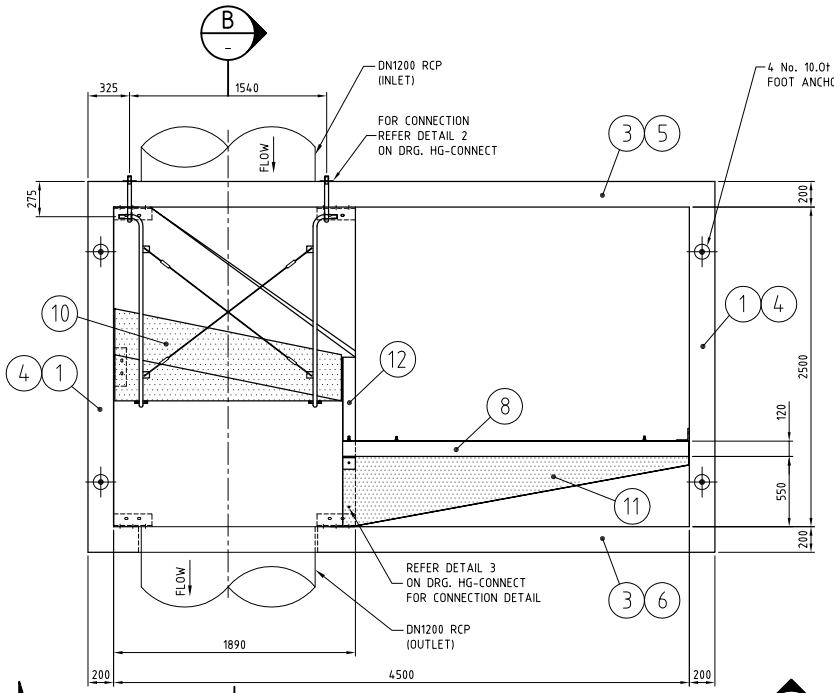
Holcim (Australia) Pty Ltd ABN 87 099 732 297

DSN.	WST	07-12-10
DWN.	MZ	07-12-10
CKD.	RM	15-12-10
APP.	WST	15-12-10

SUPERSEDES HG45A/L-01 REV. 0

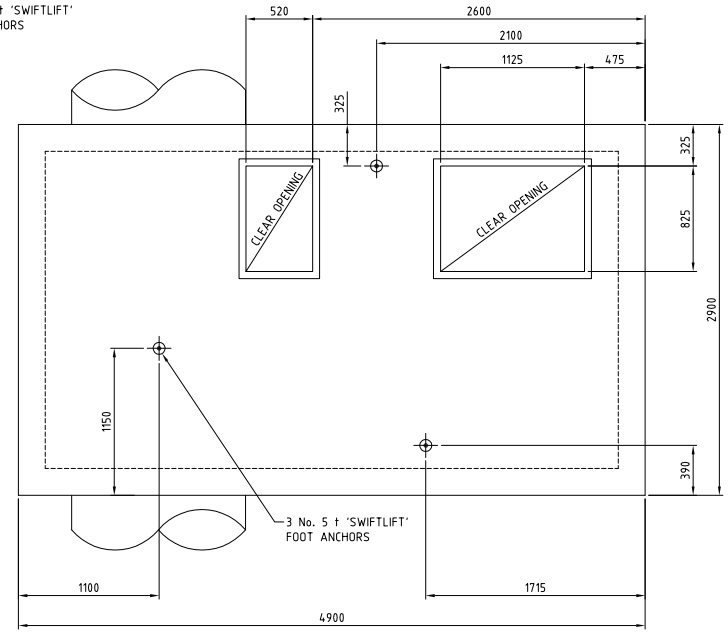
HUMES WATER SOLUTIONS
STANDARD HUMEGARD
HUMEGARD HG45A/L
DN1350/DN1350 RCP
GENERAL ASSEMBLY

PLOT SCALE	SIZE	DRG. NO.	ISSUE
1:1	A1	HG45A/L-01	1



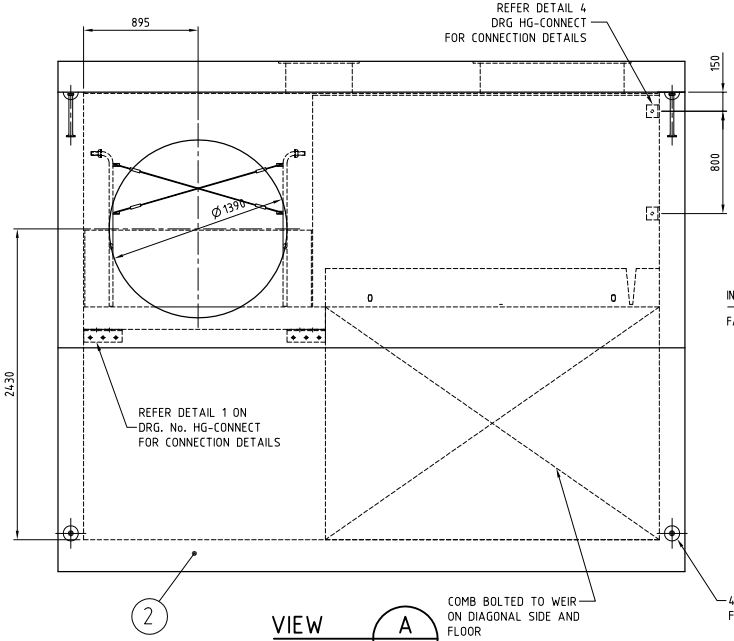
PLAN VIEW (LID REMOVED)

SCALE 1:20



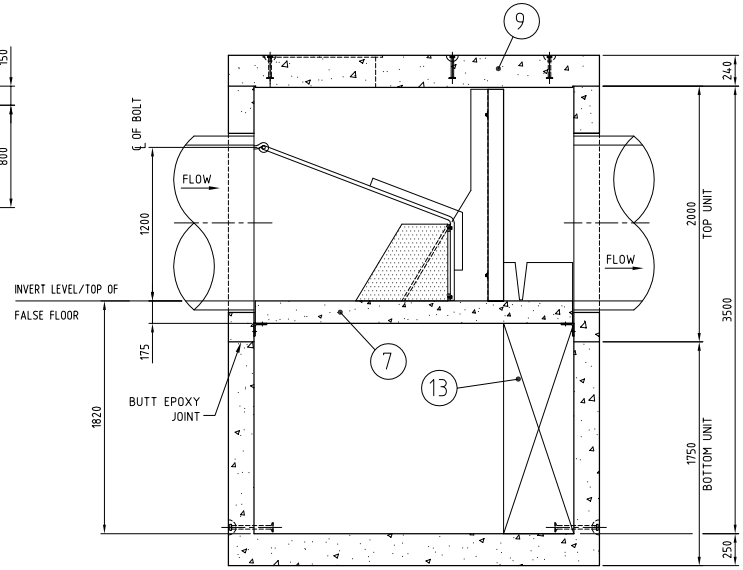
PLAN ON LID

SCALE 1:20



VIEW

SCALE 1:20



SECTION

SCALE 1:20

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
1	GENERAL REVISION, REISSUED FOR MANUFACTURE	MZ	15-12-10	RM

ITEM No	DWG DESCRIPTIONS	DWG No
1	END WALL - BOTTOM UNIT	HG45-02
2	BASE SLAB	HG45-04
3	SIDE WALL - BOTTOM UNIT	HG45-05
4	END WALL - TOP UNIT	HG45-03
5,6	SIDE WALL - TOP UNIT	HG45-06
7	FALSE FLOOR	HG45/L-07
8	CONCRETE BAFFLE WALL	HG45/L-07
9	PRECAST LID	HG45/L-08
10	FLOATING BOOM	HG45/L-09
11	WEIR	HG45/L-10
12	BAFFLE SIDE WALL	HG45/L-11
13	COMB	HG45/L-12

530

NOTES:

1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF BOTTOM UNIT = 20.8 t
   MASS OF TOP UNIT = 17.3 t
   MASS OF LID = 8.1 t
6. PIPE HOLE SIZE ALLOWS FOR PIPE MORTAR CONNECTION.

DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

Humes

TECHNICAL SERVICES
BRISBANE, QUEENSLAND

DSN.	WST	01-12-10
DWG.	MZ	01-12-10
CKD.	RM	15-12-10
APP.	WST	15-12-10

SUPERSEDES HG45/L-01 REV 0

HUMES WATER SOLUTIONS
STANDARD HUMEGARD
HUMEGARD HG45/L
DN1200/DN1200 FJ RCP
GENERAL ASSEMBLY

PLOT SCALE 1:1 | SIZE A1 | DRG. NO. HG45/L-01 | ISSUE 1

Precast solutions

531

Top:
StormTrap® system

Middle:
RainVault® system

Bottom:
Segmental shaft

Stormwater

Stormwater treatment

Primary treatment

- HumeGard® Gross Pollutant Trap

Secondary treatment

- HumeCeptor® hydrodynamic separator

Detention and infiltration

StormTrap® system

Soakwells

Harvesting and reuse

RainVault® system

ReserVault® system

RainVault® Mini system

Precast concrete cubes

Segmental shafts

Stormwater drainage

Steel reinforced concrete pipes – trench

Steel reinforced concrete pipes – salt water cover

Steel reinforced concrete pipes – jacking

Box culverts

Uniculvert® modules

Headwalls

Stormwater pits

Access chambers/Manholes

Kerb inlet systems

Floodgates

Geosynthetics

Sewage transfer and storage

Bridge and platform

Tunnel and shaft

Walling

Potable water supply

Irrigation and rural

Traffic management

Cable and power management

Rail

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Rockhampton
Ph: (07) 4924 7900
Fax: (07) 4924 7901

Townsville
Ph: (07) 4758 6000
Fax: (07) 4758 6001

New South Wales

Grafton
Ph: (02) 6644 7666
Fax: (02) 6644 7313

Newcastle
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Fax: (02) 4032 6822

Sydney
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Fax: (02) 9625 5200

Tamworth
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Fax: (02) 6763 7301

Victoria

Echuca
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Fax: (03) 5482 3090

Melbourne
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Fax: (03) 9360 3887

Tasmania

Launceston
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Fax: (03) 6335 6330

South Australia

Adelaide
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Fax: (08) 8168 4549

Western Australia

Gnangara
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Perth
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TECHNICAL REPORT 9

Resident Care

6th September 2016

Living Gems
C/- Ruby Developments
P.O. Box 5056
GCMC, QLD 9726

ATTN: Mr. Adrian Puljich – General Manager

HOME CARE SUPPORT SERVICES TO LIVING GEMS HOME OWNERS

Dear Adrian,

This letter confirms that PresCare Community Care, Walk on Wheels, The Contented Chef and Connect2Health will provide home care support services consisting of, domestic and personal care, nursing, home delivered meals and allied health to home owners residing within a Living Gems Resort.

In particular we confirm that home owners within the proposed Living Gems development located Skennars Head NSW, will have access to each of the above noted home care support services.

Yours sincerely,

Michael Bosel
Chief Commercial Officer
PresCare Group

TECHNICAL REPORT 10

Flood Impact Assessment

67 Skennars Road, Local Catchment Design Storm and Long-term Inundation Assessment

Reference:
R.B22887.001.02.docx
Date: April 2018

67 Skennars Road, Local Catchment Design Storm and Long-term Inundation Assessment

Prepared for:	Planit Engineering
Prepared by:	BMT Pty Ltd (Member of the BMT group of companies)

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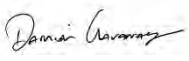
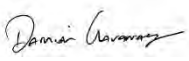
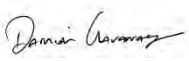
Title:	67 Skennars Road, Local Catchment Design Storm and Long-term Inundation Assessment
Project Manager:	Damion Cavanagh
Author:	Damion Cavanagh; Sebastian Froude; Christopher Vos, Phillip Ryan
Client:	Planit Engineering
Client Contact:	Andrew Wells
Client Reference:	
Synopsis:	

REVISION/CHECKING HISTORY

Revision Number	Date	Checked by		Issued by	
00	15/12/2017	DCC		PAR	
01	15/12/2017	DCC		PAR	
02	16/04/2018	DCC		PAR	

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Executive Summary

Ballina Shire Council has raised concerns about the potential impacts upon both local catchment flooding and downstream wetland inundation that may arise from a proposed retirement village development at 67 Skennars Head Road, Skennars Head.

The site is proposed to be filled to achieve local and regional flood immunity. The site development proposed will alter the imperviousness of the site and consequently alter the volume, frequency and peak flows generated from the site.

To predict the potential impacts of the development, a variety of hydrology and hydraulic modelling tools have been developed. Modelling has been extended to include the entire Chickiba Creek catchment due to the tidally affected of the catchment and presence of tidal drainage lines and wetland in the vicinity of the site. The transmission of tides along these drainage channels has the potential to influence flood modelling outcomes associated with the site.

Two different types of hydrology models were developed, including a WBNM model to provide design event runoff hydrographs, and a SOURCE catchment model to provide long-term (multi-year) runoff hydrographs. These hydrographs were then used as input to two different hydraulic models. Both models were developed in the TUFLOW hydraulic modelling package and are the same in most regards, with the key differences being the use of a smaller cell size (5m) in the design flood assessments, and a larger cell size (15m) in the inundation modelling assessment. These cell sizes have been adopted to manage model run times to reasonable levels, without compromising assessment outcomes.

In terms of model outcomes the local catchment flood modelling initially identified impacts within the caravan site which were likely to be unacceptable. It was identified that with the augmentation of the existing culverts under Skennars Head Road to the immediate north of the site, that these issues were mitigated as flood waters previously being detained on the sports field were able to be partially drained through these culverts and the development site. In terms of modelled impacts, the 18% AEP event identifies a significant improvement in peak water levels north of the development site and within the caravan park, with a limited areas of peak flood level increases along the drainage channel to the east of the caravan park site. The 5% AEP event identifies continued improvements in peak flood levels north of the road and within the caravan park site with no areas of increased flood levels. The 1% AEP event identifies some limited areas of improvement in flooding in the caravan park site and a small area of increases in peak floods at the south east corner of the development site within the drainage channel extent.

The difference in duration mapping presented shows that the majority of the downstream areas have no significant change in inundation duration, with isolated areas along the western fringe of the wetland showing increases in duration of inundation in the range 0.5 – 5.0%. The identified change in inundation patterns is primarily due to the provision of the additional culvert under Skennars Head Road which has allowed for additional flow to be released via this structure and pass through the development site to the wetland area.

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List of Tables

1 Introduction

1.1 Background

Ballina Shire Council's review of the development application (DA) for a proposed retirement village at 67 Skennars Head Road, Skennars Head has led to the issue of a Request for Information (RFI). The location of the proposed development is shown in Figure 1-1.

The relevant RFI wording for the purposes of this assessment report is shown below.

> Consequently, the application needs to confirm that the drainage system downstream of the wetland has sufficient conveyance capacity to maintain the current hydrologic conditions in both the wetland and greater catchment if the development proceeds. The drains (extending from the development to the canal) shall also need to be included
>
> within easements to ensure that Council can maintain the conveyance capacity of the drains in the future. There are a number of low lying properties within the catchment surrounding the wetland that already experience flooding and drainage issues, (the adjoining mobile home park, Holy Family School, etc.). The open channel drainage systems surrounding these properties have very little grade resulting in poor conveyance and extended periods of water retention. The application needs to demonstrate, through the provision of suitable stormwater modelling, that these properties will not be adversely affected by the development.

On 11 September 2017 a meeting was convened between Planit Engineer, BMT and relevant Council DA officers to discuss the RFI and confirm assessment expectations. The discussions were focused around the concerns and needs of Council in completing their assessment of the DA and liabilities regularly incurred by Council in so doing. Council identified a range of stakeholder concerns (i.e. concerned neighbours) and broader ecological considerations (impact of additional water on wetlands) in this discussion.

In summary, the RFI requirements and clarification sought from Council identified that a range of local catchment hydrology/hydraulic assessments were required to confirm:

- If the drainage system downstream of the wetland had sufficient conveyance capacity to maintain the current hydrologic conditions.
- Council could maintain the conveyance capacity of the drains in the future.
- Low lying properties within the catchment would not be adversely affected by the development.

Living Gems (proponent) commissioned BMT to complete these assessments to address the requirements of Council's RFI.

1.2 Scope of Work

In order to demonstrate the potential effects of the proposed development a variety of hydrologic and hydraulic modelling has been undertaken for two different styles of assessments including long term inundation modelling (to determine potential impacts on the downstream wetland areas) and

local catchment flood modelling (to determine potential impacts on nearby housing and other sensitive areas).

1.2.1 Long-term Flood/Inundation Modelling

The long-term inundation modelling has been conducted using a historic meteorological dataset of five years duration, to represent a typical range of conditions that affect flood inundation in the catchment of Chickiba Creek. This has included use of real tide records to drive downstream tidal boundaries, and use of real rainfall data to drive catchment runoff processes. Modelling has been completed over a 5 year period on the basis that this duration of modelling is representative of long term conditions and will have the ability to identify potential changes resulting from the proposed development.

1.2.2 Local Catchment Design Storm Flood Impact Assessment

Local catchment flood modelling has been conducted to demonstrate the potential hydraulic impacts of the proposed development on adjoining areas. A variety of typical design storms have been assessed.

Title:

Locality Map

Figure: 1-1

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BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

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2 Site Characteristics

2.1 Topography

The site is bounded to the north by Skennars Head Road and site elevations generally fall away from north to south. The site's lowest elevations are in the south west corner where elevations are typically in the range 1.0 to 1.5 m AHD. The elevations across the site are presented in Figure 2-1. This figure also highlights the relevant existing drainage flow paths and hydraulic features such as culverts (the topographic relief shown in this Figure is described in Section 2.1.1).

A number of elevation data sources have been used in the hydraulic modelling completed; these are further described in the sections below.

2.1.1 Existing LiDAR DEM

LiDAR survey of the Ballina regions including the entire Chickiba Creek catchment was collected in 2012. BMT has purchased this data from the NSW Department of Land and Property Information, in the format of a Digital Elevation Model (DEM) with 5 m resolution. This DEM has been utilised as the base elevation layer for portions of the catchments where locally specific survey information was not available (See Section 2.1.2). The LiDAR DEM is presented in for the entire Chickiba Creek Catchment in Figure 2-2.

2.1.2 Site Survey

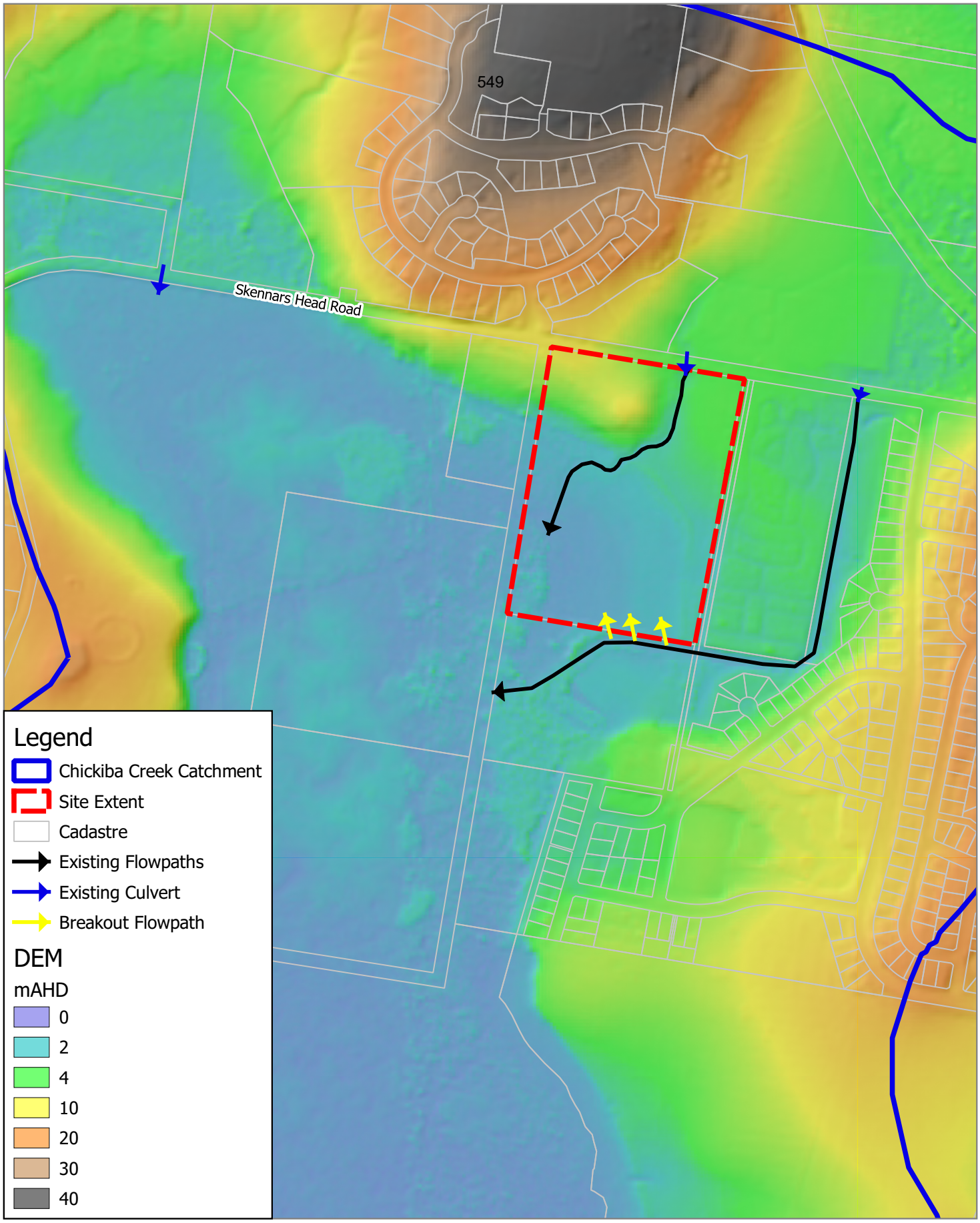
In consultation with BMT, ground survey was collected by Northern Rivers Land Solutions in October 2017 and again in February 2018. The focus of this survey was to collect detailed information on the drainage channels, sufficient to allow these to be represented in the hydraulic model. Survey points are presented in Figure 2-3. Prior survey of the site had been obtained by Kennedy's surveying and this information has also been utilised.

The surveyors reported that due to the presence of high density vegetation and water levels in the vegetated wetland areas downstream of the proposed development, they were unable to survey this area for safety / access reasons.

This survey was converted into a suitable format for importation into the hydraulic model. The hydraulic model configuration is detailed in Section 3.3.

2.1.3 Proposed Design Surface

A revised design surface was provided by Planit Engineering (2018-04-04) as AutoCAD drawing. This drawing was converted to a DEM in Geographic Information System (GIS) format. The proposed design surface DEM is presented in Figure 2-4. The revised design surface has taken into account various negotiated outcomes on the development.



Title:

LiDAR DEM and Drainage Features - Site Vicinity

Figure: 2-1

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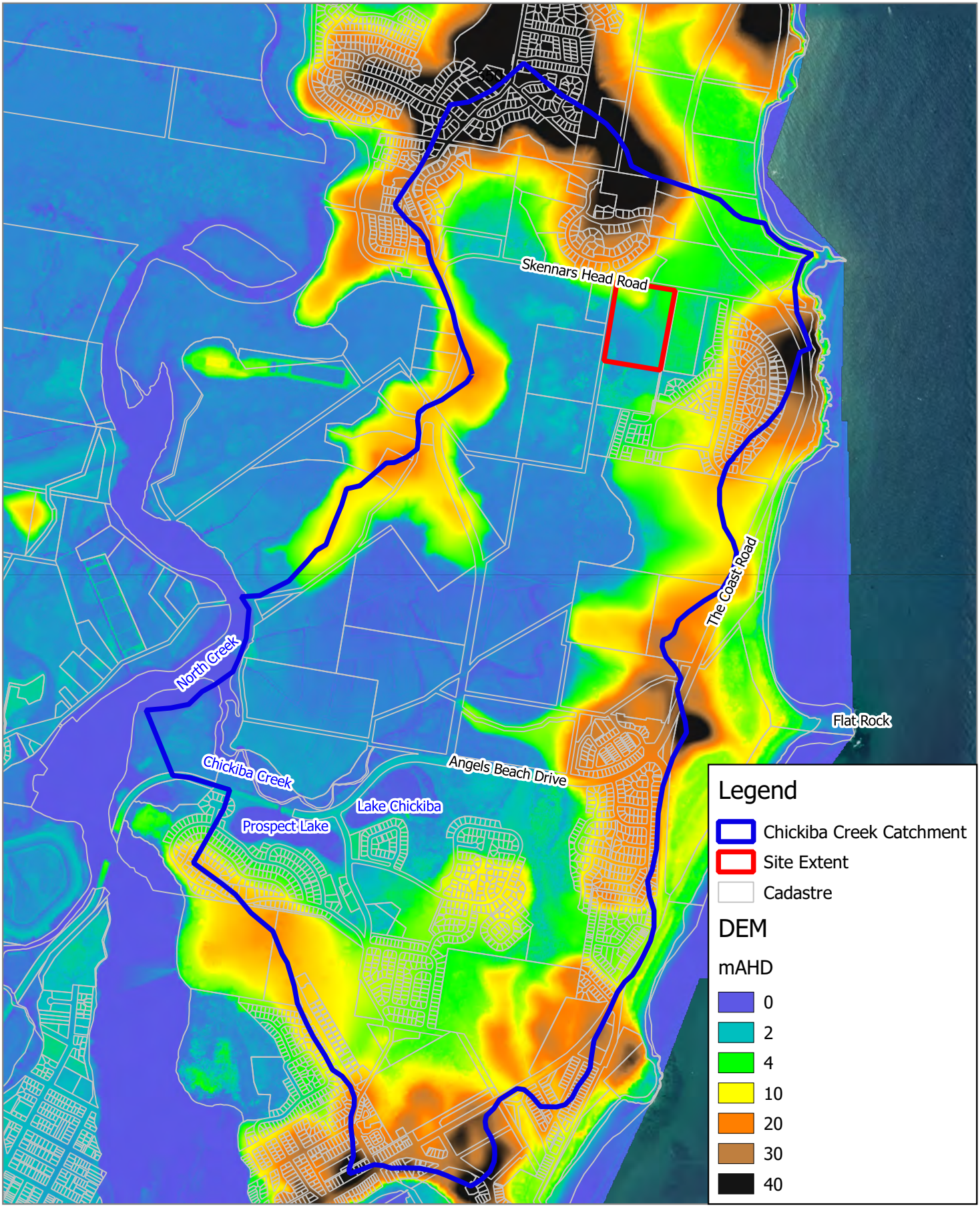

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LiDAR DEM - Chickiba Creek Catchment

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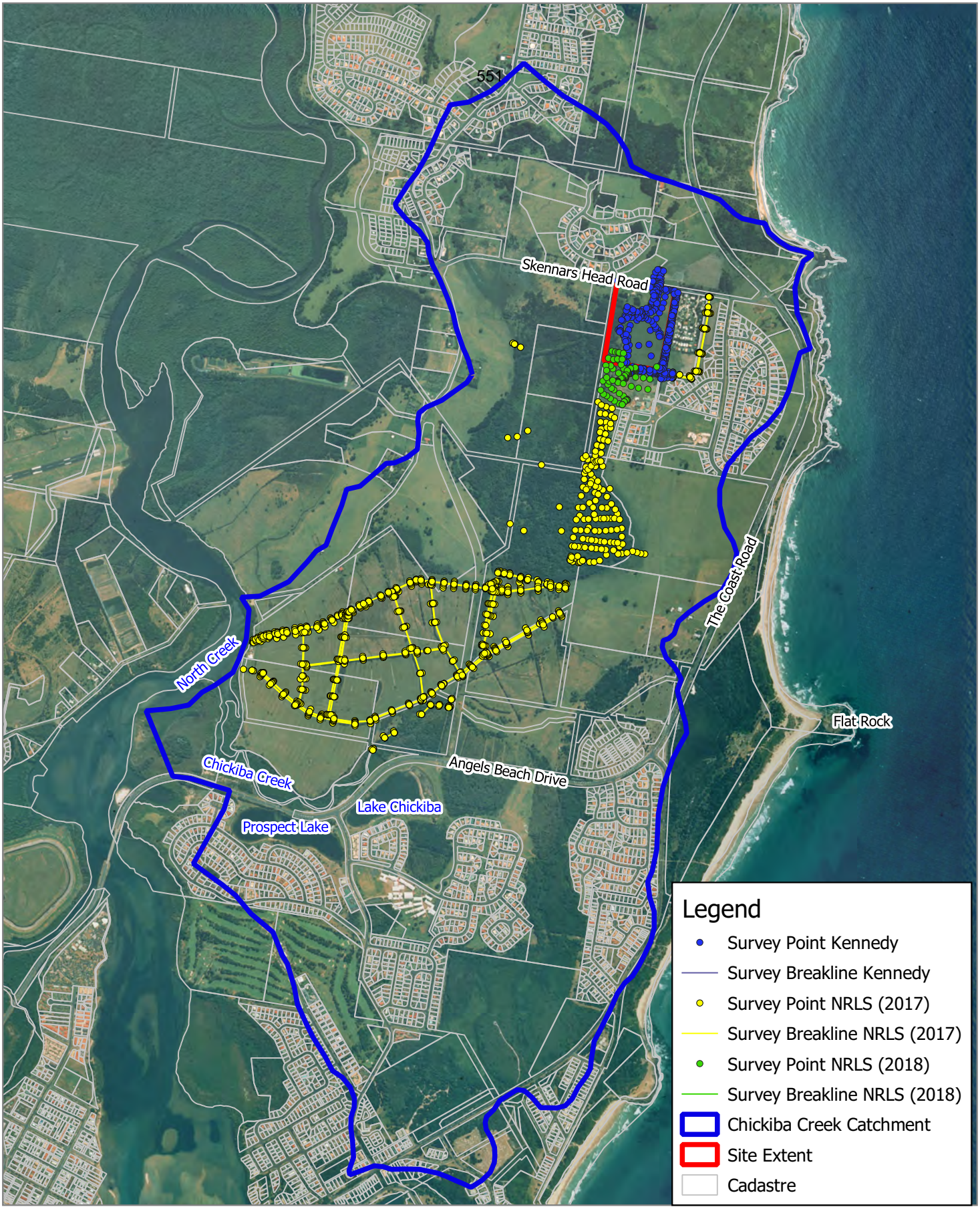

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Ground Survey, Northern Rivers Land Solutions and Kennedy Surveying

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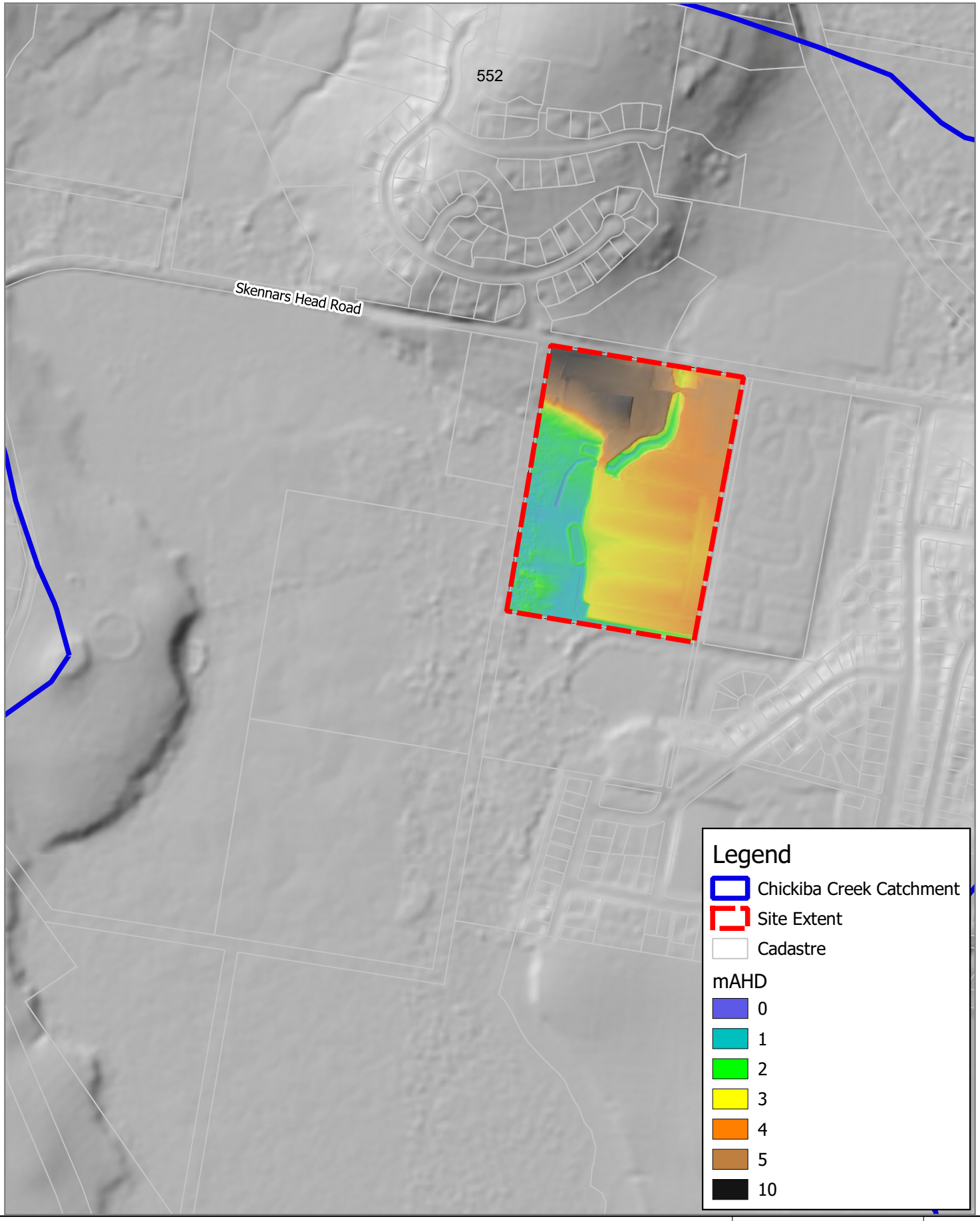

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Proposed Design Surface
20180404 Combined surface export to WBM.dwg

Figure: 2-4

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2.3 Existing and Proposed Land Use

From site inspection and review of aerial photography the existing site at 67 Skennars Road appears to be predominately cleared agricultural land. There remain some forested areas along the western edge of the site. An existing poorly defined overland flow channel passes through the site. This channel drains a small catchment that exists to the north of Skennars Head Road. This catchment has an area of approximately 17.6 ha.

Figure 2-5 shows the predominant land use on the existing site. Figure 2-6 shows the existing drainage channel adjacent the site and caravan park.

The proposed development includes roads, dwellings and two detention basins.

Figure 2-5 Photo: Existing Site Landuse

Figure 2-6 Photo: Existing Drainage Channel at South of Site

2.4 Site Flooding

The site is potentially subject to flooding from two dominate mechanisms, namely:

- Flooding from North Creek during a regional flood event; and
- Flooding from rainfall within the local catchment of Chickiba Creek.

The local flooding is caused by short duration rainfall, whereas the regional flooding is caused by longer duration rainfall falling across the broader North Creek catchment. Regional flooding impacts of the proposed development have been addressed previously (BMT, 2016).

This report is focused on the proposed development's potential impact on local flooding characteristics and longer term inundation impacts resulting from increased site runoff volumes.

2.5 Drainage Features

Three culverts underneath Skennars Head Road are present in the hydraulic model area. A culvert under Skennars Head Road drains the 17.6 ha catchment to the north of the proposed development site. This drains through the site to the large wetland area to the south west.

Another larger drain is present on the eastern side of the Ballina Headlands Holiday Park (BHHP), This drains a sub-catchment north of Skennars Head Road, to the north east of the development site, with an approximate area of 33.9 ha. This drain runs along the eastern and southern edges of the BHHP. To the immediate south of the proposed development site an existing bund prevents

low flows from entering the site. Hydraulic modelling (described in later sections) shows that during flood events this bund is overtopped with flows entering the site across the site's southern boundary.

The DEM and existing drainage features / flowpaths in the vicinity of the site are shown in Figure 2-1.

3 Model Configuration

3.1 Introduction

For the assessment a number of different numerical models have been utilised, these are categorised as either hydrologic or hydraulic models.

A hydrologic model simulates the rate of storm runoff from the catchment. The amount of runoff derived from rainfall and the attenuation of the flood wave as it travels down the catchment is dependent on the catchment slope, catchment area, vegetation, imperviousness and antecedent conditions as well as the rainfall distribution and intensity.

A hydraulic model simulates the dynamic flood behaviour. The rate of travel, flood levels and velocities are dependent on the shape, size and surface characteristics (roughness) of the waterways and floodplain.

For the hydrologic modelling two separate models have been developed and used including a local flood model and a catchment model for long-term inundation assessment.

The local flood model hydrology is based on the WBNM hydrological modelling completed as part of the Richmond River Flood Mapping Study (BMT, 2010). The WBNM model was calibrated to the 2009, 2008 and 1974 historical flood events for the entire Richmond River Catchment. This utilised the WBNM software, refer to section 3.2.1 for more details on the WBNM hydrologic model configuration. The primary use of the WBNM hydrology model has been as an event based hydrology model, i.e. to model a single rainfall event rather than continuous simulation of wet and dry periods.

The catchment model used in this study is a SimHyd hydrology model within the SOURCE modelling framework. The SOURCE catchment modelling framework is suited to the assessments at this site as SOURCE is designed to operate on larger catchment areas, it offers a range of hydrologic tools (of which SimHyd was selected) which account for baseflow/groundwater influences in predicting catchment runoff (likely to be relevant in this catchment,) and it operates across multi-year periods applying either real or synthetic meteorological datasets. Therefore, for the long-term inundation modelling a SOURCE hydrology model was developed, this is detailed in Section 3.2.2.

The hydraulic modelling of both the local flooding events and long-term inundation event has been completed using the TUFLOW software. Two separate hydraulic models have been developed, however, where possible the model inputs are the same. Two separate hydraulic models have been used due to the runtime considerations. The long-term modelling uses a larger 2D cell size (15m) to allow multiple years of data to be simulated within a realistic timeframe. The local catchment flood model requires a shorter simulation time and as such a smaller cell size (5m) has been used to improve model resolution.

The hydraulic models used for the inundation and local flooding are described in Sections 3.3.2 and Section 3.3.3, respectively.

3.2 Hydrology Models

3.2.1 WBNM

The Watershed Bounded Network Model (WBNM) hydrologic software has been used for the local flood modelling assessment. This is based on the hydrologic modelling developed as part of the Richmond River Flood Mapping Study (BMT, 2010) and this model has been used in the Newrybar Swamp Drainage and Flood Mitigation Study (BMT, 2015).

Some modifications to the sub-catchments were required to provide greater resolution for use in the local flood modelling completed as part of this study. These modifications are detailed in the section below.

3.2.1.1 Sub-Catchment Delineation

WBNM models are developed on the basis of a catchment divided into a number of sub-catchments based on the stream network. This allows hydrographs to be calculated at various points within the catchment, and the spatial variability of rainfall and rainfall losses to be modelled. WBNM separates overland flow routing from channel routing, allowing changes to either or both of these processes, for example in urbanising catchments.

To analyse the complex flow patterns incorporating the varying terrain and land uses in the TUFLOW hydraulic model, greater definition of the hydrologic sub-catchments is required for this study. The sub-catchments from the regional WBNM model developed for the Richmond River Flood Mapping Study (RRFMS) that surround the proposed development site were further delineated from 7 sub-catchments to 16 sub-catchments, utilising the available LiDAR data.

3.2.1.2 WBNM Parameters

The WBNM model has been developed by entering information for each sub-catchment such as; area, centroid, outlet, % impervious in addition to recommended catchment parameters as shown in Table 3-1. These parameters are reproduced from the regional model, developed for the 2008 flood study.

Table 3-1 WBNM Parameter Choices

WBNM Parameter	Value
Pervious Lag Parameter	2.0
Impervious Lag Parameter	0.1

For the development scenario, urbanised sub-catchments were modelled utilising an imperviousness of 67.0% based on the proposed land-use areas provided by Planit Engineering (Drawing J107, 0016G). For impervious areas, an initial loss of 0 mm and continuing loss of 0 mm/h were applied.

3.2.1.3 Design Rainfall

For design events, rainfall depths are usually determined by the estimation of intensity-frequency-duration (IFD) design rainfall curves for the catchment. Standard procedures for derivation of these curves are defined in AR&R (2001).

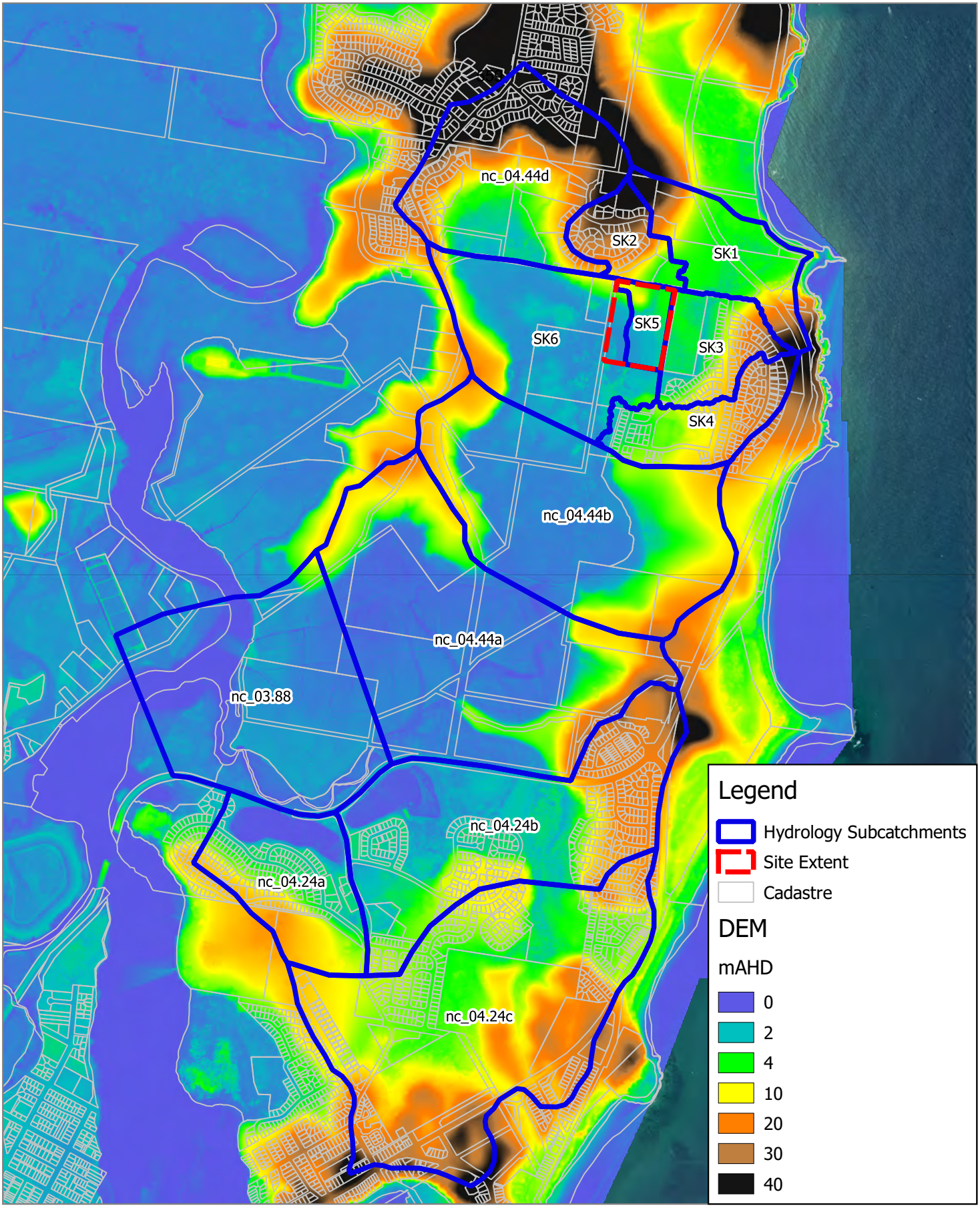
For the RRFMS, the regional WBNM hydrology model has been split into four regions for intensity-frequency-duration (IFD) design rainfall parameters, this approach is consistent with the Ballina Flood Study Update (BMT, 2008). The study site is within the Alstonville IFD region. Table 3-2 shows design rainfall intensities used for a range of design events, as per the modelling undertaken for the RRFMS.

Table 3-2 Average Design Rainfall Intensities (mm/h)

Duration (hrs)	Design Event	
	5% AEP	1% AEP
0.25	161	203
0.5	118	149
1	83	106
2	61	81
3	51	69
6	37.3	53
12	27.4	40

The recently released ARR update (2016) revised the recommended application of temporal patterns for use in design flood estimation. For consistency with the RRFMS, this study has adopted the temporal patterns and initial and continuing loss guidance in accordance with AR&R (2001).

For the WBNM hydrologic model, design temporal pattern Zone 3 and an initial loss of 20 mm and continuing loss of 2.0 mm/h were utilised for pervious areas, as per the RRFMS modelling.



Title:

WBNM Subcatchments

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3.2.2 SOURCE

SOURCE (https://ewater.atlassian.net/wiki/display/SD37/Introduction+to+Source, and following sites) has been used as the catchment model to generate long-term runoff hydrographs for each drainage catchment of Chickiba Creek. SOURCE provides the ability to simulate current catchment characteristics and hydrological responses to rainfall, in addition to evaluating the impacts of land use change.

Construction of a SOURCE catchment model requires transforming the physical catchment information into a mathematical form that is used to convert rainfall to runoff (and if required calculate subsequent pollutant loads). The outcome is a numerical representation of the physical features that capture the land-based framework, hydrological processes and pollutant load generation aspects of the catchment. Following the model construction phase, calibration and verification is ideally completed to ensure the constructed numerical model adequately represents the study area.

The underlying data used to construct a catchment model within SOURCE include:

- A digital elevation model (DEM) for sub-catchment delineation;
- A land use map for the catchment in consideration;
- Meteorological data (daily rainfall and evaporation data);
- Hydrologic data for model calibration (if available); and
- Observed flow data for calibration including any point source, storages and extractions (if available).

The catchment model developed is presented in Figure 3-2. The node link network presented is conceptual and references the SOURCE model configuration only.

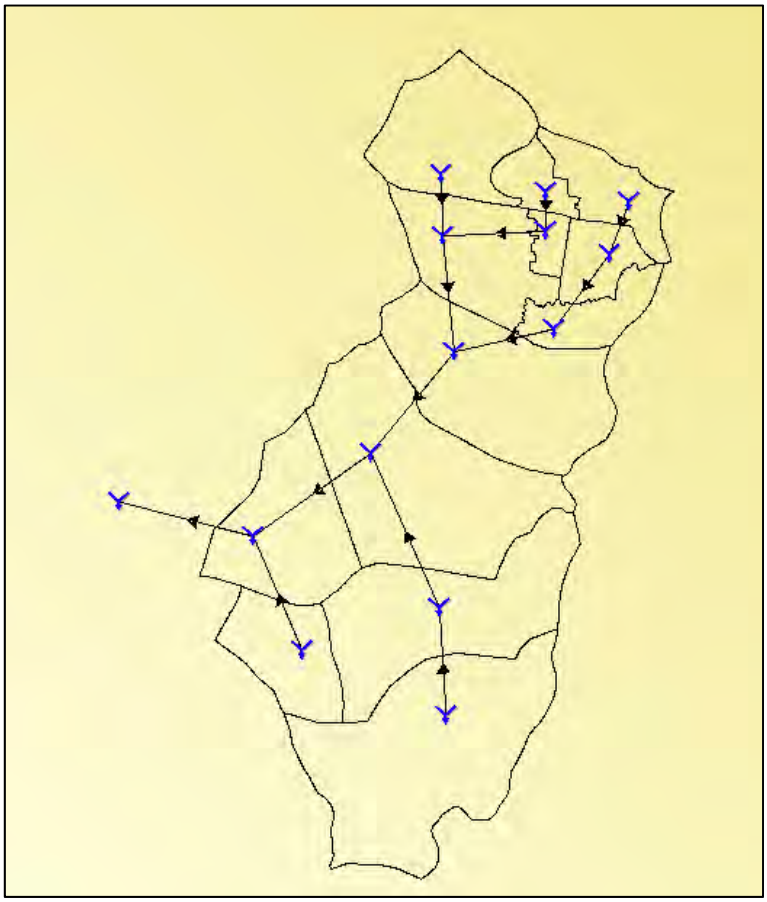


Figure 3-2 Source Model Configuration

3.2.2.1 DEM

The raw topographic data used by the catchment model is described in Section 2.1.1.

3.2.2.2 Rainfall

SILO (Scientific Information for Land Owners) daily rainfall gridded surfaces for the period 1990-2016 were used in the model construction. The SOURCE gridded climate collation tool was used to assign rainfall to each land use within each sub-catchment of the model.

3.2.2.3 Potential Evapo-Transpiration (PET) Data

SILO daily PET gridded surfaces for the period 1990-2016 were used, with the SOURCE gridded climate collation tool again used to assign PET values to each land use within each sub-catchment of the model.

3.2.2.4 Land Use

The 2009 NSW Land Use Mapping data set was used across the catchment to represent the land use (called functional units within SOURCE) in the catchment. The final land uses assigned within the model were:

- Green Space;

- Grazing Natural Vegetation;
- Horticulture;
- Rural Residential;
- Peri Urban;
- Urban Residential;
- Commercial;
- Industrial;
- Roads; and
- Water.

Land use in the Chickiba Creek catchment is outlined in Table 3-3 for both the existing development state and future development state after the proposed construction. It can be seen that the 'Industrial' land use has increased in moving to the developed case. While the development is not 'industrial' in nature, within the SOURCE model the Industrial land use has a 90% imperviousness (see Table 3-6) and this has been conservatively adopted for the purposes of the inundation modelling.

Table 3-3 Land Use Chickiba Creek Catchment

Land Use	Existing		Developed	
	Area (ha)	Area (% distribution)	Area (ha)	Area (% distribution)
Green Space	289.3	31.14	289.2	31.13
Grazing Natural Veg	304.0	32.72	294.8	31.73
Horticulture	0.0	0.00	0.0	0.00
Rural Residential	11.7	1.26	11.7	1.26
Peri Urban	11.0	1.19	11.0	1.19
Urban Residential	265.9	28.62	265.7	28.60
Commercial	20.5	2.21	20.5	2.21
Industrial	0.1	0.01	9.5	1.02
Roads	0.9	0.09	0.9	0.09
Water	25.7	2.77	25.7	2.77

3.2.2.5 Hydrology

The SimHyd hydrology model (there are multiple options in SOURCE) was applied across all hydrologic functional units within the catchment model. As there is no gauge data available for model calibration, imperviousness's adopted were those used in similar studies in the region (AWC, 2016). These impervious values are presented below in Table 3-4.

Table 3-4 Adopted Imperviousness Values

Landuse	Imperviousness (%)
Green Space	0
Grazing Natural Veg	0
Horticulture	0
Rural Residential	2
Peri Urban	5
Urban Residential	70
Commercial	70
Industrial	90
Roads	70
Water	N/A

The Chickiba Creek catchment is small and largely tidal and there is no flow gauging stations or data to define catchment runoff. This presents a limitation to calibrating catchment SimHyd model parameters to local conditions.

However, BMT recently completed similar SOURCE modelling for the Belongil Creek catchment for Byron Shire Council (AWC, 2016) and was able to validate SOURCE model parameters as part of that study. The process of model validation essentially occurred by comparing the predicted water levels against observed water level data in a downstream waterway within the model domain (in this study SOURCE was the catchment hydrology model and TUFLOW was the hydraulic model).

The adopted hydrology parameters are included in Table 3-5.

Table 3-5 Adopted SIMHYD Parameters

Parameter	Adopted Value
Impervious Threshold	1 mm
Rainfall Soil Interception Store	3.4 mm
Pervious Fraction	See Table 3-4
Soil Moisture Store Coefficient	40 mm
Infiltration Shape	3
Infiltration Coefficient	300
Interflow Coefficient	0.41
Recharge Coefficient	0.6
Baseflow Coefficient	0.08

3.2.2.6 Modelling Period

The SOURCE model has exported catchment runoff for the entire simulation period i.e. 1990 to 2016. These have been provided to the hydraulic model as a model input. The hydraulic modelling has been completed for a 5 year period from 1/1/2011 through to 1/1/2016.

Rainfall and PET data applied in the SOURCE model is presented in Figure 3-3.

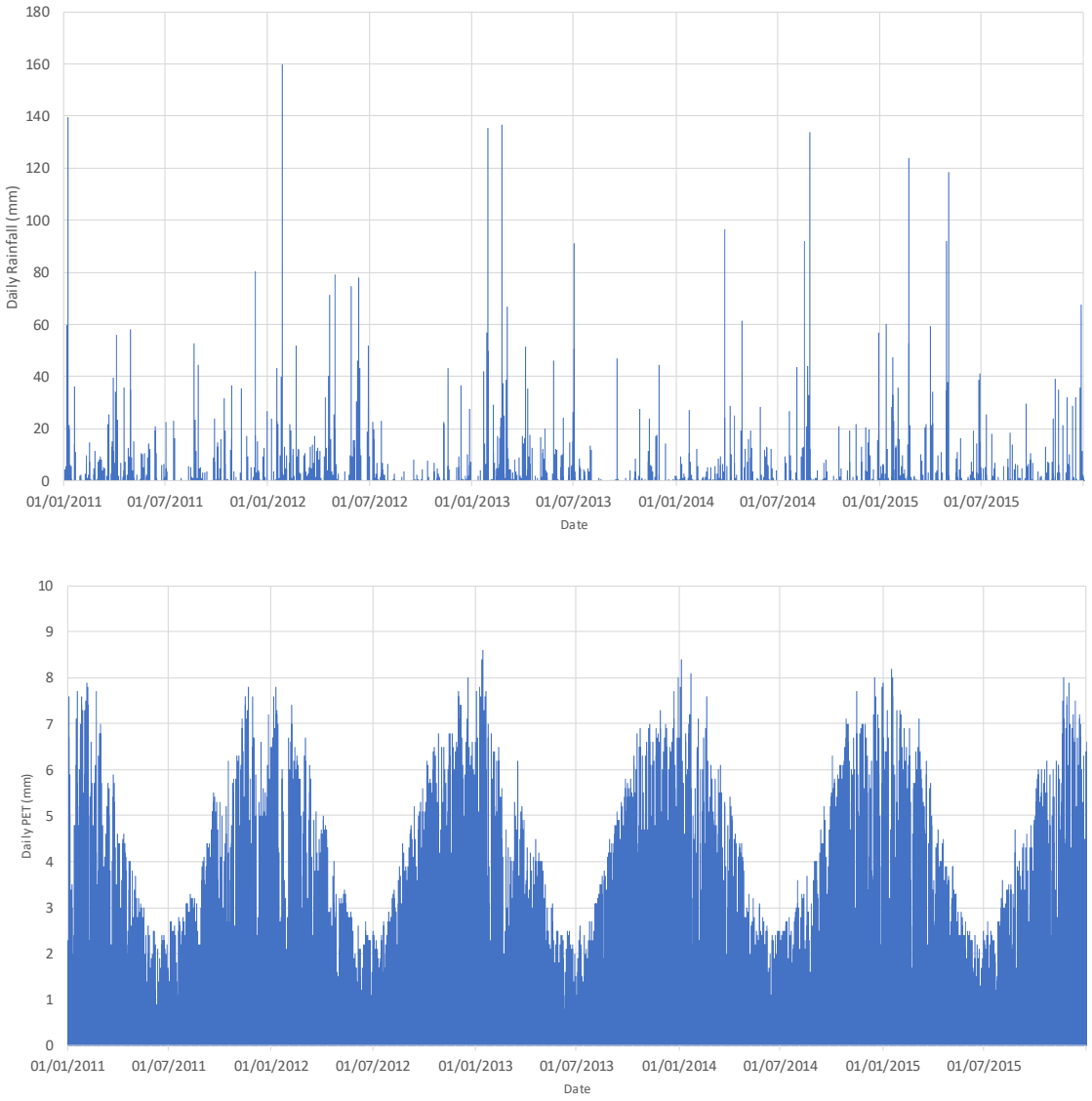


Figure 3-3 Rainfall and PET Data 1/1/2011 to 1/1/2016

3.3 Hydraulic Models

3.3.1 TUFLOW Software

The two-dimensional (2D) and one-dimensional (1D) hydraulic modelling software package TUFLOW has been used for all hydraulic modelling in this study.

TUFLOW has been utilised in thousands of hydraulic modelling studies across the world for over two decades. It is an industry leading hydraulic modelling package that is constantly being improved and adapted to the needs of modern users. Locally TUFLOW has extensively been used in flood modelling for most local government authorities in Northern NSW. BMT is the sole developer and proprietor of the TUFLOW suite of models.

3.3.2 Inundation

This section describes the TUFLOW model utilised for the long-term inundation modelling, a separate section below details the TUFLOW model for the local flood modelling.

3.3.2.1 Model Extent

The hydraulic model extends from north of Skennars Head Road to the confluence of Chickiba Creek and North Creek. The active 2D area of the model comprises and area of approximately 404.6ha. The 2D hydraulic model extends south to Angels Beach Drive, the two lakes south of Angels Beach Drive (Prospect Lake and Lake Chickiba) are modelled as 1D storage areas. This allows for the storage / volume in these lakes to be represented in the model, without adding additional computational effort required by modelling these in 2D. The structures underneath Angels Beach Drive are modelled as 1D culverts and these are connected to Chickiba Creek which is modelled in 2D (relevant details of these structures were provided by Ballina Shire Council).

The primary drainage channels in the catchment have typically been represented as 1D channels with the 2D cells used to represent the floodplain / wetland areas. Any hydraulic structures (e.g. culverts) have been represented as 1D structures in the TUFLOW model.

The TUFLOW model extent and configuration is presented in Figure 3-7.

3.3.2.2 Cell Size

One of the primary considerations in 2D hydraulic modelling is the 2D cell size, a smaller cell size may allow better representation of the topography and flow paths, but increases the computational effort and therefore the time required to run the model.

Different 2D cell sizes have been adopted for the inundation and local flood modelling. For the long term inundation modelling a larger 2D cell size is required to allow the simulation to be run in a realistic timeframe. For the inundation modelling described in this section a 2D model cell size of 15 metres has been utilised. The majority of the drainage channels in the catchment are narrower than the 2D cell size and these drainage channels are represented as 1D channels. This embedded 1D channel approach, allows the drains to be accurately represented, particularly for drains that are narrower than the selected 2D cell size.

The long-term inundation modelling runtime for a 5 year simulation is approximately 4 days. Simulations were completed on a purpose built ‘high-end’ modelling computer.

3.3.2.3 Elevations

The base dataset for the TUFLOW model is the LiDAR DEM described in Section 2.1.1. Where additional more accurate data (i.e. survey data) is available this is used in preference to the LiDAR data.

Ground survey data (described in Section 2.1.2) has been incorporated into the TUFLOW hydraulic model using two methods. For the drainage channels, which are represented as 1D channels, the survey has been converted into a cross-section in (elevation – offset) format, this information has been provided to TUFLOW, an example is provided in Figure 3-4.

For the areas modelled in 2D, the survey has been used to create breaklines in the TUFLOW model. The locations of breaklines in the TUFLOW model are presented in Figure 3-9.

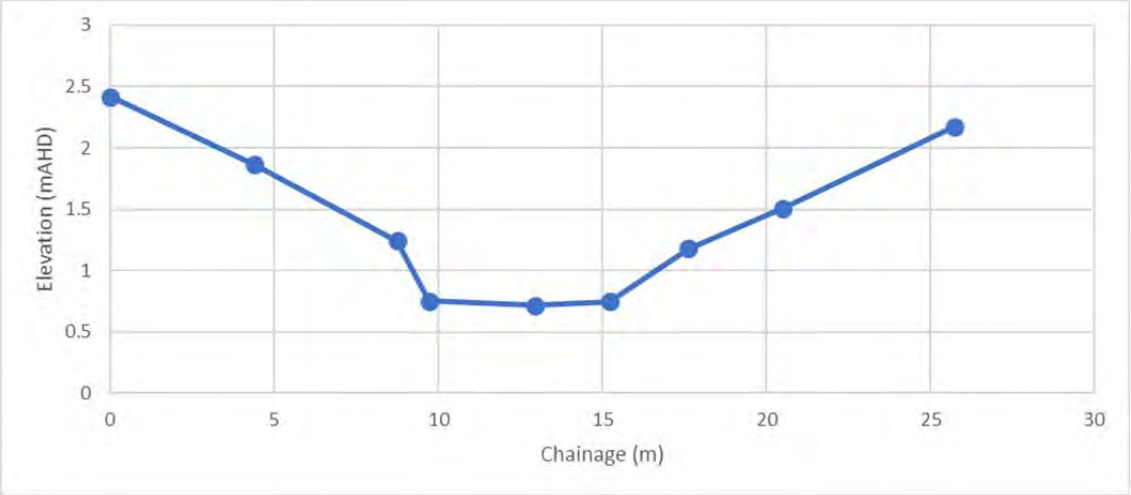


Figure 3-4 TUFLOW Model: Example 1D Cross-Section

3.3.2.4 Land Use

Land use areas in the hydraulic model were digitised based on the aerial photography. The land use categories and associated Manning's n roughness values are outlined in Table 3-6. A spatial distribution of the land use areas is presented in Figure 3-8.

The adopted Manning's n values are consistent with those used in the Newrybar Flood Model, prepared for Richmond River County Council by BMT (BMT, 2015).

Table 3-6 Adopted Manning's n Values

Category	Manning's n value
Pasture	0.050
Dense Vegetation	0.120
Tidal Waterway	0.030
Road	0.025
Urban Block	1.000
Grass	0.040

3.3.2.5 Modelling Period

To simulate the longer-term influences of the proposed development on the wetlands / waterways downstream of the study site the hydraulic model was simulated for a period of 5 years. The hydraulic model simulation period extends from 1/1/2011 through to 1/1/2016 which covers a range of meteorological conditions.

3.3.2.6 Downstream Water Level Boundary

The downstream hydraulic model boundary is the tidal water levels of North Creek. To establish this downstream boundary within the hydraulic model, tidal water level data from the Missingham Bridge tide recorder was purchased from the Manly Hydraulic Laboratory.

This data was provided in Richmond River Valley Datum and has been converted into m AHD with a shift of 0.860 m (m AHD = RRVD – 0.860 m). As the tidal data is recorded at 15 minute intervals, there is some "noise" in the recorded water level (i.e. minor increases and decrease in tidal level) which appear to be an artefact of the way that the data was collected, rather than a representation of any real changes in water level. To lessen the 'noise' and smooth the data, a moving average filter was applied to average the water level across 5 data points.

A summary of the time-series properties is presented in Table 3-7. A time-series of the 1st month of data (1/1/2011 through 1/2/2011) is presented in Figure 3-5, this shows both the raw data points and the boundary data applied after the moving average filter is applied. The tidal time-series over a 4 day period is presented in Figure 3-6, this highlights the smoothing applied. There is only a minor dampening of the tidal signal.

Table 3-7 Summary Statistics Tidal Boundary (2011-01-01 to 2016-01-01)

Statistic	Value (mAHD)
Min	-0.95
10th percentile	-0.45
25th percentile	-0.26
Mean	0.06
75th percentile	0.36
90th percentile	0.61
Max	1.27

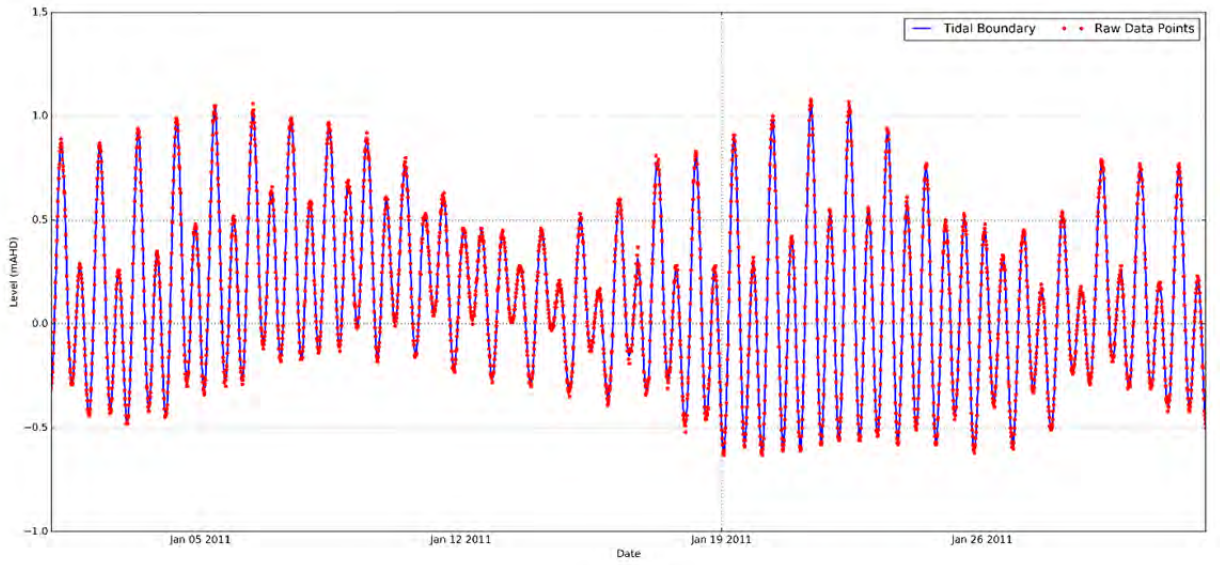


Figure 3-5 Tidal Time-series: January 2011

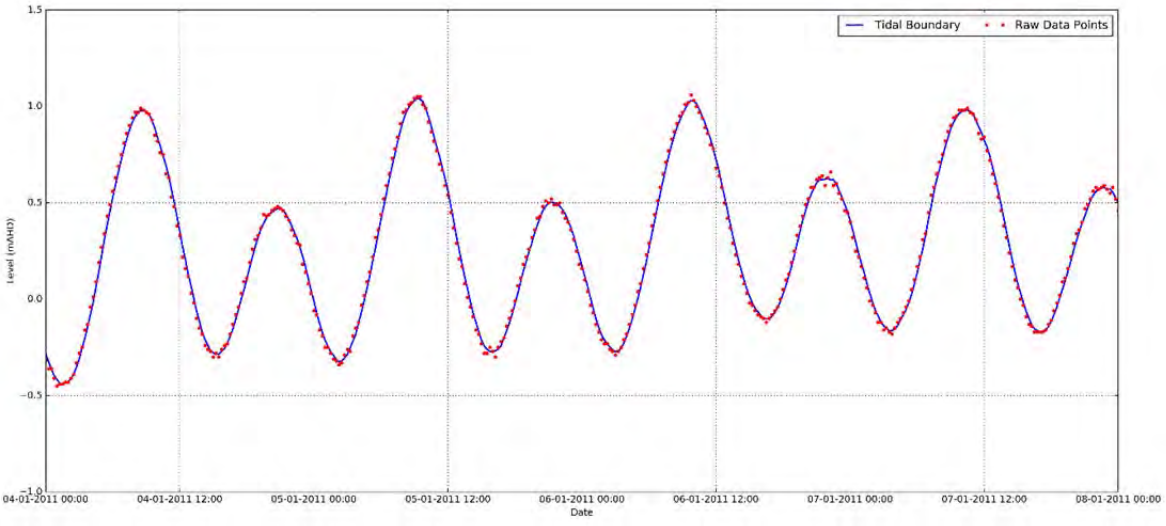


Figure 3-6 Tidal Time-series: Smoothing

3.3.2.7 Inflows

The model inflows for the long-term simulation are those derived from the SOURCE hydrology model (as described in Section 3.2.2). SOURCE has been established to provide runoff hydrographs for each model sub-catchment. These flows have been input to the TUFLOW hydraulic model.

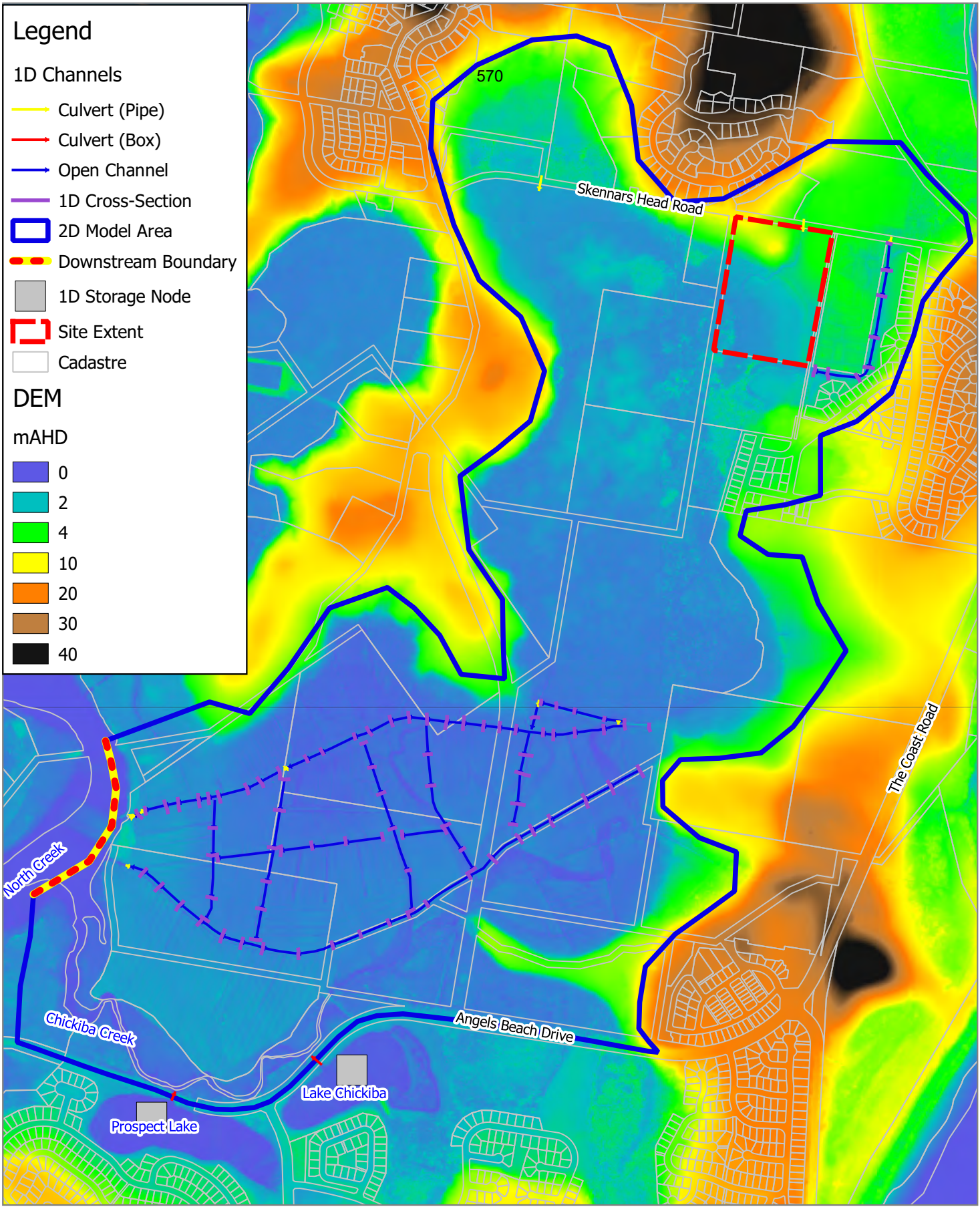
For areas where the channel is modelled in 1D, the inflows are directed to the 1D nodes, for sub-catchments with no 1D elements, the inflow is applied as a TUFLOW source-area inflow type, which divides the flow between the wet cells.

3.3.2.8 Developed Case

For the developed case model, the proposed design surface (refer Section 2.1.3) has been included to overwrite the existing elevations in the existing case.

The proposed detention basins have been modelled as 1D nodes with user defined height v's area relationships, based on the design surface. The culverts for the proposed detention basin outlets have been modelled as 1D elements. The two proposed culverts underneath the internal roads have been modelled as 1D culverts.

The developed case TUFLOW inundation model changes are presented in Figure 3-10.



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TUFLOW Model: Layout

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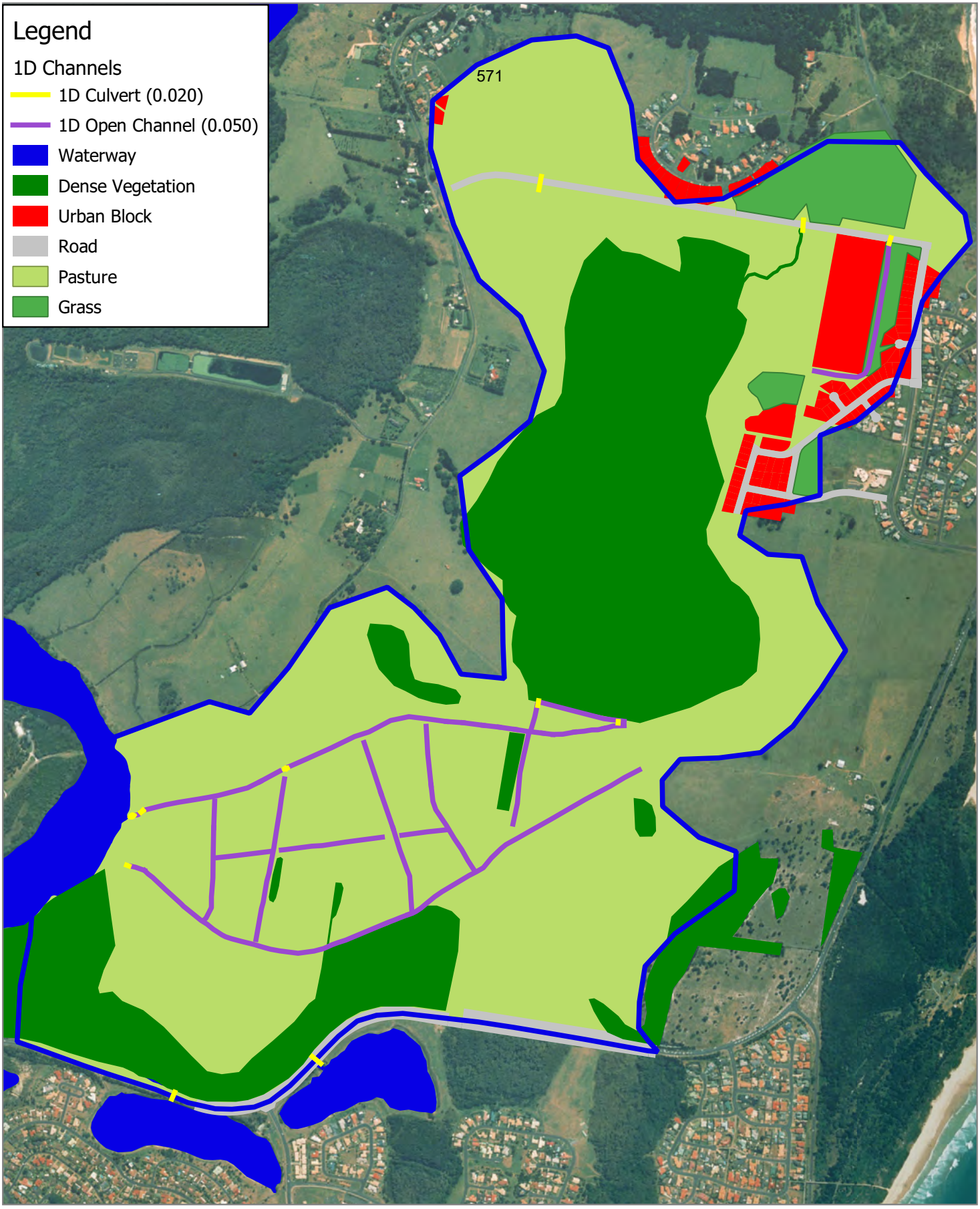

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TUFLOW Model: Land Use Areas

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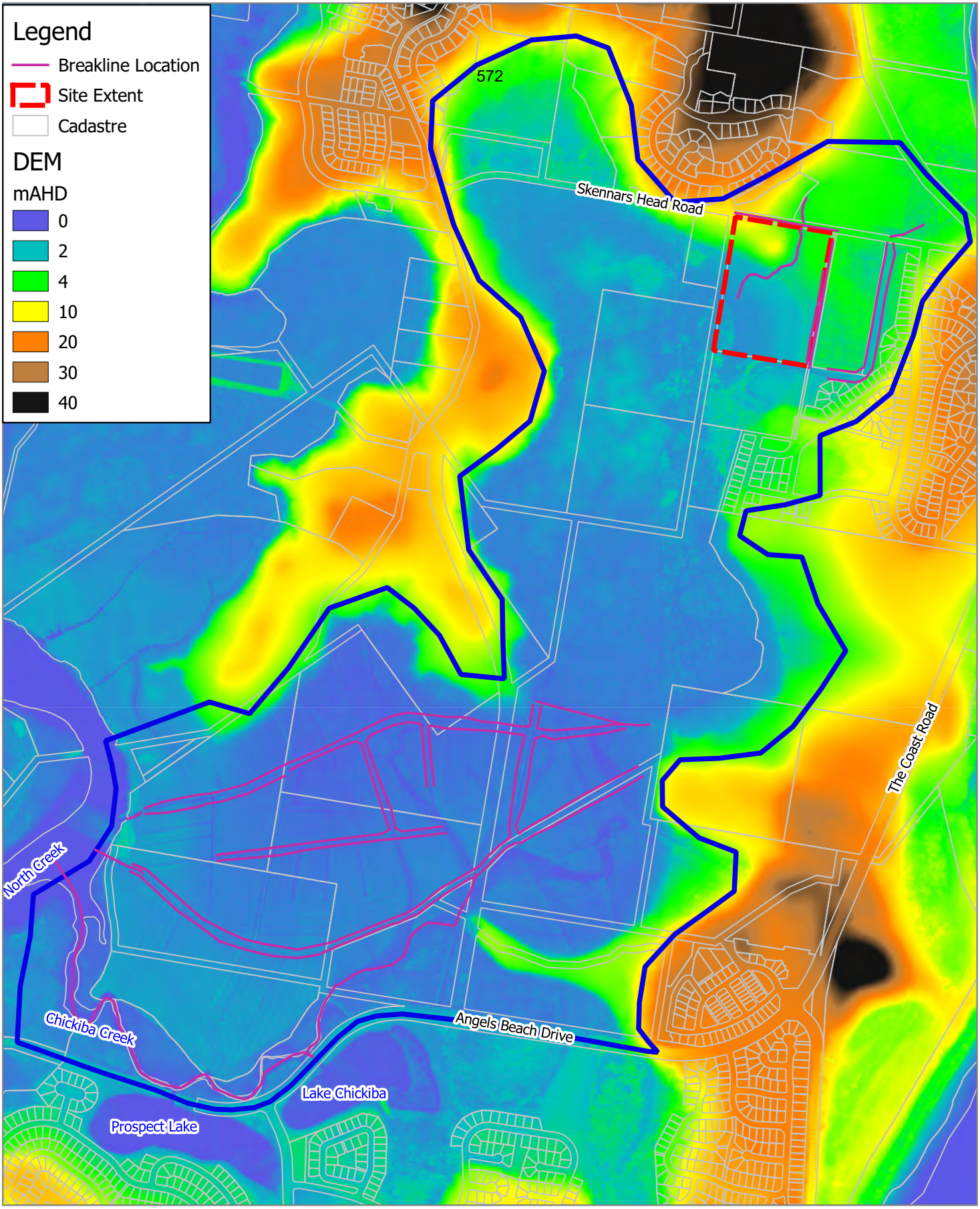

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TUFLOW Model: Breaklines

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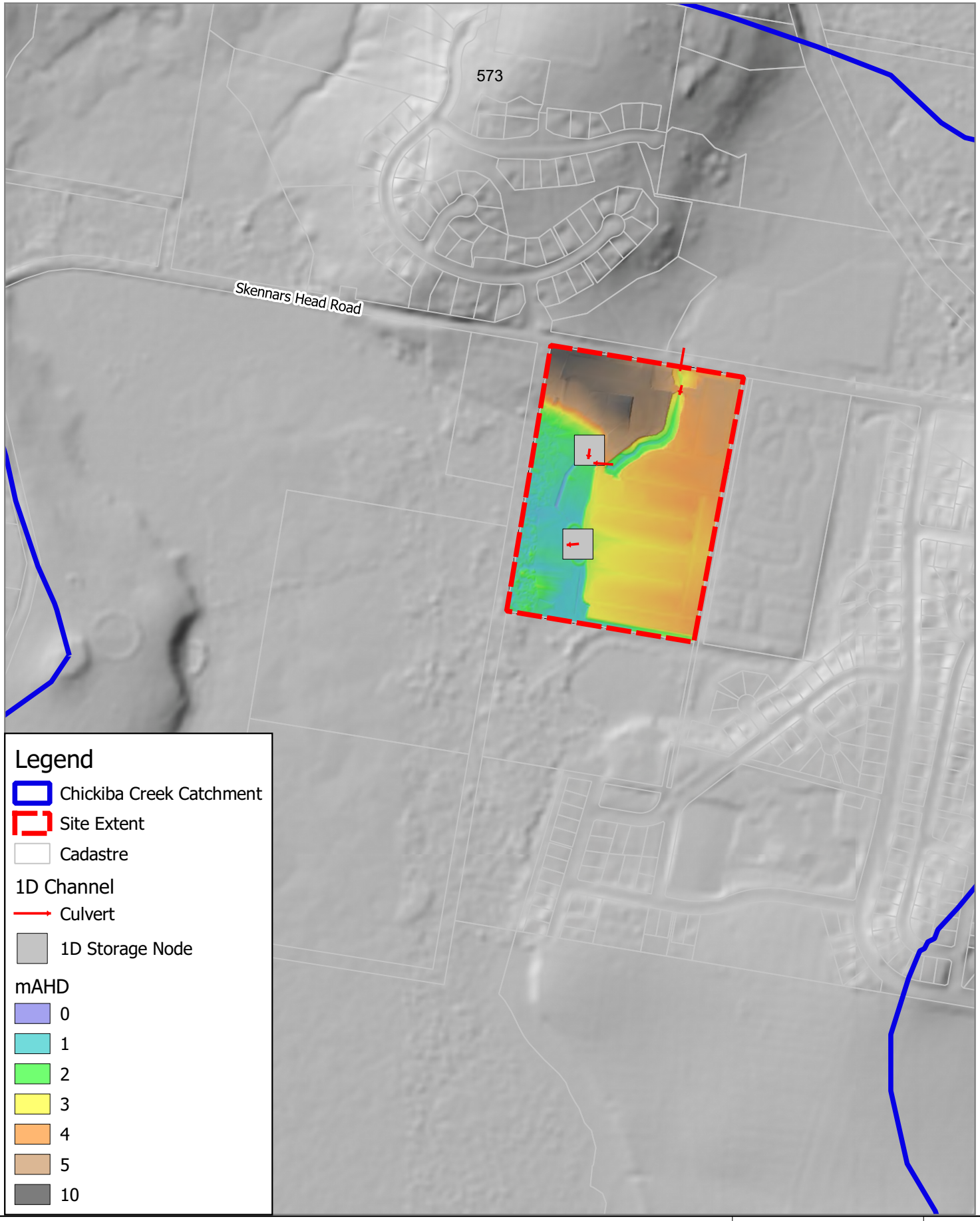

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TUFLOW Model: Developed Case (Inundation Model)

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3.3.3 Local Flood Impact Assessment

This section describes the TUFLOW model utilised for the local flood impact assessment a separate section above details the TUFLOW model utilised for inundation modelling.

3.3.3.1 Model Extent

The model extent and 1D/2D configuration is the same as the inundation modelling described in Section 3.3.2.1.

3.3.3.2 Cell Size

For the local flooding which assesses shorter duration design flood events, the hydraulic model needs to simulate for a much shorter period and therefore a finer cell size can be utilised to increase model resolution. For the local flood modelling a 2D cell size of 5m has been adopted.

3.3.3.3 Elevations

The elevation datasets input to the TUFLOW model for local flooding are the same as used for the long term inundation modelling as detailed in Section 3.3.2.3. As the cell size of the local flood model (5m) is different to the long-term inundation model (15m), the local model has more elevation points, however, the underlying elevation datasets are consistent between the models.

3.3.3.4 Land Use

The land use areas and adopted Manning's n values for the local flood model are the same as the for the long-term inundation modelling described in Section 3.3.2.4.

3.3.3.5 Critical Duration Analysis

Different sections of the catchment respond to different rainfall durations, for example in the upper catchment a short sharp rainfall event is likely to provide the highest water levels, however, in the lower sections of the catchment a longer duration rainfall may result in a greater inundation extent.

In order to determine which rainfall durations are critical (provide the highest water levels) the hydrology model assessed 13 different rainfall durations for the 1% Annual Exceedance Probability flood, ranging from 10 minutes to 12 hours.

Flows for WBNM sub-catchment SK2, to the north of Skennars Head Road are presented in Figure 3-11. The 12 hour duration provides the highest peak flow rate, however, the 9 hour duration also provides a similar flow rate. All 13 durations were simulated in the hydraulic model and the 12 hour duration was found to provide the highest water level on the majority of the site. The 12 hour duration has been used for all local flood impact assessment modelling.

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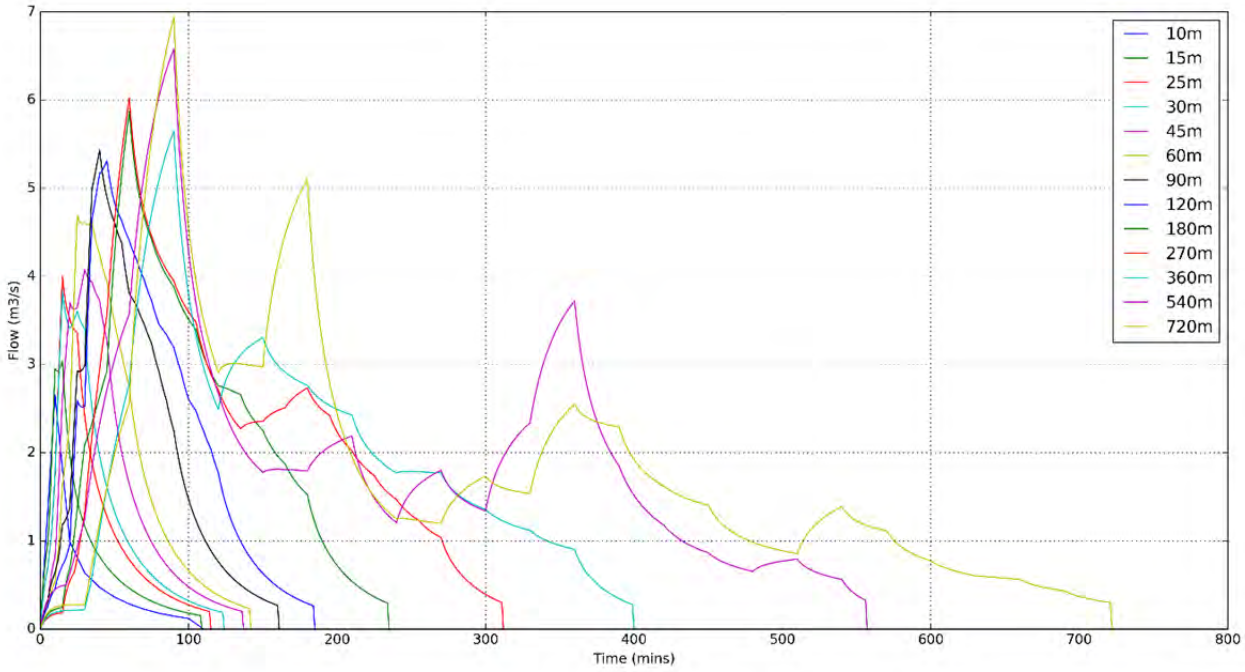


Figure 3-11 WBNM Hydrology Flows: 1% AEP, Sub-Catchment SK2

3.3.3.6 Downstream Water Level

The downstream water level for the local flood model has been set to 1.11 mAHD to represent the Highest Astronomic Tide (HAT). This value of 1.11 mAHD comes from Section 4.4 of the Ballina Coast Regional Processes study available on the Ballina Shire Council website (https://www.ballina.nsw.gov.au/cp_themes/default/em_res.asp?id=2783). The HAT level is applied throughout the simulation.

3.3.3.7 Inflows

The model inflows for the inflows for the local flood impact assessment are those derived from the WBNM hydrology model (as described in Section 3.2.1). WBNM has been configured to provide runoff hydrographs for each model sub-catchment. These flows have been input to the TUFLOW hydraulic model.

For areas where the channel is modelled in 1D, the inflows are directed to the 1D nodes, for sub-catchments with no 1D elements, the inflow is applied as a TUFLOW source-area inflow type, which divides the flow between the wet cells.

3.3.3.8 Developed Case

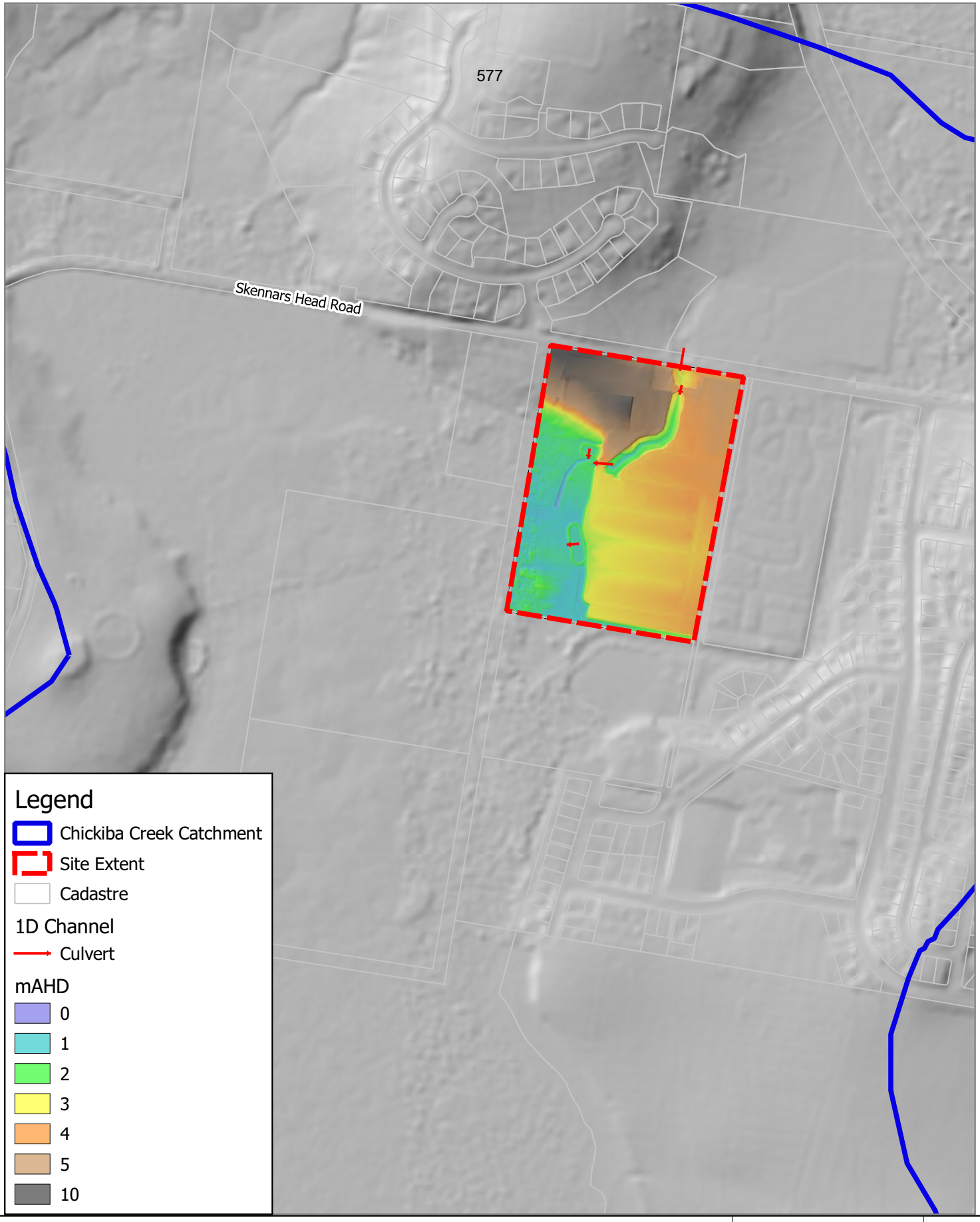
For the developed case model, the proposed design surface (refer Section 2.1.3) has been included to overwrite the elevations in the existing case.

For the local flood modelling the proposed detention basins have been modelled in 2D, the higher resolution 5m cell size allows for sufficient representation of this within the 2D cells, this is a slightly different approach to the long term model, where due to the coarse 2D cells size these were modelled is 1D nodes. The culverts for the proposed detention basin outlets have been modelled

as 1D elements. The two proposed culverts underneath the internal roads have been modelled as 1D culverts.

Preliminary modelled indicated that there was a need to double the capacity of the culverts under Skennars Head Road to alleviate ponding of stormwater. The provision of the added hydraulic conveyance capacity has meant that the ponding in this area (i.e. portions of the sporting fields) and northern sections of the caravan park received less flooding in a range of events, particularly the smaller events assessed. As such the culverts have been retained in the local flood assessment and inundation assessments discussed later in this report. As a consequence of the inclusion of the added hydraulic structure, further hydraulic structures have been added through the development site to ensure the conveyance capacity is maintained.

The developed case TUFLOW inundation model changes are presented in Figure 3-12.



Title:

TUFLOW Model: Developed Case (Local Flood Model)

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4 Inundation Impacts

The focus of the inundation modelling has been to identify potential changes in flood extent and duration downstream of the site caused by the proposed development.

If constructed the proposed development runoff hydrograph will change, with the development effectively giving rise to more frequent runoff events of greater volume. The impact of these changes may include increases in the extent and/or duration of inundation within the downstream wetland areas.

The downstream wetland areas have low catchment relief (i.e. they are very flat) and reside in a tidally influenced floodplain area. As such, inundation impacts due to changes in catchment runoff are also potentially influenced by tidal conditions at the time of the event.

The adopted assessment approach has been to complete long-term continuous simulation (over a five year period) to allow representation of a typical range of estuarine and meteorological/catchment conditions that could be considered representative of long-term system operation. From this the effects of proposed modification can be determined.

A SOURCE hydrology model (refer Section 3.2.2) was developed to provide catchment inflows for the existing and developed scenarios over the adopted assessment period. These hydrologic inputs provide inflows to the hydraulic model for each sub-catchment. The TUFLOW hydraulic model performs all hydraulic routing of runoff through the creeks and drain lines including the time-varying effects of tidal inundation from North Creek into these same areas.

The TUFLOW hydraulic model has been established to record the total duration that each 2D cell is inundated to a depth of more than 1 cm. This allows for a change in duration of inundation to be calculated for the existing and developed case models.

4.1 Modelling Scenarios

To test the impacts of the proposed design on the long-term inundation within the wetland area downstream of the proposed development, two scenarios were simulated; existing case and developed case. The developed case inundation model has inflows from the developed case SOURCE model as well as the changes to the hydraulic model to represent the proposed development (as detailed in Section 3.3.2.8).

4.2 Modelling Results

Both the existing and developed case simulations were run for a period of 5 years from 1/1/2011 to 1/1/2016, a period of 43,824 hours. The duration of inundation with a depth of greater than 1cm was recorded.

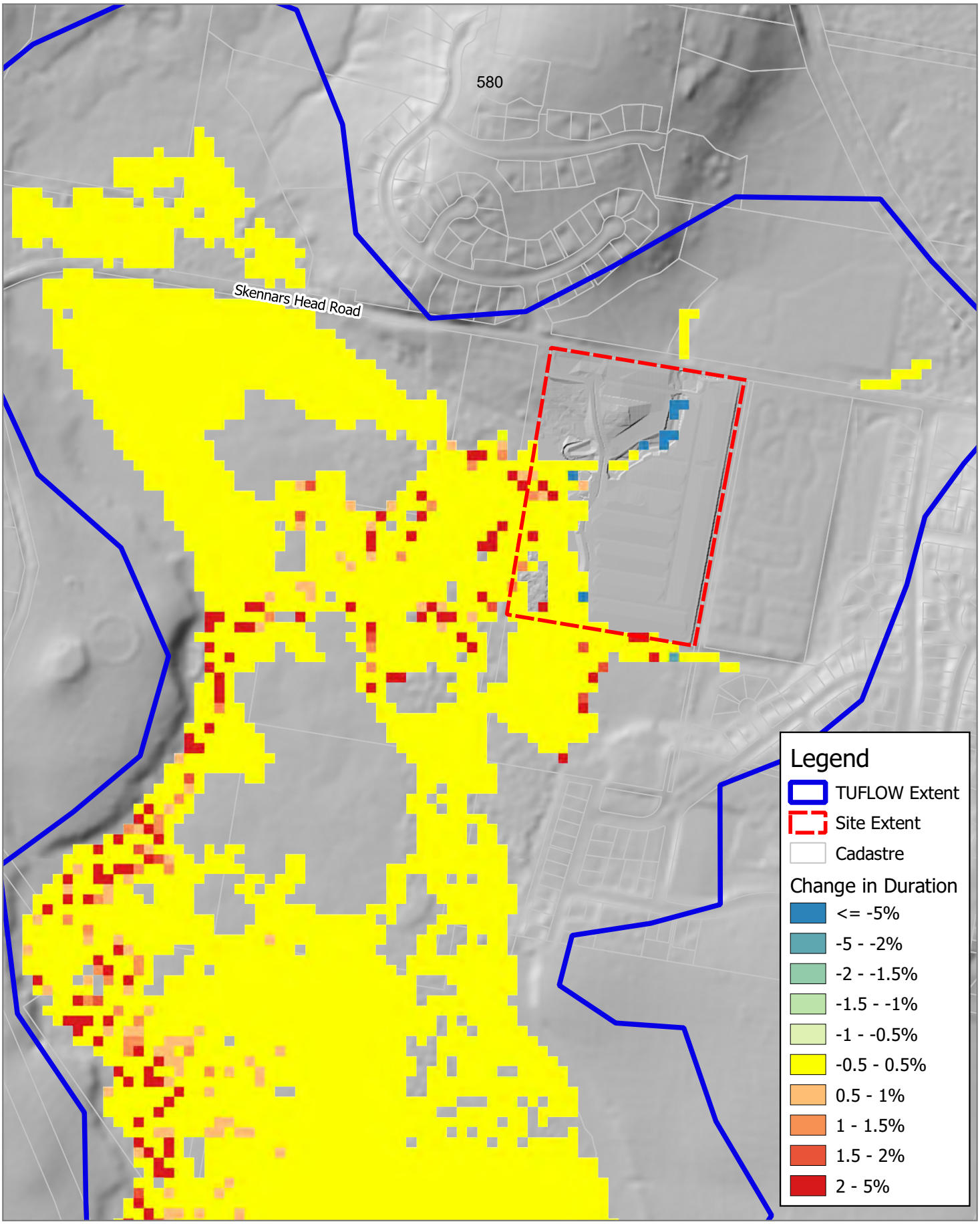
For the developed case the duration of inundation was compared to the existing case. These are presented as a percentage of the total simulation time. For example a value of 1% indicates that over the entire 5 year simulation the duration of inundation has increased by 438.2 hours or approximately 18 days.

The difference in duration of inundation is presented in Figure 4-1.

4.3 Discussion

The difference in duration mapping presented shows that the majority of the downstream areas have no significant change in inundation duration, with isolated areas along the western fringe of the wetland showing increases in duration of inundation in the range 0.5 – 5.0%.

The identified change in inundation patterns is primarily due to the provision of the additional culvert under Skennars Head Road which has allowed for additional flow to be released via this structure and pass through the development site to the wetland area.



Title:

Difference in Duration in Inundation

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5 Local Flood Impacts

Local flood impacts are described in this section. Local flood events are those which are significant locally and are typified by intense rain over shorter durations that give rise to local runoff events and nuisance flooding. The flood impact assessment utilises a high resolution (5m) TUFLOW flood model to demonstrate the effects of increased peak flows from the proposed development on the adjoining areas.

For the local flood modelling, inflows have been generated with the WBNM hydrologic model as detailed in Section 3.2.1, the local TUFLOW model configuration is detailed in Section 3.3.3.

5.1 Model Scenarios

The existing and developed case models have been run for two different flood magnitudes:

- 18% Annual Exceedance Probability (AEP) event AEP, commonly referred to as the 5 year Average Recurrence Interval (ARI) event
- 5% AEP, also known as the 20 year ARI event; and
- 1% AEP event or 100 year ARI event.

5.2 Modelling Results

The peak water levels, depths and velocities for the existing case 18% AEP event are presented in Figure 5-1 to Figure 5-3, the 5% AEP results are presented in Figure 5-4 to Figure 5-6. The peak water levels, depths and velocities for the existing case 1% AEP are presented in Figure 5-7 to Figure 5-9.

For the 5% AEP and the 1% AEP flood events the peak flood levels for the existing case are subtracted from the proposed case. A positive afflux indicates that the peak water level is predicted to increase and a negative value indicates that the peak water level is predicted to decrease. The peak flood affluxes are presented in Figure 5-10 to Figure 5-12, respectively.

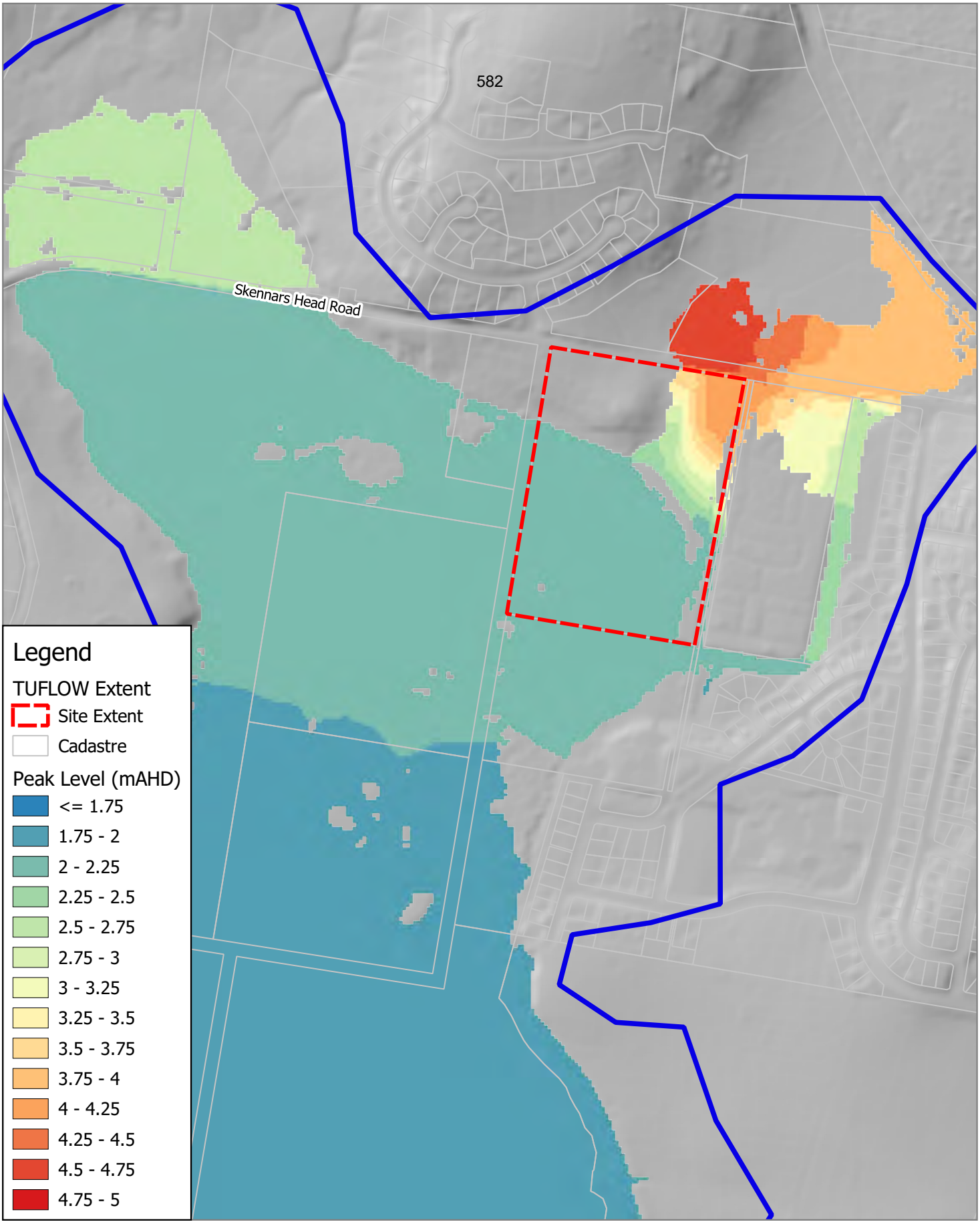
5.3 Discussion

The peak flood level impacts show that the proposed development changes flood behaviour on the site significantly, with large areas of the site not being flooded in the developed case. To support future development this is the required outcome after filling.

The 18% AEP event identifies a significant improvement in peak water levels north of the development site and within the caravan park, with a limited areas of peak flood level increases along the drainage channel to the east of the caravan park site.

The 5% AEP event identifies continued improvements in peak flood levels north of the road and within the caravan park site with no areas of increased flood levels.

The 1% AEP event identifies some limited areas of improvement in flooding in the caravan park site and a small area of increases in peak floods at the south east corner of the development site within the drainage channel extent.



Title:

Peak Water Levels: Existing Case – 1% AEP, 12 hour event

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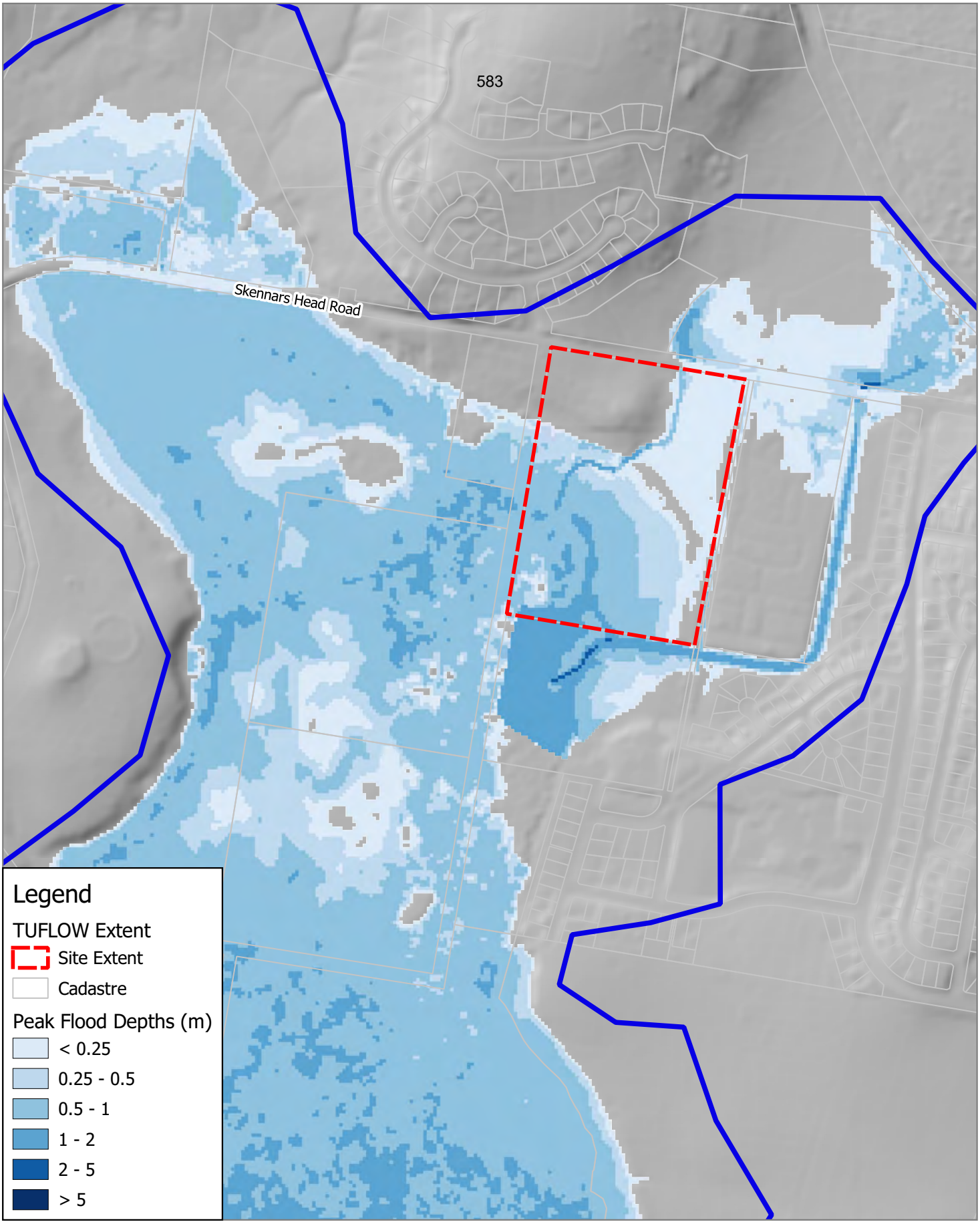

Title:

Peak Water Depths:
Existing Case – 1% AEP, 12 hour event

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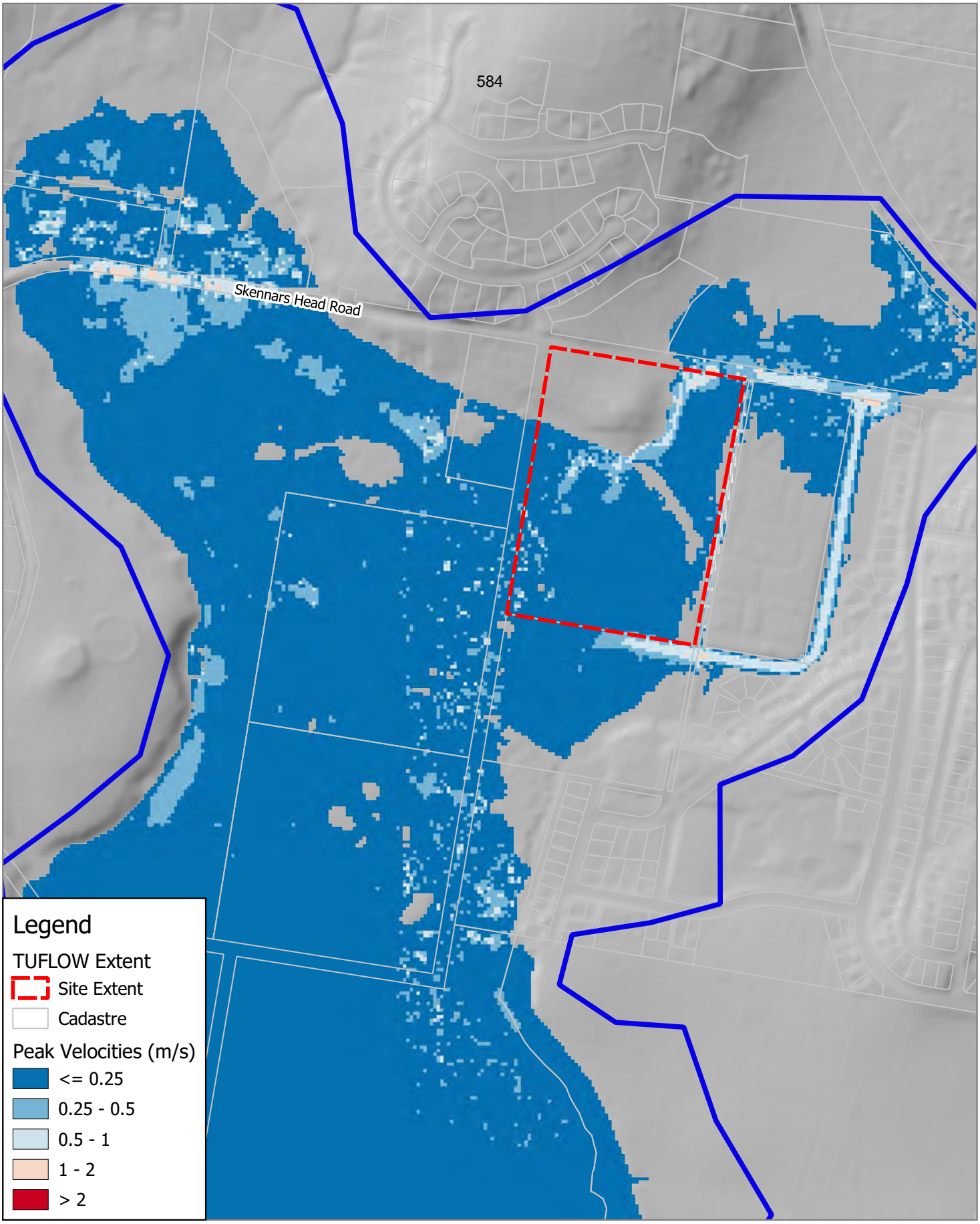

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Peak Water Velocities: Existing Case – 1% AEP, 12 hour event

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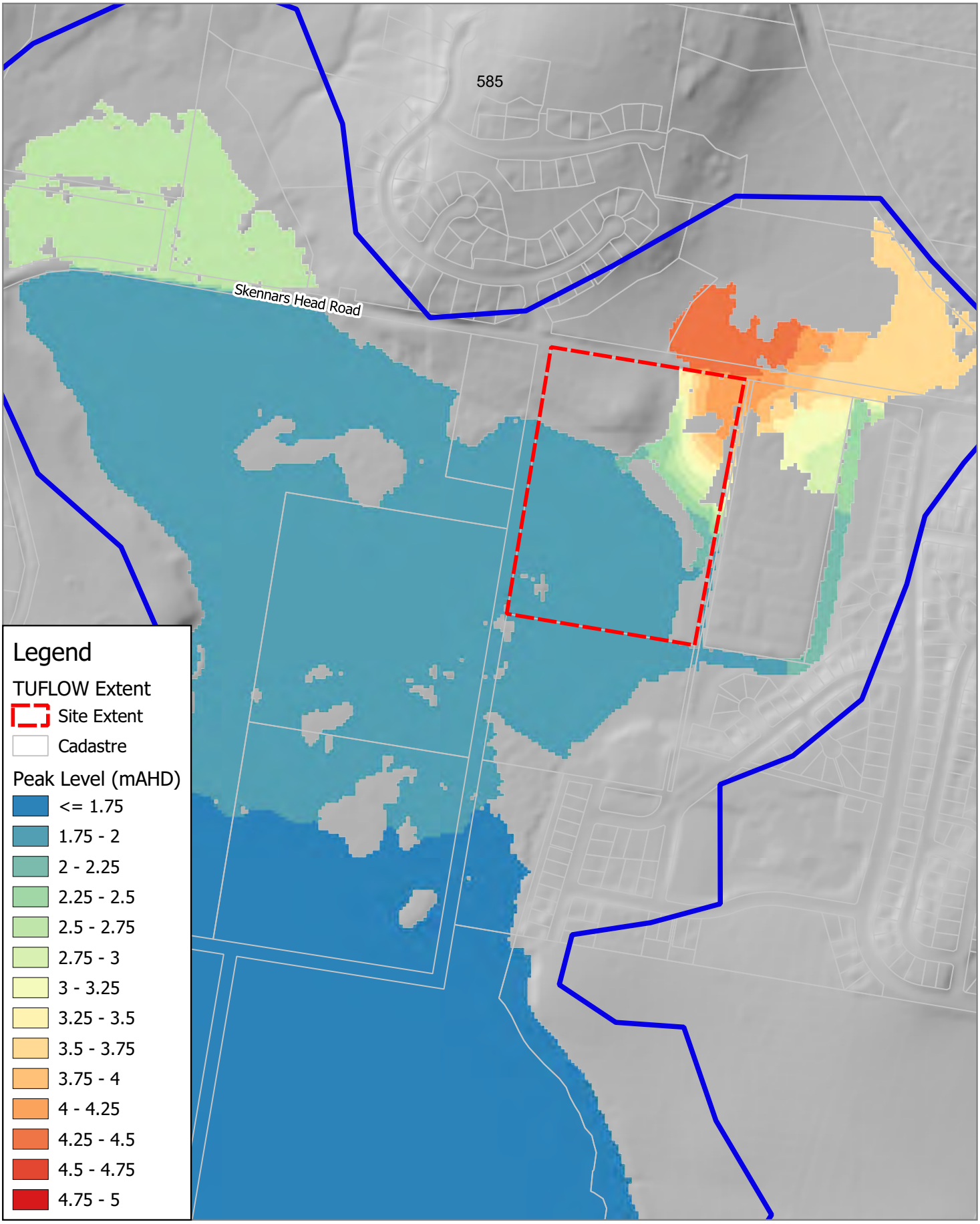

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Peak Water Levels: Existing Case – 5% AEP, 12 hour event

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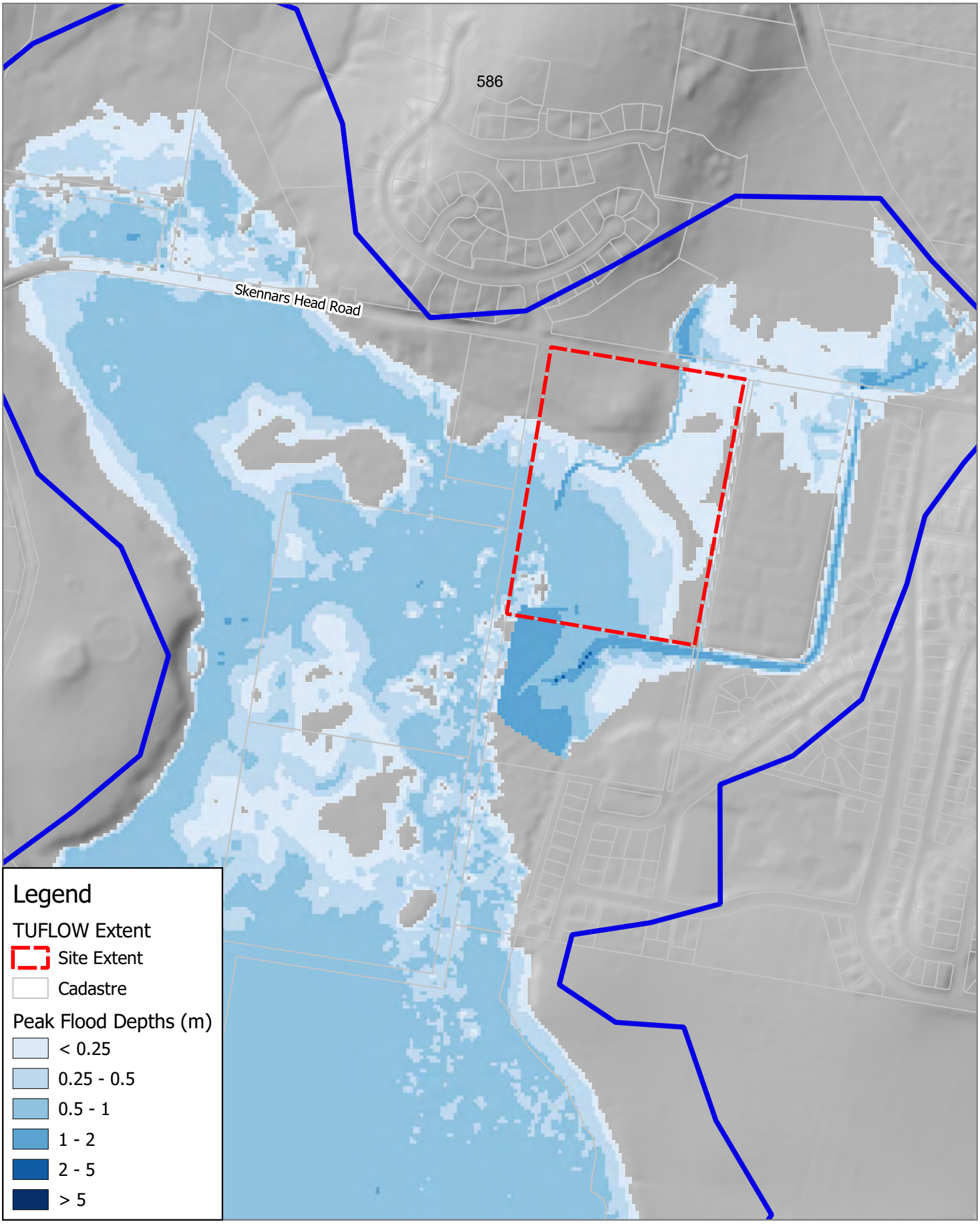

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Peak Water Depths:
Existing Case – 5% AEP, 12 hour event

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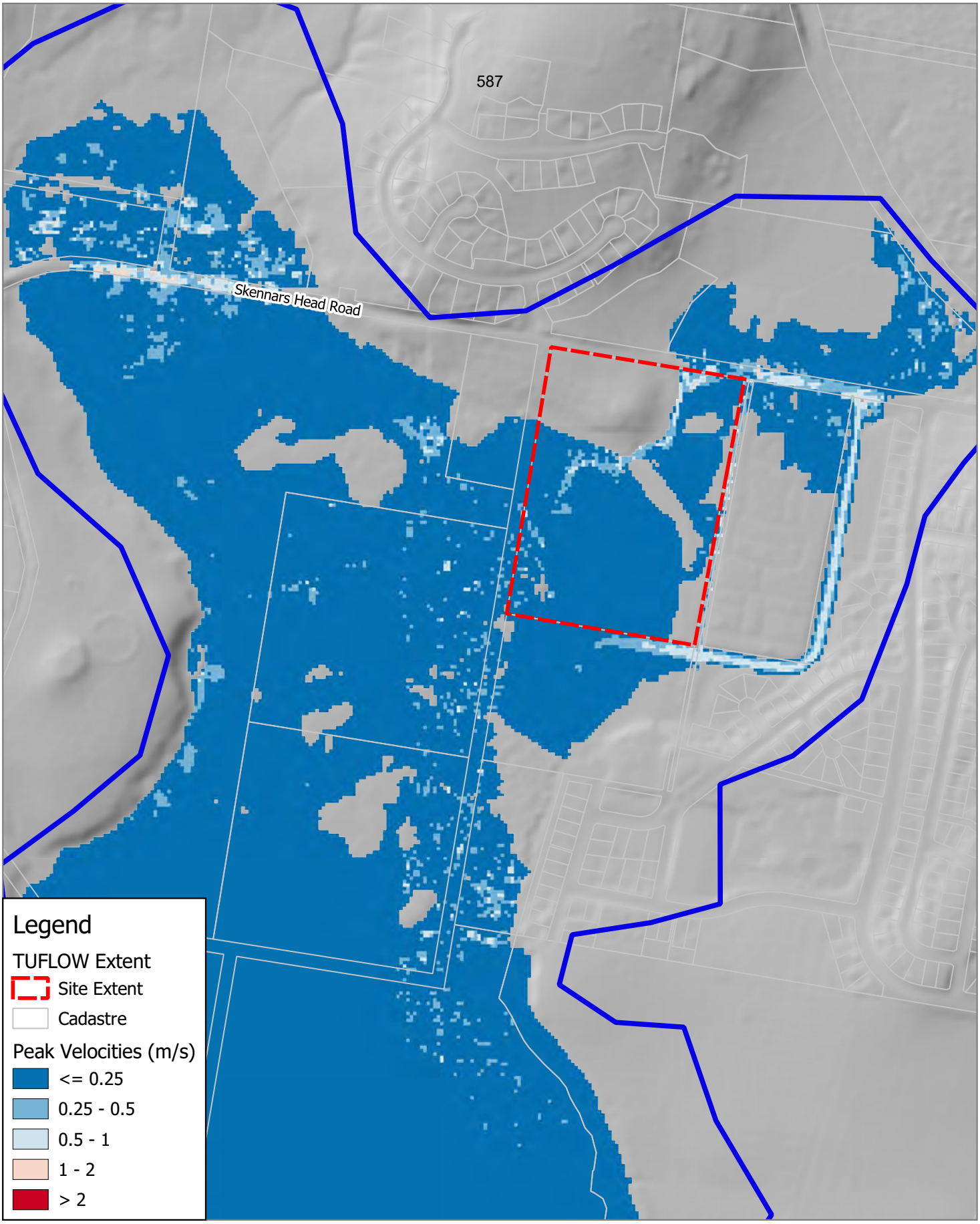

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Peak Water Velocities: Existing Case – 5% AEP, 12 hour event

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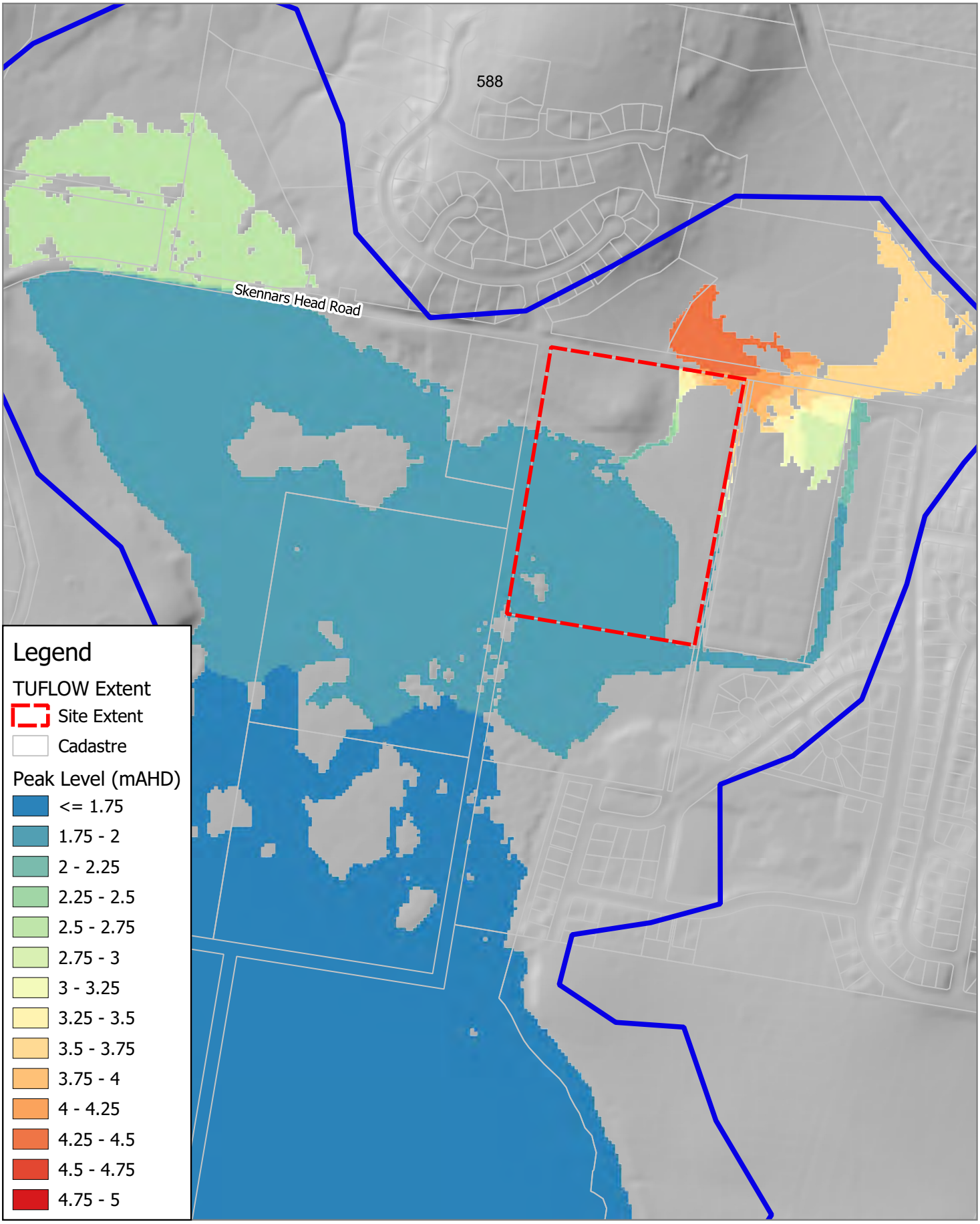

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Peak Water Levels: Existing Case – 20% AEP, 12 hour event

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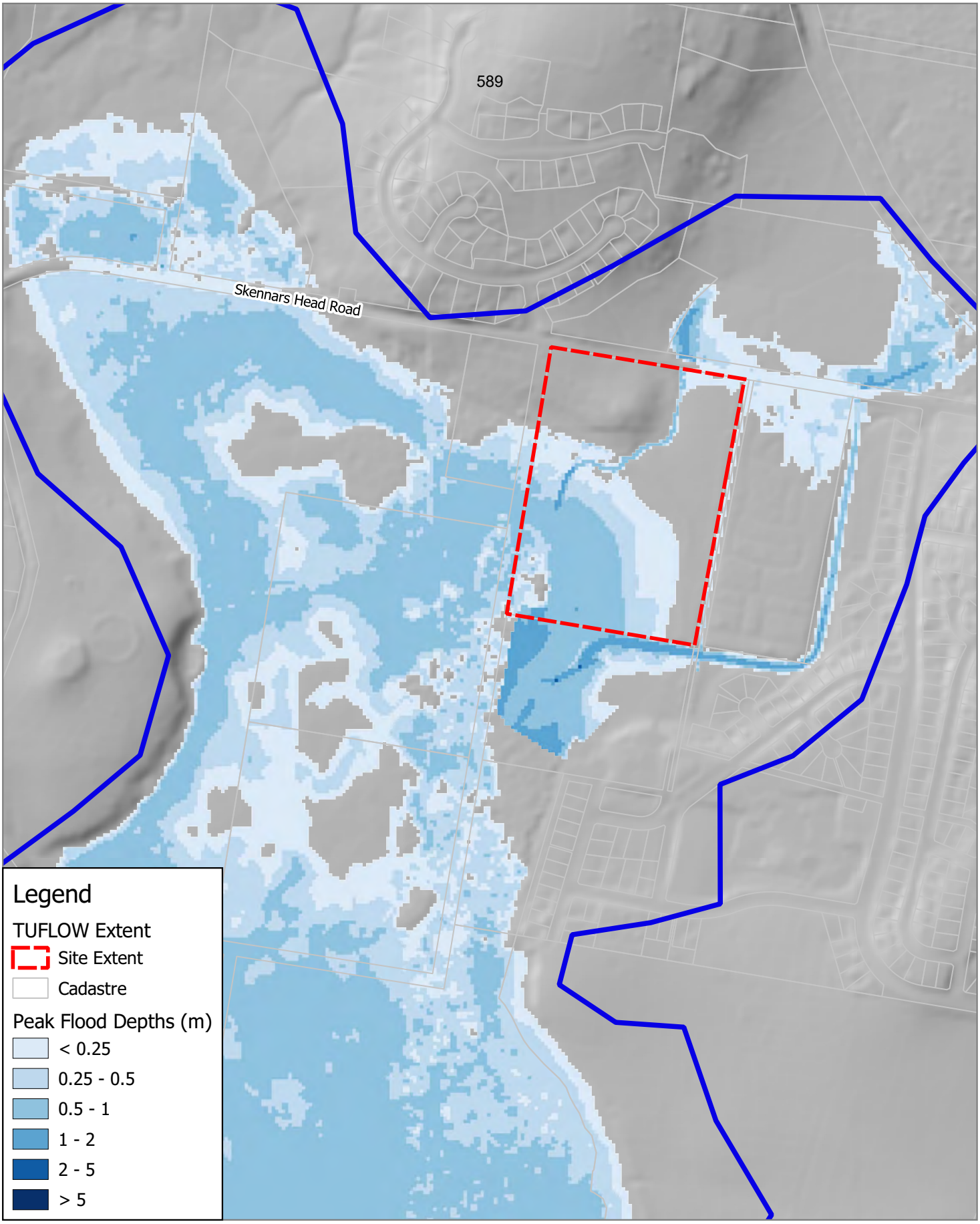

Title:

Peak Water Depths:
Existing Case – 20% AEP, 12 hour event

Figure: 5-8

Rev: B

0 100 200 300 400 m

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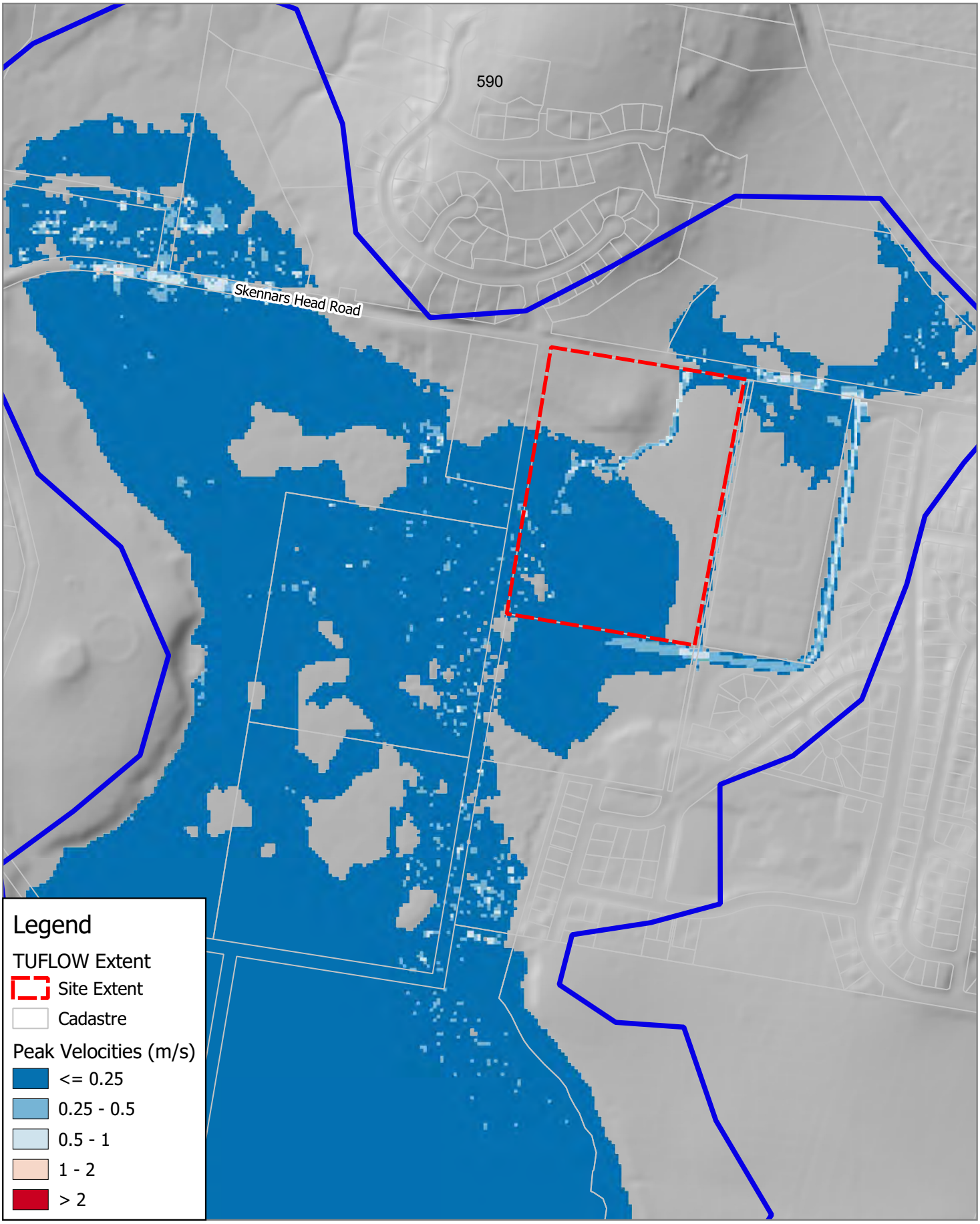

Title:

Peak Water Velocities: Existing Case – 20% AEP, 12 hour event

Figure: 5-9

Rev: B

0 100 200 300 400 m

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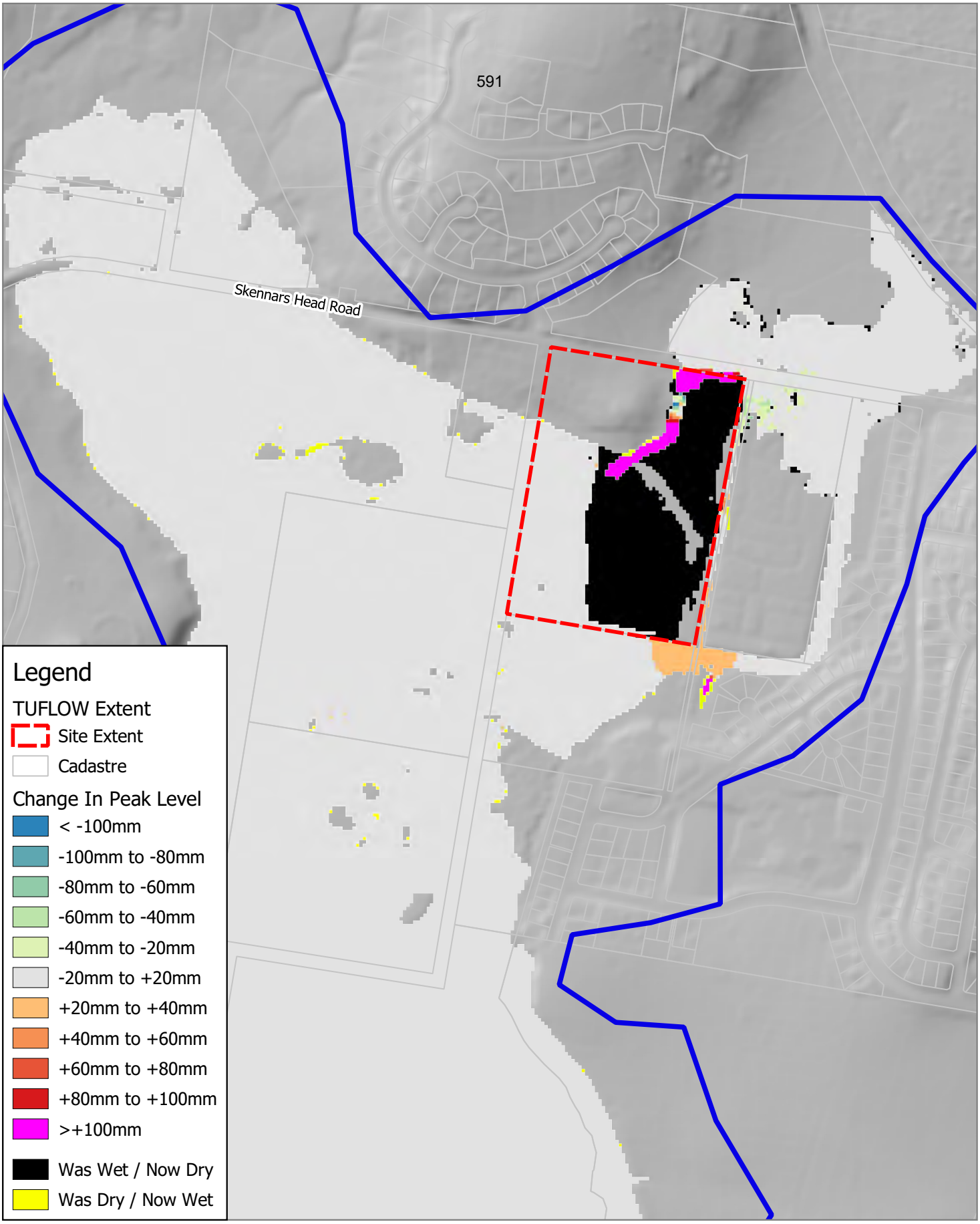

Title:

Peak Flood Level Impacts: Existing Case – 1% AEP, 12 hour event

Figure: 5-10

Rev: B

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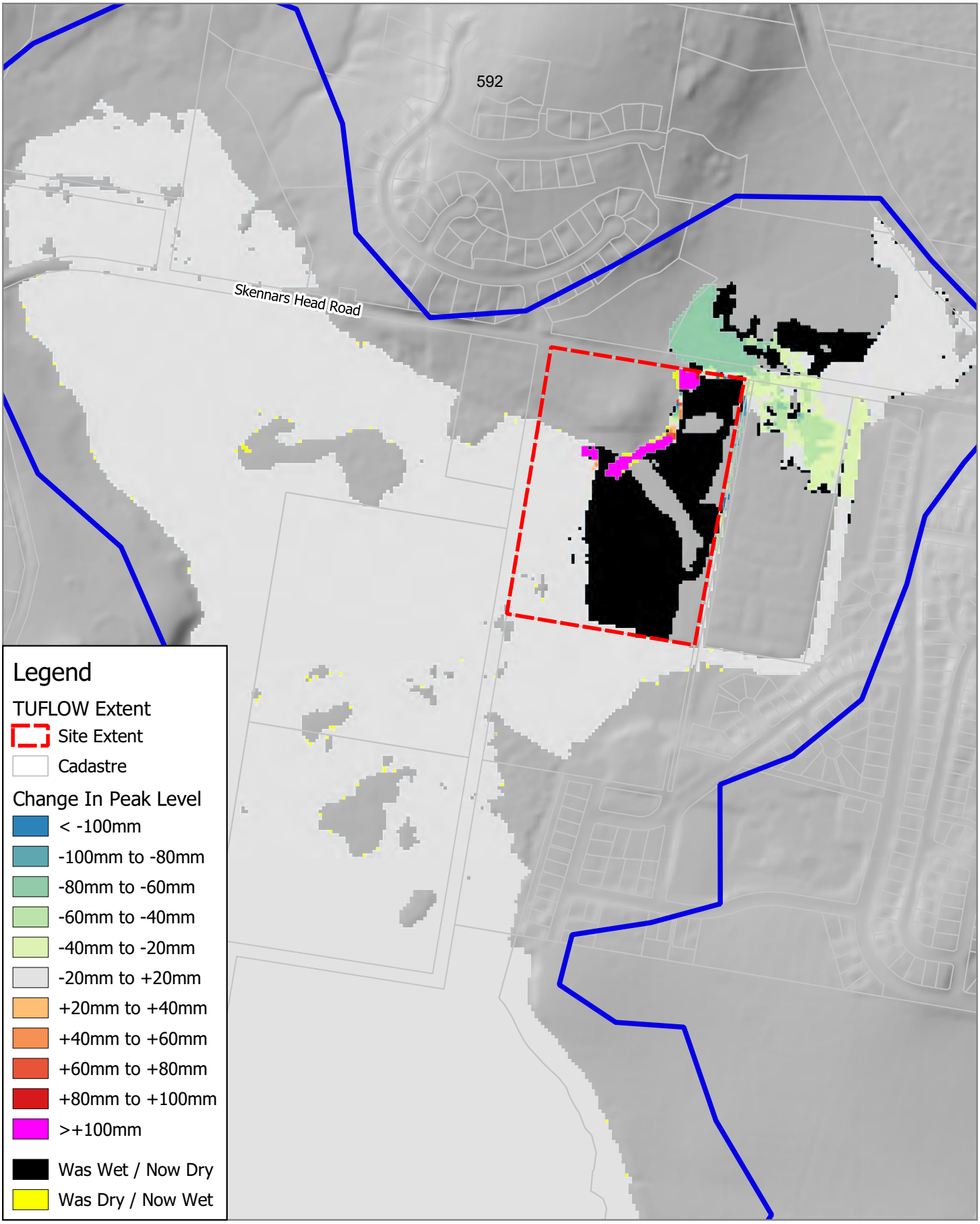

Title:

Peak Flood Level Impacts: Existing Case – 5% AEP, 12 hour event

Figure: 5-11

Rev: B

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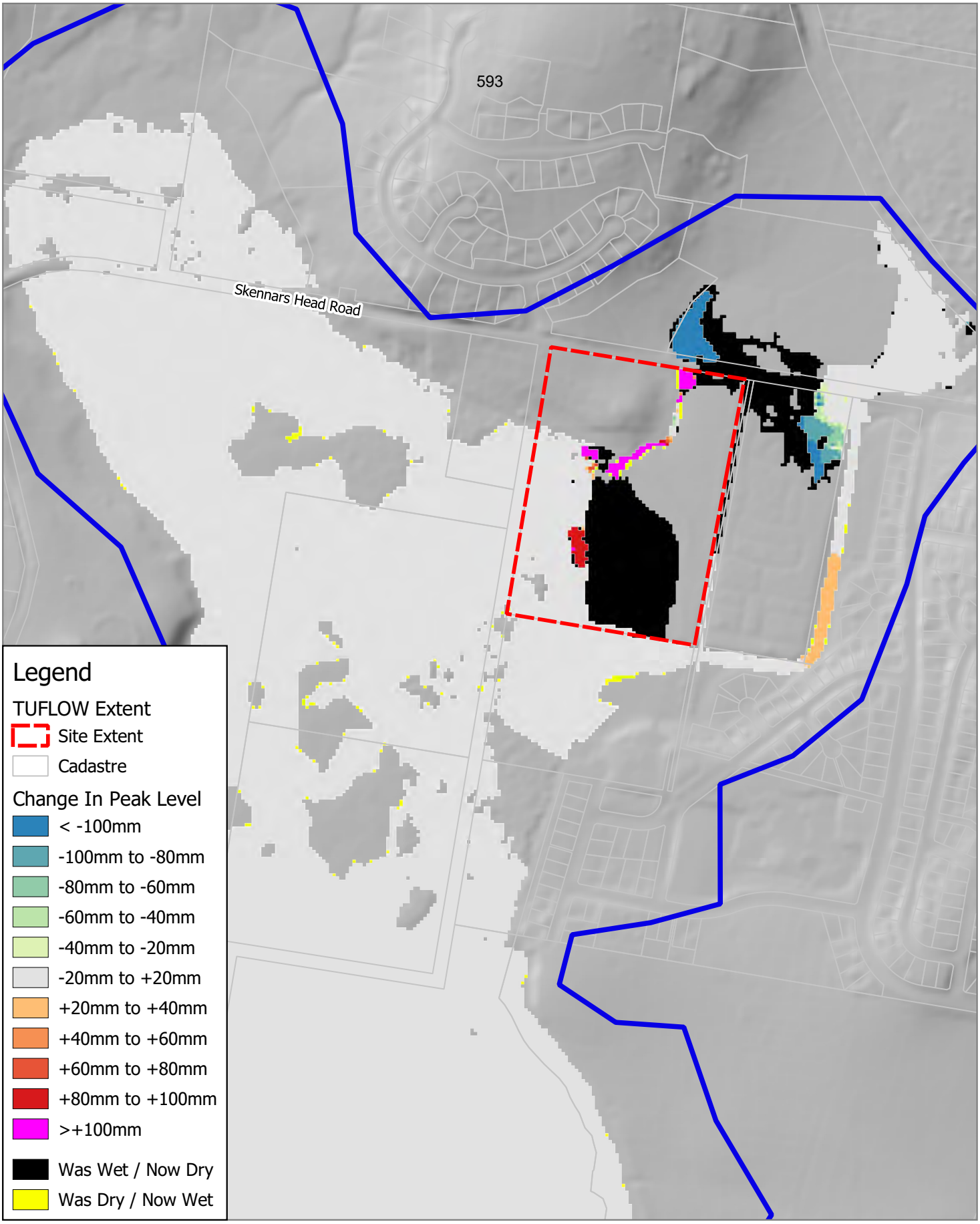

Title:

Peak Flood Level Impacts: Existing Case – 20% AEP, 12 hour event

Figure: 5-12

Rev: B

0 100 200 300 400 m

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Filepath: "C:\Projects\B22887_skennars_head\Mapping\QGIS\Report_002\Fig_5_1_FLD_Q100_0208_h.qgs"

6 Findings and Conclusions

A retirement village development has been proposed at 67 Skennars Head Road, Skennars Head. The site is proposed to be filled to achieve flood immunity in both local and regional flood events and to promote internal drainage of stormwater. The site itself once developed will provide a number of dwelling homes and internal roads which will increase the imperviousness of the site compared to its current undeveloped state. The filling of the site and change in imperviousness / drainage characteristics has the potential to impact upon both local catchment flooding, and downstream inundation patterns.

A variety of hydrology and hydraulic modelling tools have been developed to assess the range of potential impacts identified from the site development. Model extents include the entire Chickiba Creek catchment. This has been necessary as the catchment is tidally affected, and the transmission of tides along drainage lines of the catchment has the potential to influence modelling outcomes.

Two different types of hydrology models were developed, including a WBNM model to provide design event runoff hydrographs, and a SOURCE catchment model to provide long-term runoff hydrographs. These hydrographs are then used as input to two different hydraulic models. Both models were developed in the TUFLOW hydraulic modelling package and are the same in most regards, with the key differences being the use of a smaller cell size (5m) in the design flood assessments, and a larger cell size (15m) in the inundation modelling assessment. These cell sizes have been adopted to manage model run times to reasonable levels, without compromising assessment outcomes.

In terms of model outcomes the local catchment flood modelling initially identified impacts within the caravan site which were likely to be unacceptable. It was identified that with the augmentation of the existing culverts under Skennars Head Road to the immediate north of the site, that these issues were mitigated as flood waters previously being detained on the sports field were able to be partially drained through these culverts and the development site. In terms of modelled impacts, the 18% AEP event identifies a significant improvement in peak water levels north of the development site and within the caravan park, with a limited areas of peak flood level increases along the drainage channel to the east of the caravan park site. The 5% AEP event identifies continued improvements in peak flood levels north of the road and within the caravan park site with no areas of increased flood levels. The 1% AEP event identifies some limited areas of improvement in flooding in the caravan park site and a small area of increases in peak floods at the south east corner of the development site within the drainage channel extent.

The difference in duration mapping presented shows that the majority of the downstream areas have no significant change in inundation duration, with isolated areas along the western fringe of the wetland showing increases in duration of inundation in the range 0.5 – 5.0%.

The identified change in inundation patterns is primarily due to the provision of the additional culvert under Skennars Head Road which has allowed for additional flow to be released via this structure and pass through the development site to the wetland area.

7 References

AWC (2016), *Capacity Assessment of the Belongil Creek Drainage System*. Report prepared for Byron Shire Council, unpublished.

Ballina Shire Council (2017), *Stormwater Management Standards for Development*. Ballina Shire Council, Ballina February 2016.

BMT (2008) BALLINA FLOOD STUDY UPDATE. BMT Pty Ltd, March 2008.

BMT (2010). RICHMOND RIVER FLOOD MAPPING STUDY. Prepared for Richmond River County Council.

BMT (2015). NEWRYBAR SWAMP DRAINAGE AND FLOOD MITIGATION STUDY. Prepared for Richmond River County Council.

BMT (2016). FLOOD ADVICE FOR THE PROPOSED DEVELOPMENT OF 67 SKENNARS HEAD ROAD, SKENNARS HEAD. Letter provided to Ballina Shire Council. Reference L.B21395.004_67_Skennars_Head_Road.docx.

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TECHNICAL REPORT 11

Disability Considerations

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02 66877461

12 May 2018

Senior Project Manager
GemLife
PO Box 5056,
GCMC, Qld 9726

Attention: Grant Epple

Dear Grant,

Living Gems SEPP Seniors Living project, 67 Skenners Head Road, Skenners Head, NSW.
Accessibility of dwellings.

A review of the floor plans and elevations for dwelling types 1, 2, 3, 4 and 5 have been assessed by this office and were found to be capable of being constructed in a manner that complies with the accessibility provisions of Schedule 3 clauses 5-21 of State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004. Fully detailed plans are required at construction stage.

It is noted that the gradient of individual sites will vary throughout the project and the path of travel from the dwelling entry to the street will need to be assessed for each individual site at construction stage to ensure compliance with the SEPP.

The table attached indicates the items assessed and comments where applicable. Floor plans are also attached for the nominated dwelling types.

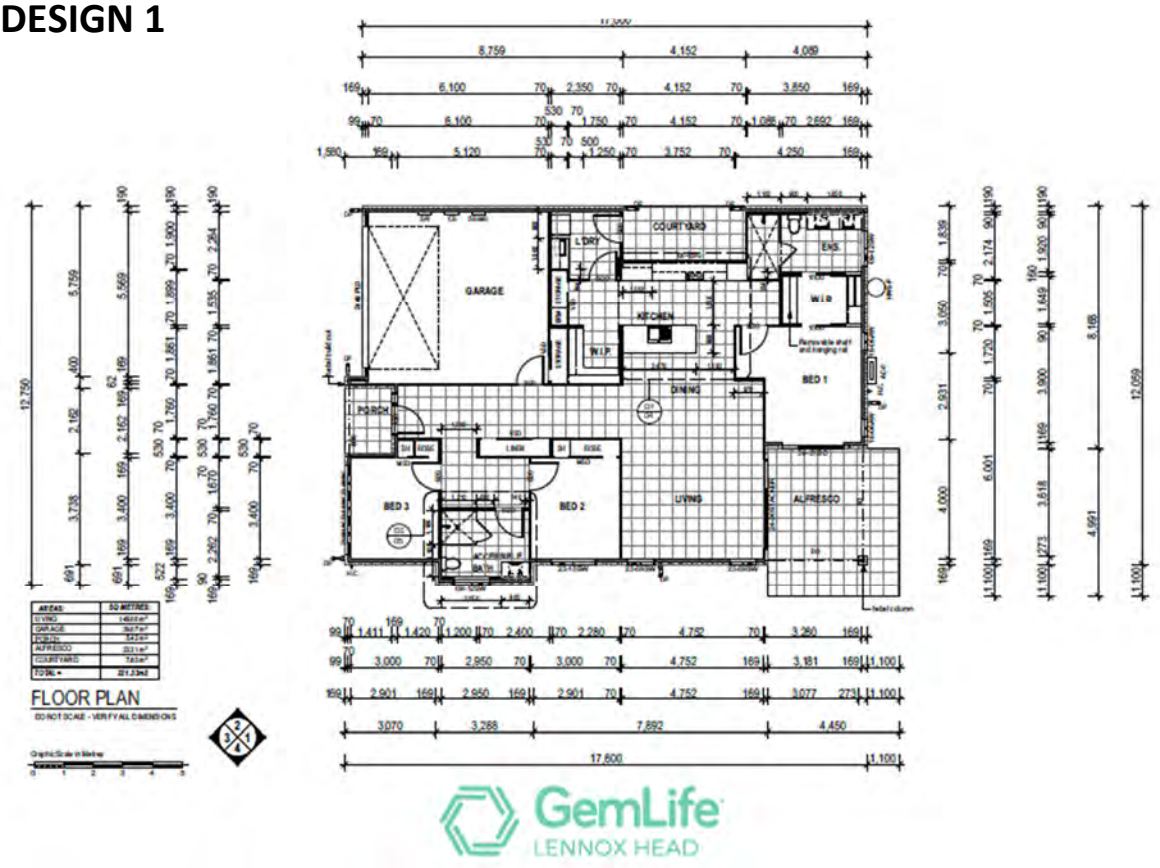
Yours faithfully,

Haley Thornton
Building Surveyor MAIBS
Access Consultant (Associate Member ACAA)

Living Gems SEPP Seniors Living Development Skenners Head DWELLING TYPES 1, 2, 3, 4 & 5 (12/05/18)			
Schedule 3 clauses 5-21 of State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004.			
Clause	**Requirement**	**Comment**	**Capable of compliance Yes/No**
PART 1			
5	Private car accommodation	AS 2890.6-2009 spatial dimensions achieved. Garage clear ceiling height 2500 required. Auto door opening devices to be indicated on construction plans installed greater than 2500mm above the garage floor. A detail of the transition from the driveway to the garage is required with the construction plans to ensure compliance.	Yes
6	Accessible entry	Clause 4.3.1 & 4.3.2 of AS 4299 and AS 1428.1-2009, 920mm door leaf required. Threshold ramp 35mm proposed, detail of edge treatment to threshold ramp to be included in construction detail. Clarify Dwelling 1 stacker sliding doors to the alfresco area to have latch side circulation space of 395mm for a side approach on the outside of the door. Door handles to to comply with AS 1428.1-2009.	Yes
7	Interior - general	All internal doors comply with AS 1428.1-2009, 920mm door leaf required. 1m wide corridors	Yes
8	Bedroom	One queen bed and circulation space. Electrical and phone layout to be assessed at construction stage. Accessible sliding door tracks will be required.	Yes
9	Accessible bathroom	Pre and post adaption plans provided. AS 1428.1-2009 circulation spaces achieved on post adaptation plan. Floor surface slip resistance rating to be provided with construction plans. Electrical layout, fittings and fixtures to be assessed at construction stage.	Yes
10	Visitable/accessible toilet	Visitable toilet to be installed when the dwelling is constructed (pre-adaptation). AS 1428.1-2009 circulation spaces achieved on post adaptation plan.	Yes
11	Surface finishes	External patios, courtyards and paved surfaces to be slip resistant. Slip resistance rating to be provided with construction plans.	Yes
12	Door hardware	Lever door handles required Clause 4.3.4 of AS 4299-1995, and AS 1428.1-2009. D type handles required to sliding doors in accordance with AS 1428.1-2009. Full details to be assessed at construction stage.	Yes
13	Ancillary items	Switches and power points AS 4299-1995. Location and type to be shown on the construction plans Full details to be assessed at construction stage.	Yes
PART 2			
14	Application of this part	Applies	Yes
15	Living room and dining room	Living areas and dining areas are of sufficient size to achieve compliance. Full details to be assessed at construction stage. Electrical and phone layout to be provided at construction stage. Accessible sliding door tracks will be required.	Yes
16	Kitchen	Circulation spaces comply with cl. 4.5.2 of AS 4299-1995, and AS 1428.1-2009. Benches, tapsets, cooktops and oven	Yes

		are capable of achieving compliance, details to be provided at construction stage. Cupboard handles and electrical layout to be assessed at construction stage.	
17	Access to kitchen, main bedroom, bathroom and toilet	Applies to multi-storey dwellings	N/A
18	Lifts in multi-storey buildings	Applies to multi-storey buildings	N/A
19	Laundry	AS 1428.1-2009 circulation spaces achieved. Floor surface slip resistance rating to be provided with construction plans. Details of threshold ramp to courtyard to be provided with construction plans. Fittings and fixtures capable of achieving compliance. Accessible path of travel provided to the clothesline.	Yes
20	Storage for linen	4.11.5 AS 4299-1995. Adjustable shelving to be provided in the linen cupboard. Details to be provided on the construction plan.	Yes
21	Garbage	The garbage storage area must be accessible, detail of edge treatment to paths to be included in construction plans.	Yes

DESIGN 1



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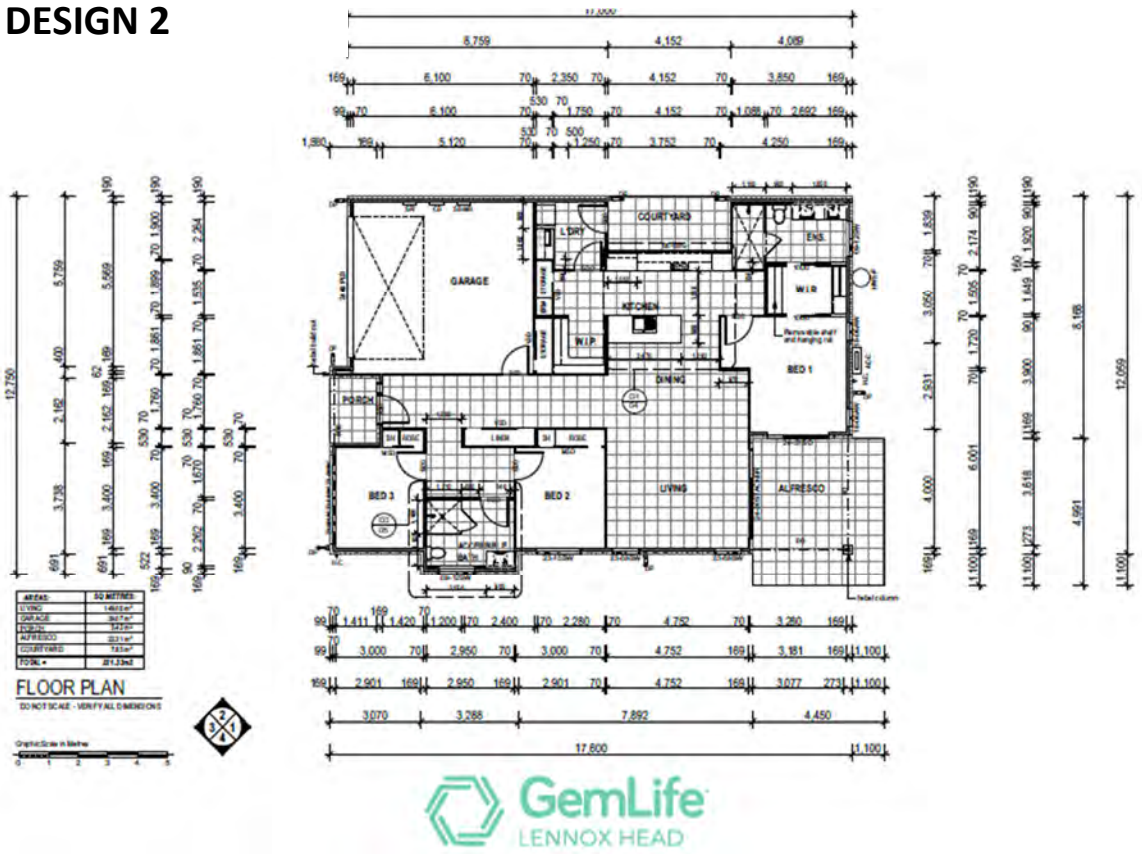

GemLife LENNOX HEAD

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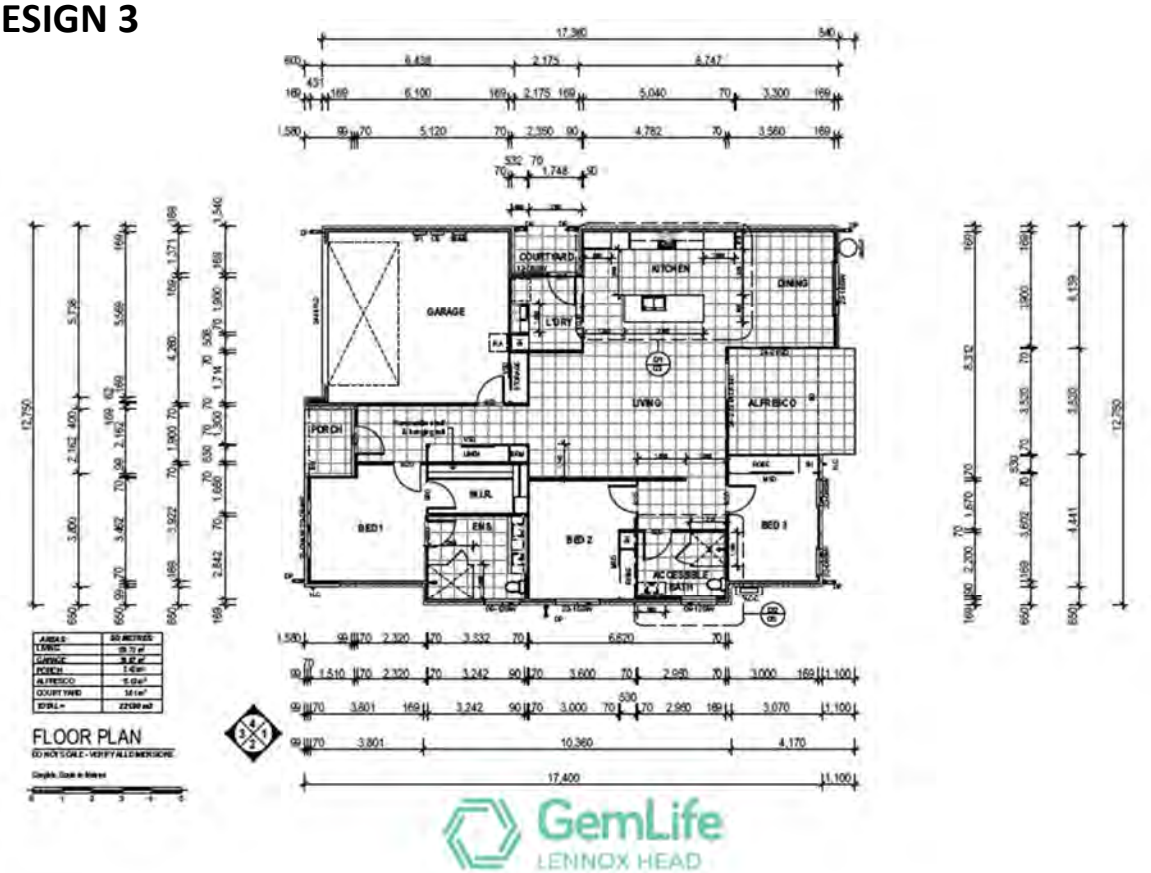

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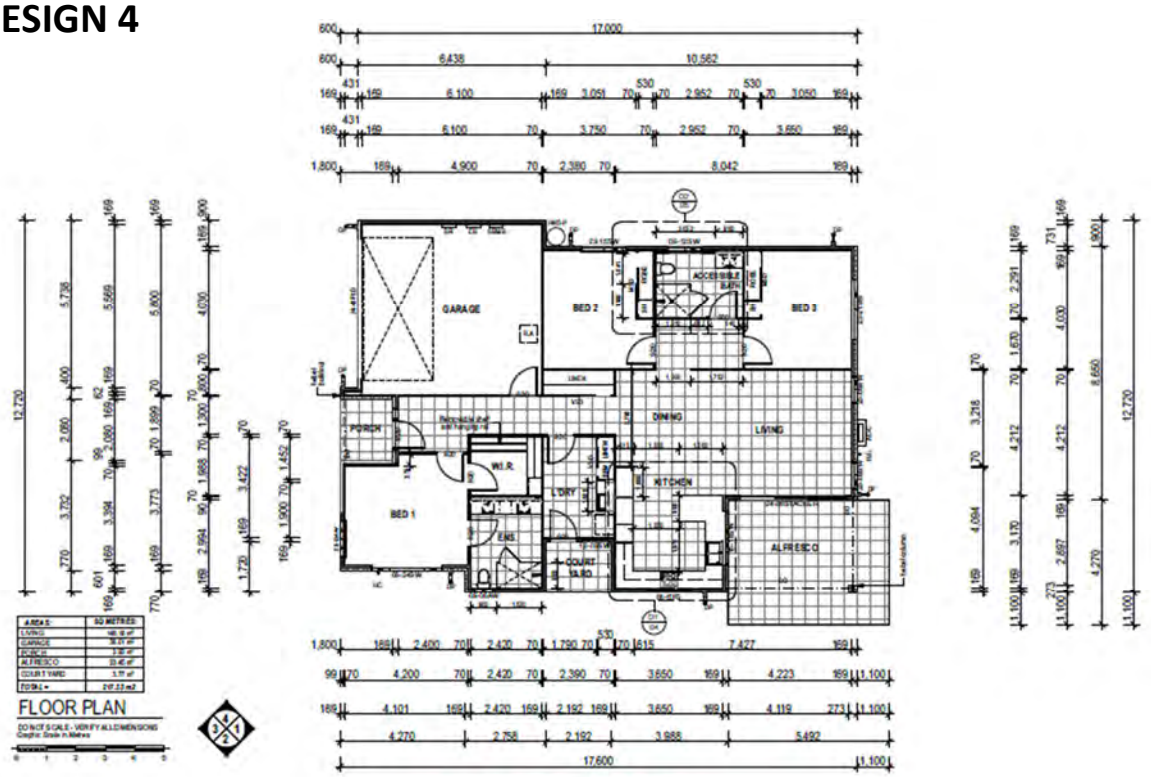

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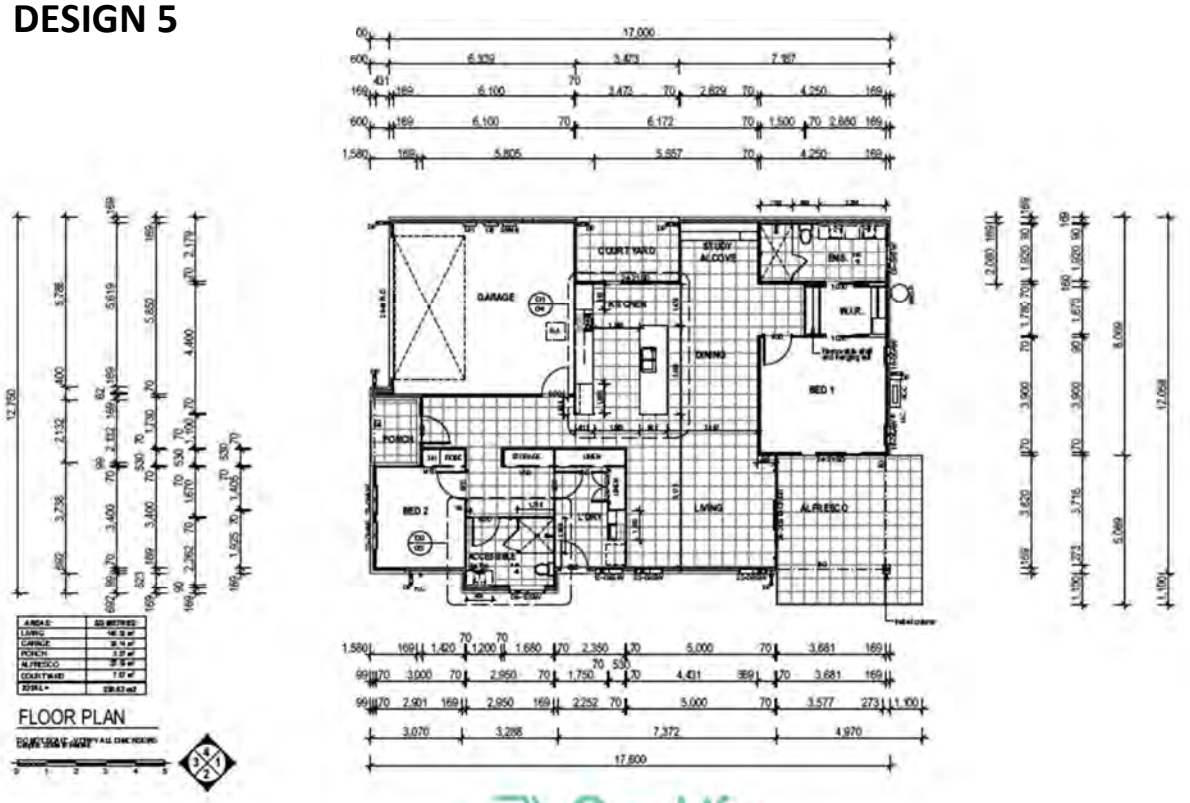

GemLife LENNOX HEAD

ACCESS AUDITS | ACCESS REPORTS | PERFORMANCE SOLUTIONS

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ACCESSIBILITY CONSULTANTS

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ACCESSIBILITY REPORT

SEPP SENIORS LIVING

DA PLANS

LIVING GEMS

SENIORS LIVING DEVELOPMENT

67 SKENNERS HEAD ROAD, SKENNERS HEAD, NSW

3 April 2017
Amended 25 May 2018
Reference: 17053

Prepared by:

Haley Thornton
Building Surveyor MAIBS
Access Consultant

BCA Check Pty Ltd
4/57 Ballina Street, Lennox Head NSW 2478
PO Box 375 LENNOX HEAD NSW 2478

ABN 95104451210

DOCUMENT CONTROL

Revision	Date	Description	Prepared	Authorised
0	03/04/17	DA plans	HT	Haley Thornton
1	20/04/17	Amended	HT	Haley Thornton
2	23/05/18	Updated DA issue	HT	Haley Thornton
3	25/05/18	Updated DA issue	HT	Haley Thornton

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The information and calculations contained in this report are specific to the proposed works and suitable only for the purposes of this report. No reliance should be placed on this information for any purpose other than for the purposes of this report. All dimensions, size and shape of features as shown on plans in this document are subject to detailed design plans and may vary subject to final design. The information contained in this report is based on independent research undertaken by BCA Check Pty Ltd t/a National Access. To the best of our knowledge, it does not contain any false, misleading or incomplete information.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The purpose of this accessibility report is to demonstrate that the accessibility provisions of State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004 have been adequately addressed to enable Council to properly conclude that the development is designed and can be built in full compliance with "accessibility" requirements.

The proposed development consists of a 147 lot seniors living village. The majority of the site requires fill in order to achieve the minimum flood floor levels. The applicant is proposing the entire eastern boundary of the site is lifted to achieve a minimum fall of 0.5% to the west.

Public transport is available to both Lennox Head and Ballina town centre from the subject site. Generally accessible paths of travel to public transport bus stops are available to and from services and facilities in Ballina including retail, commercial, community facilities and medical centres (GP services). Minor modifications are required to ensure a safe, accessible path of travel.

Due to existing footpath construction in Lennox Head village a safe continuous path of travel suitable for electric wheelchair users will be difficult to achieve without upgrade works in relation to kerb ramps gradient and lips, bus stop gradient, and excessive footpath cross-fall. It is acknowledged that some electric wheelchair and motorised cart users will be able to negotiate the pedestrian pathway network in Lennox Head village, however, the limitations present a barrier to safe access for many electric wheelchair and motorised cart users. For the purposes of this report, access to off-site community facilities will be assumed to be in Ballina.

Following assessment of the pedestrian access plan prepared by Planit Engineering Job J107, plan SK01 revision B, dated 15/05/18, and assessment of the design pedestrian paths of travel on the site and external pedestrian links to facilities the following statements can be made-

1. In regard to Clause 26(2)(c) of SEPP-HSPD, and the recommendations in this report, the development is capable of achieving appropriate access to an adequate and suitable "accessible" public transport service.

2. In regard to Clause 26(1)(a)(b)&(c) of SEPP-HSPD and the recommendations in this report the development is capable of achieving convenient access to an adequate choice of retail, commercial and community/recreational services and medical practitioner services.

3. In regard to SEPP-HSPD and the recommendations in this report the development is capable of achieving compliant accessible pedestrian pathways in accordance with AS 1428.1-2009 from the entry of each dwelling required to be accessible to-
    - Community facilities located on site including recreation facilities, club house, visitor parking, and garbage areas. It is noted that letter boxes must be provided in an accessible common location adjacent to the street entrance.
    - An adjoining public road or internal road.

1.0 INTRODUCTION

1.1 General

The subject site comprises a single parcel of land, Lot 239 in DP 12001225, known as No 67 Skenners Head Road, Skenners Head. The site has a total area of 11.6ha and is located approximately 3.2km to the south of Lennox Head Town Centre and 6km to the North of Ballina CBD. The site has a moderately steep hill in the north-western corner with the top of the hill at RL 10m AHD. The remainder of the site is flat at RL 0.5m – 3m AHD. Approximately 10% of the site has a gradient steeper than 1:10.

Existing bus stops are located along Skenners Head Road to the west of the site approximately 100 metres from the western boundary and to the east of the site approximately 130m from the eastern boundary. The site frontage is 290m. Some upgrade works will be required to facilitate pedestrian movement between the development and the existing bus stops.

The majority of the site will be filled in order to achieve the minimum flood floor levels. It is proposed that the entire eastern boundary of the site is lifted to achieve a minimum fall of 0.5% fall to the west. Retaining walls are proposed along the southern and eastern boundaries of the site in order to prevent fill encroaching on adjoining land. Retaining walls are also proposed at locations throughout the site.

Pedestrian footpaths are generally proposed on the roadways. Separate footpaths are proposed at the main pedestrian entrance at the front boundary of the site and where compliance with AS 1428.1-2009 cannot be achieved on the roadway.

A continuous accessible path of travel for wheelchair and motorised cart users is a fundamental requirement for equitable access to the built environment. This should be provided from all public car parks, public transport or taxi set down areas, and property boundary to and throughout any common use buildings, common facilities, community installations and recreation elements within the site. This route can consist of pathways, roadways, pedestrian crossings and ramps. It cannot incorporate any step, stairway or other impediment. It is noted that proposed road gradients will require consideration in terms of pedestrian access as compliance with AS 1428.1-2009 is required where the road is also the designated pedestrian pathway.

The following documents have been referenced within the report –

(a) Accessibility provisions of SEPP-HSPD.
(b) AS 1428.1-2009 Design for access and mobility - General Requirements for Access - New Building Work, where relevant.
(c) AS 4299-1995 Adaptable Housing where relevant.
(d) Disability Standards for Accessible Public Transport (Disability Discrimination Act (DDA))

1.2 Development description

The proposed seniors living development consists of:

- 146 residential seniors living lots;
- 1 on-site manager's residence;
- Internal road network;
- Visitor car parking;
- On-site clubhouse/community activity space, recreation facilities.

2.0 ACCESSIBILITY - SEPP (Housing for Seniors or People with a Disability) 2004.

2.1 Summary

This compliance table has been prepared to ensure that the accessibility provisions of the SEPP-HSPD have been considered in design documentation. Full details should be included in construction documentation.

SEPP Clause	Requirement	Detail provided/required	Capable of Compliance (Y/N)
26(1)(a)	Bus Services Access to shops, banks, retail and other commercial services Public transport within 400m of the site, and 400m of facilities.	Bus service available with frequent services 7 day/week to services in Lennox Head and Ballina. Wheelchair accessible buses are used on the bus routes.	YES, See section 2.2 of this report
26(1)(b)	Access to community and recreational facilities. Public transport within 400m of the site, and 400m of facilities.	Bus service available with frequent services 7 day/week to services in Lennox Head and Ballina. Wheelchair accessible buses are used on the bus routes On-site clubhouse/community activity space. On-site recreation facilities.	YES
26(1)(c)	Access doctor - Public transport within 400m of the site, and 400m of facilities in Ballina and Lennox Head.	Bus service available with frequent services 7 day/week to services in Lennox Head and Ballina. Wheelchair accessible buses are used on the bus routes.	YES (See comments in section 2.2 of this report).
26(2)(a)	Gradient for access to facilities within 400m walk.	N/A	N/A
26(2)(b)	Public transport within 400m	N/A (Sydney only)	N/A
26(2)(c) & (3)	Public transport within 400m of the site, and 400m of facilities.	Bus stops are located within 400mm of the site and within 400m of facilities in Lennox Head and Ballina. Additional works required to achieve adequate accessibility.	Capable of achieving compliance. Additional works are required to ensure the path of travel to bus stops meet SEPP requirements (See comments in section 2.2 of this report).

	Overall gradients of pathways to transport and facilities no more than 1:14 subject to below.	Gradient in the direction of travel exceeds 1:14.	Additional works required. (See comments in section 2.2 of this report)
	1:12 for 15m max.	Gradient complies	Yes
	1:10 for 5m max.	Gradient complies	Yes
	1:8 for 1.5m max.	Kerb ramps at the Skenners Head Rd crossing leading to the bus stop exceed 1:8 gradient on both sides of the road.	Capable of achieving compliance. Additional works are required. See section 2.2 of this report.
26 (4)(a)	Suitable access pathway from site to bus stop and facilities – safe and suitable for electric wheelchairs, motorised cart or the like	Sloping driveway crossing to Headlands Holiday Park has excessive cross-fall. Kerb ramps at the Skenners Head Rd crossing exceed 1:8 gradient on both sides of the road. Circulation space at pathway adjacent to northern bus stop to be 1500 x 1500 at the change in direction. Additional boarding area to be provided 2070 x 1540 at northern bus stop. Path of travel on the eastern side of Ballina Bus terminus should be increased to 1.2m where obstructed by sign post.	Capable of achieving compliance. Upgrade works required. Details to be included in construction documentation. See section 2.2 of this report.
26 (4)(b)	Distances to be measured along pathway	All distances have been measured along the existing pathways.	Yes
29	Site compatibility	Access matters considered in 26 above.	Yes
30(3)(f)	Pedestrian and vehicle access at the entrance to the site. Designated pedestrian pathway.	Plans indicate designated pedestrian access at the main street entrance.	Yes
30(4)(g)	Street frontage features - bus stops and associated pathways to be included on plans.	Designated pedestrian access from the boundary to bus stops.	Yes, see section 2.2 of this report. Works required.
31	In-fill self-care	N/A	
32	Design of residential development	Compliance with Division 2, Clause 38.	See below.
Clause 38(a)	Obvious and safe pedestrian links from the site to public transport	Pedestrian access separate to vehicular access. See Section 2.2 of this report.	Yes, see section 2.2 of this report.
Clause 38(b)	Attractive, safe environment for pedestrians and motorists, parking for visitors and residents	Pedestrian access separate to vehicular access, or distinct pavement surface for pedestrian use.	Capable of achieving compliance, ramps and landing required in some locations.
41	Development standards for self-contained dwellings	Compliance with Schedule 3, see below	Capable of achieving compliance.

Schedule 3			
Standards applying to self-contained dwellings			
Part 1 Clause 2(1)	Wheelchair access – if whole of site is less than 1:10, 100% of site to have access to dwellings and to an adjoining public road.	Approximately 90% of dwellings to have access within site by a continuous accessible path of travel to adjoining road. Summary of AS1428.1-2009 path of travel requirements included in Appendix C of this report.	See below.
Clause 2(2)	The percentage of dwellings that must have wheelchair access from the street to the dwelling entrance must equal the proportion of the site that has a gradient less than 1:10, and if the site gradient less than 1:10 100% of dwellings must have wheelchair access by a continuous accessible path of travel (AS1428.1-2009) to an adjoining public road. Applicable clauses AS 1428.1-2009 section 6, 7, and 10.	Approximately 10% of the site has a gradient steeper than 1:10. Therefore approximately 90% of dwellings must have wheelchair access by a continuous accessible path of travel (AS1428.1-2009) to an adjoining public road. Confirmation of the percentage of the site exceeding 10% is required.	Capable of achieving compliance. 146 seniors living dwellings in total therefore approximately 14 dwelling are not required to have a continuous accessible path of travel from the entrance to an adjoining public road. Final civil plans must clearly demonstrate the percentage of the total site having a gradient steeper than 1:10.
Clause 2(3)	Common areas – wheelchair access required to common areas and facilities	Wheelchair access is required to common areas (recreation facilities, club house, mail boxes, garbage area, carparks, to comply with AS1428.1-2009	Capable of achieving compliance. Access must be provided in accordance with AS 1428.1 so that a person using a wheelchair can use common areas and common facilities associated with the development.
Clause 3	Adequate pathway lighting, 20 lux at ground level, avoid glare.	Lighting to comply with Schedule 3, Part 1, Clause 3.	Yes, details to be included in construction documentation.
Clause 4	Letterboxes must be situated on a hard standing area and have wheelchair access and circulation by a continuous accessible path of travel (AS 1428.1) and must be located together in one or more central locations adjacent to the street entry.	Path of travel to letterboxes including walkways, landings, pavement surfaces to comply with AS 1428.1-2009. Minimum circulation space at a letterbox for wheelchair access is 2070 x 1540 at a gradient of 1:40 or less.	Common letterbox area adjacent to the street entry is required. Further detail required. Ensure plans indicate wheelchair turning space on a hard paved area.
Clause 5	Private car accommodation	Private car parking to comply with AS 2890.6-2009. Private carparking	Yes

		spaces should be double garage size where possible, minimum 4.8 x 5.4 (clear height 2500mm). It is considered reasonable that some private spaces could have a width of 3.8m. Discussions with the approval authority may be required to establish minimum requirements if double garages cannot be provided.	
Clause 6	Every entry to all dwellings must comply with clause 4.3.1 and 4.3.2 of AS 4299.	Ensure site levels are provided to enable every entry to be accessible, i.e. no steps at entry doors, accessible threshold. **AS 4299 cl.4.3.1 Accessible entrance** AS1428.2 entry doors and thresholds to comply with AS 1428.1-2009. Maximum threshold 35mm with threshold ramp, gradient and cross fall 1:40. **AS 4299 cl.4.3.2 Landing** Where the accessible entry door is exposed to the weather, it shall be provided with a landing outside the door with a maximum fall of 1:40 and a low threshold at the entry door to exclude water. The threshold to have smooth transition. The landings 2070 x 1540mm.	Yes
Clause 7-20	Accessible dwellings	Capable of achieving compliance, construction plans to indicate features as detailed in Clauses 7-20. Dwelling floor plans have been assessed. See separate letter.	Yes
21	A garbage storage area must be provided in an accessible location.	The path of travel to the garbage storage area and any door/gates must comply with AS 1428.1-2009.	Yes

2.2 Bus Stops and external paths of travel

The proposed development is located on land in a Local Government Area (LGA) that is not within the Sydney Statistical Division. The site is located between Lennox Head and Ballina town centres. A transport service is required to be available to the residents who will occupy the proposed development. Blanch's Bus Company provides a variety of bus services around the Northern Rivers. Routes 640 provides a service from Mullumbimby to Ballina return. The route travels along Skenners Head Road with "hail and ride" bus stops located within 400m of the subject site. The bus service provides approximately 6-8 return services Monday-Saturday to both Ballina and Lennox Head.

Three services are provided in both directions on Sundays. A copy of the bus services map and an extract of the timetable is provided in Appendix D.

Wheelchair accessible buses are used on route 640 as indicated on the bus timetable. Connecting bus services are also available at the Ballina Bus terminal to Lismore with Ballina Bus Lines. Accessible Taxi services are available via Ballina Taxi Service. The path of travel to bus stops is required to comply with the following SEPP-HSPD standards-

1. Overall gradients of pathways to transport and facilities no more than 1:14 subject to variations detailed below-
   Gradient of 1:12 for 15m maximum;
   Gradient of 1:10 for 5m maximum;
   Gradient of 1:8 for 1.5m maximum.

2. Suitable access pathway from site to bus stop and facilities – safe and suitable for electric wheelchairs, motorised cart or the like.

The provisions of item 1 above can be measured to determine suitability. Item 2 does not include measurable standards, however it is considered reasonable to make a comparison with the provisions of the Federal Government's Disability Standards for Accessible Public Transport (DSAPT) 2002 which apply throughout Australia. These Standards form part of the Disability Discrimination Act and establish the standard for accessible public transport including buses and bus stops. The Building Code of Australia Part D3 and H2 is also used as a reference as applicable to accessible bus stops. Ensuring that design elements such as walkways, kerb ramps and bus stops link together on a continuous accessible path of travel will ensure that safe wheelchair and motorised cart access is available.

In addition to the design elements of SEPP-HSPD the following provisions of DSAPT and the BCA may be used to determine an appropriate benchmark for the "accessible pathway that is safe and suitable for an electric wheelchair, motorised cart or the like"-

a) Width of path of travel 1200mm;
b) Circulation space sufficient to manoeuvre onto and off an accessible bus (1540 x 2070mm in the direction of travel) hard stand area;
c) Gradient and cross-fall (camber) of 1:40 at the boarding point and turning area;
d) Camber/cross-fall 1:40 maximum along pathways;
e) Kerb ramp layout and design to comply with AS 1428.1-2009;
f) Level landings at changes in direction along the path of travel 1500 x 1500 at 90^{o} turns; 1540 x 2070 (in the direction of travel) at 180^{o} turns.

Crossfall (or camber) is the slope of the footpath at right angles to the direction of travel. Some crossfall is required for drainage, but excessive crossfall results in difficult conditions for pedestrians using wheelchairs or motorised carts, who have to exert extra energy to resist the

sideways forces. Three wheeled scooters can be less stable on surfaces with a steep cross-fall than four wheeled scooters. Electric wheelchair and motorised cart users can have difficulty controlling mobility devices on paths of travel with excessive cross-fall.

The generally accepted maximum cross-fall for accessible paths of travel (AS 1428.1-2009) is 1:40 (2.5 %) on hard paved surfaces, or 1:33 (3 %) on bitumen surfaces provided the surface is adequately drained to avoid any ponding of water within the path. It is noted that AS 1428.1-2009 does not apply to public outdoor spaces, and reference is made to Councils Policies to determine appropriate cross-fall for the external paths of travel. For the purposes of this report safe crossfall for footpaths is considered to be 1:40 or 1:33 for bitumen surfaces.

The main bus stops and associated paths of travel adjacent to the site; and in the town centres of Lennox Head and Ballina have been assessed for electric wheelchair and motorised cart accessibility using the above parameters and SEPP-HSPD provisions. Details of the bus stop assessment are summarised in Table 2 below. Figure 1 indicates four bus stops within 400m of the subject site located along Skenners Head Road.

Figure 1 – Bus Stops within 400m of 67 Skenners Head Road

Figure 2 below indicates the location of the arrival and departure bus stops in Lennox Head. The arrival bus stop in Lennox Head is located at the Lennox Head Professional Centre with a travel distance of 120m to the medical centre. The departure bus stop is located to the north of the main street, 430m from the medical centre (550m round trip). Although the 400m travel distance is exceeded from the medical centre to the departure bus stop the round trip of 540m is consistent

with the maximum allowable 400m travel distance (800m round trip) to and from specific services as required by SEPP-HSPD.

Due to existing footpath construction in Lennox Head village, a safe continuous path of travel suitable for electric wheelchair and motorised cart users will be difficult to achieve without upgrade works in relation to kerb ramps, bus stop gradient and cross-fall, footpath cross-fall and location of accessible crossing points across Ballina Street. It is acknowledged that some electric wheelchair and motorised cart users will be able to negotiate the pedestrian pathway network in Lennox Head, however, the limitations present a barrier to safe access for electric wheelchair and motorised cart users. For the purposes of this report access to facilities required by SEPP-HSPD will be assumed to be located in Ballina.

Figure 2 - Pedestrian pathway from bus stops to medical centre – Lennox Head town centre

Figure 3 below indicates the location of Bus stops within the Ballina town centre. The main bus terminus in Tamar Street is located within 400mm of most services within the Ballina CBD. Connecting buses and taxi services are also available. Accessible paths of travel to public transport

bus stops are available to and from services and facilities in Ballina including retail, commercial, community facilities and medical centres (GP services). Alternative paths of travel are available where footpath cross-fall is excessive. Some kerb ramps across Tamar Street and Moon Street exceed 1:8, however, there are alternative accessible paths of travel to numerous retail and commercial services in the CBD.

The Transit bus stop provides the opportunity to connect with other Bus Companies with a variety of routes through Ballina and surrounding areas. Accessible taxis are also available.

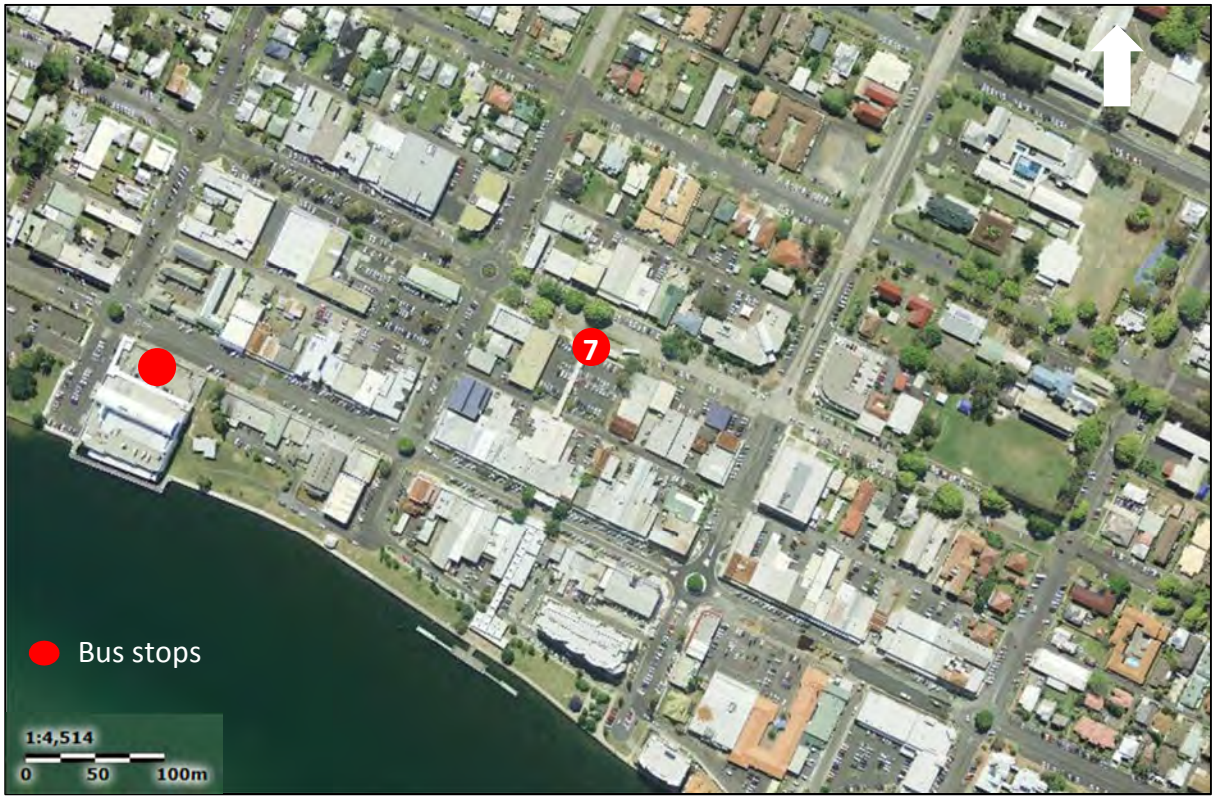


Figure 3 – Ballina Bus Terminus (7) and River Street bus stop (8)

Table 2 – Accessibility assessment – Path of travel to bus stops

No.	Bus stop location	Existing bus stop suitable for electric wheelchairs	Access to/from bus stop suitable for electric wheelchairs
1	Skenners Head Rd - to Ballina, located on soccer fields side, opposite headlands Holiday Park	No - Additional hard-paved circulation space is required at the boarding point 2070 (in the direction of travel) x 1540. See figure 4.	No - The path of travel to the bus stop exceeds 1:8 gradient at the road crossing kerb ramps (measured at 1:5-1:7.5). The concrete pathway adjacent to the boarding point is less than 1.2m wide (1500 x 1500 turning space should be provided at the change in direction). Shared cycleway/pedestrian markings required. Kerb ramp layout and design to comply with AS 1428.1-2009.
2	Skenners Head Rd - to Lennox Head, located in front of	Yes	No - The driveway crossing to the Headlands Holiday Park has steep sloping sides that may cause a wheelchair to overturn. Cross-fall across the driveway crossing is excessive. A 1200mm

	Headlands Holiday Park		wide path of travel to the bus stop is required across the driveway with a maximum cross-fall of 1:40. And maximum gradient of 1:10 for no more than 5m. Shared cycleway/pedestrian markings required.
3	Skenners Head Rd - to Lennox Head, located opposite Henderson Dr	No - Additional hard paving required between the bus stop and the road, currently garden area.	Yes – Path of travel complies with SEPP-HSPD. Shared cycleway/pedestrian markings required.
4	Skenners Head Rd to Ballina, corner of Henderson Dr and Skenners Head Rd northern side	No - Bus stop is not accessible to wheelchair users as there are no kerb ramps or wheelchair circulation areas.	No - No accessible paths of travel available.
5	Lennox Head travelling north. Located at Lennox Professional Centre	No - Bus stop is located at the southern end of Ballina Street commercial precinct. Boarding area gradient exceeds 1:40.	No - The path of travel adjacent to the bus stop has a crossfall exceeding 1:40. Kerb ramps at the Park Lane crossing from the bus stop to the main street exceed 1:8 gradient without a suitable transition from the road to the kerb ramp. Cross-fall along the path of travel to the northern (return) bus stop is excessive, particularly the driveway crossings and footpath immediately to the south of the return bus stop.
6	Lennox Head travelling south, main bus shelter	No - The boarding point has a gradient of 1:15, the maximum gradient and cross-fall for safe boarding is 1:40.	No - Cross-fall along the path of travel from the bus stop to the pedestrian crossing is excessive, particularly the driveway crossings and footpath immediately to the south of the bus stop. A safe path of travel for wheelchair users is not available to the retail, commercial and medical facilities in Ballina Street.
7	Ballina Bus Zone Tamar Street	Yes – Boarding point is accessible.	No - Signpost obstructs the clear width of the pathway leading to the bus stop from the east, 1200mm required for safe passage, currently 1060mm.  Selection of commercial, retail and medical services are within 400m of the bus stop with wheelchair accessible paths of travel.
	Ballina Kerr Street Hungary Jacks	Yes	Yes - Ramp access to Ballina Central shopping centre - overall less than 1:20 gradient.
	Ballina Kerr St - KFC	Yes	Yes - Generally level footpath and walkway to Ballina Fair shopping centre.

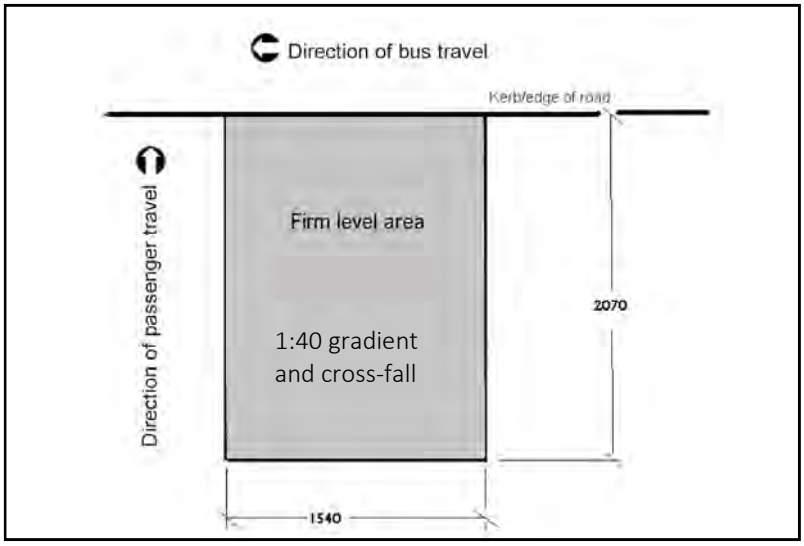


Figure 4 – Clear circulation space recommended at bus stop boarding points

2.3 Direction and distance to facilities

SEPP-HSPD clause 30(4)(j) requires information regarding the direction and distance to facilities. Table 3 details retail, commercial, community and medical facilities and the proximity to the bus stops in Lennox Head and Ballina.

Table 3 - SEPP-HSPD clause 30(4)(j) direction and distance to facilities

Facility	On-site facilities	Ballina	Lennox Head	Distance from bus stop
Access to shops and retail outlets	No	River Street; Ballina Fair and Ballina Central Shopping Centres	Ballina Street*	Located within 400m of arrival and departure bus stops
Access to Banks	No	River Street; Ballina Fair Shopping Centre	Ballina Street*	Located within 400m of arrival and departure bus stops
Access to commercial services	No	River Street, Tamar Street	Ballina Street*	Located within 400m of arrival and departure bus stops
Access to community facilities	On-site club house	Fawcett Park river front and jetty, Ballina RSL (access via interchange or taxi from transit stop)		Located within 400m of an arrival and departure bus stops
Access to recreational facilities	On-site bowling green and tennis court	Various	Ocean front reserve, Williams Reserve*	Located within 400m of arrival and departure bus stops
Access doctor	No	Moon St Medical Centre	Medical Centre*	Located within 400m of arrival bus stop and departure bus stops

* See comments regarding path of travel

2.4 Private car accommodation

Visitor/common carparking spaces have been nominated throughout the site with 37 carparking spaces and 2 designated accessible spaces. Each dwelling will have two private car parking spaces. Schedule 3, clause 4 of SEPP-HSPD details requirements for private car parking and references AS 2890. It is noted that AS 2890.1 references AS 2890.6-2009 for carparking for people with disabilities. The following comments are made in relation to private carparking:

1. Previous versions of AS 2890.1 included requirements for carparking for people with disabilities having a width of 3.2m. In the 2004 version of the standard (current standard), carparking for people with disabilities was transferred to the new standard AS 2980.6-2009. AS 2890.6 requires an accessible carparking space to have an area of 2.4 x 5.4 with an adjacent circulation space of 2.4 x 5.4. The total area for one accessible carparking space is 4.8 x 5.4m. Plus the shared space of 2.4 x 2.4 at the front or rear of the parking space.

2. SEPP-HSPD requires compliance with AS 2980. In the definitions of SEPP- HSPD the version of AS 2890.1 that is to be adopted is the version called up in the BCA. It is noted that only AS2890.6 is adopted in the BCA.

3. SEPP-HSPD also requires 5% of the total number of private carparking spaces to be designed to be able to be increased to 3.8m. All accessible carparking spaces must have a total width of 4.8m under AS2890.6.

Having regard to the discrepancy between SEPP-HSPD and AS 2890.6 it is considered reasonable that common area accessible carparking spaces be designed to comply with the current version of AS 2890.6-2009. Private carparking spaces should be double garage size where possible, minimum 4.8 x 5.4 (internal clear height 2500mm). It is considered reasonable that some private spaces could have dimensions of 6m x 3.8m as required by AS 4299 Adaptable Housing to cater for the specific needs of some wheelchair users. Discussions with the approval authority may be required to establish minimum requirements where double garages are not proposed.

AS2890.6 also has requirements for the gradient of the area at the front or rear of an accessible carparking space. An area of 2.4 x 2.4 at the front or rear of the space must have a gradient and cross fall not exceeding 1:40, or 1:33 if a bitumen surface.

3.0 CONCLUSION

Based on the assessment of the site and DA site layout plans, the site is capable of being developed in a manner that adequately complies with the accessibility provisions of SEPP-HSPD and associated standards. Access constraints as identified in this report can be ameliorated where necessary with relatively minor works and by providing additional detail on the construction plans. No matters were identified, in relation to accessibility that would prevent the proposed development from proceeding, subject to adoption of the recommendations within this report.

REFERENCES

1. SEPP (Housing for Seniors or People with a Disability) 2004. Version applicable at time of DA.

2. Disability Standards for Accessible Public Transport 2002, Disability Discrimination Act 1992.

3. AS 1428.1-2009 *Design for access and mobility – New building work,* Standards Australia.

4. AS 1428.2-1992 Design for access and mobility Part 2: Enhanced and additional requirements - Buildings and facilities.

5. AS 2890.1 *Parking facilities* Australia, (2004), Standards Australia.

6. AS 2890.6-2009 Parking facilities - Off street carparking for people with disabilities.

7. AS 4299-1995 *Adaptable housing,* Standards Australia.

8. Disability (Access to Premises - Buildings) Standards 2010, known as the Premises Standards, Disability Discrimination Act 1992.

9. National Construction Code - Building Code of Australia 2016, Part H2 Public Transport Buildings.

10. Department of Infrastructure, Planning and Natural Resources, May 2004, A guide for Councils and applicants: Housing for Seniors or people with a disability.

11. Australian Human Rights Commission (AHRC), Guidelines for promoting compliance of bus stops with the DSAPT – December 2010.

Appendix A

67 Skenners Head Rd Seniors Village
Site Layout

AMENDMENTS: DATE/ISSUE			
A. 06.11.17	G.1503.18	M.2304.18	
B. 06.11.17	H.2203.18	N.11.05.18	
C. 06.11.17	I. 2803.18	O.2105.18	
D. 25.02.18	J. 0704.18		
E. 26.02.18	K.0504.18		
F. 01.03.18	L. 1004.18		

GENERAL NOTES

ALL WORK TO COMPLY WITH THE PROVISIONS OF THE BCA AS AMENDED FOR AUSTRALIA, AUSTRALIAN STANDARDS AND ANY RELEVANT CODES OF THE LOCAL AUTHORITY.

USE FIGURED DIMENSIONS ONLY. DO NOT SCALE - VERIFY ALL DIMENSIONS PRIOR TO ORDERING OR COMMENCEMENT OF FABRICATION. IF IN DOUBT ASK.

PLEASE READ CAREFULLY

THESE PLANS ARE THE COPYRIGHT OF THE DESIGNER REFERRED TO IN THE CONTRACT. THEY ARE NOT TO BE USED BY ANY UNAUTHORISED PERSON WITHOUT THE PRIOR WRITTEN CONSENT OF THE DESIGNER. ALL THE RIGHTS IN THESE PLANS ARE RESERVED.

CHANGES _____ DATE _____

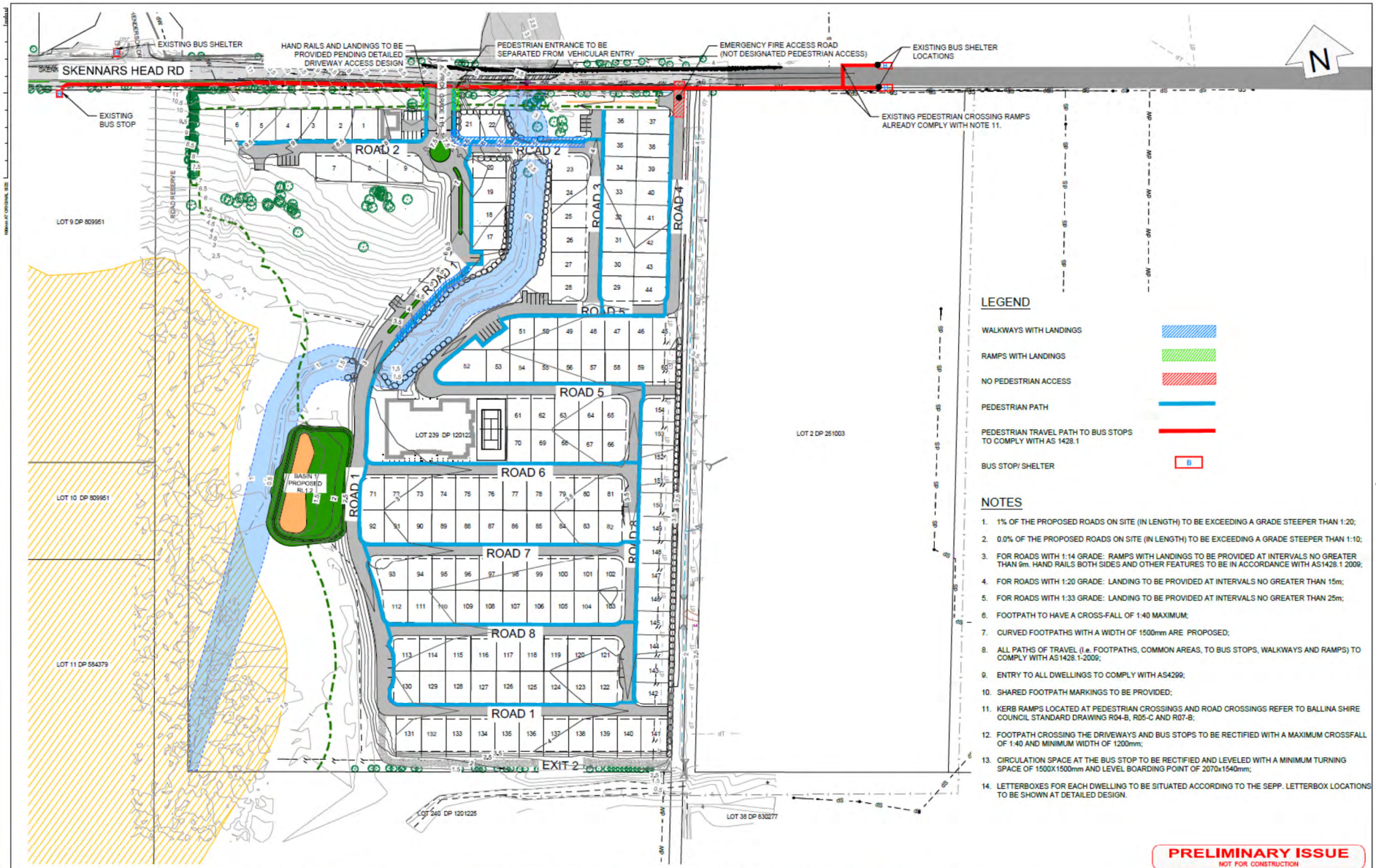
NOTES _____ DATE _____

CLIENT: GemLife

SITE: 67 SKENNARS HEAD ROAD LENNOX HEAD

MODEL: SITE PLAN		**ISSUE:**	O
JOB NO.:	LH-01	**SHT NO.:**	1 OF 1
ISSUE DATE:	21/05/18	**DRAWN:**	FJ

GemLife LENNOX HEAD



NOTES

1. 1% OF THE PROPOSED ROADS ON SITE (IN LENGTH) TO BE EXCEEDING A GRADE STEEPER THAN 1:20;
2. 0.0% OF THE PROPOSED ROADS ON SITE (IN LENGTH) TO BE EXCEEDING A GRADE STEEPER THAN 1:10;
3. FOR ROADS WITH 1:14 GRADE: RAMPS WITH LANDINGS TO BE PROVIDED AT INTERVALS NO GREATER THAN 9m. HAND RAILS BOTH SIDES AND OTHER FEATURES TO BE IN ACCORDANCE WITH AS1428.1 2009;
4. FOR ROADS WITH 1:20 GRADE: LANDING TO BE PROVIDED AT INTERVALS NO GREATER THAN 15m;
5. FOR ROADS WITH 1:33 GRADE: LANDING TO BE PROVIDED AT INTERVALS NO GREATER THAN 25m;
6. FOOTPATH TO HAVE A CROSS-FALL OF 1:40 MAXIMUM;
7. CURVED FOOTPATHS WITH A WIDTH OF 1500mm ARE PROPOSED;
8. ALL PATHS OF TRAVEL (I.e. FOOTPATHS, COMMON AREAS, TO BUS STOPS, WALKWAYS AND RAMPS) TO COMPLY WITH AS1428.1-2009;
9. ENTRY TO ALL DWELLINGS TO COMPLY WITH AS4299;
10. SHARED FOOTPATH MARKINGS TO BE PROVIDED;
11. KERB RAMPS LOCATED AT PEDESTRIAN CROSSINGS AND ROAD CROSSINGS REFER TO BALLINA SHIRE COUNCIL STANDARD DRAWING R04-B, R05-C AND R07-B;
12. FOOTPATH CROSSING THE DRIVEWAYS AND BUS STOPS TO BE RECTIFIED WITH A MAXIMUM CROSSFALL OF 1:40 AND MINIMUM WIDTH OF 1200mm;
13. CIRCULATION SPACE AT THE BUS STOP TO BE RECTIFIED AND LEVELED WITH A MINIMUM TURNING SPACE OF 1500X1500mm AND LEVEL BOARDING POINT OF 2070x1540mm;
14. LETTERBOXES FOR EACH DWELLING TO BE SITUATED ACCORDING TO THE SEPP. LETTERBOX LOCATIONS TO BE SHOWN AT DETAILED DESIGN.

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APPROVED
A	ISSUE FOR CLIENT REVIEW	18/04/17	GF	SA	RW	AW
B	AMENDED TO REVISED LOT LAYOUT	23/05/18	SA	SA	AW	AW

SCALES: 0 10 20 40 60
Full Size 1:1000 ; Half Size 1:2000
Scale (m)
DO NOT SCALE FROM DRAWING

DRAWN BY: G.FALLARA
DESIGN BY: S.ADAM
APPROVED BY:
DATE:
THIS DRAWING MUST NOT BE USED FOR CONSTRUCTION UNLESS SIGNED AS APPROVED

PLANIT ENGINEERING
SUITE 9A, 80-84 BALLINA STREET
PO BOX 161
LENNOX HEAD NSW 2478
TELEPHONE: 02 6687 4666
ABN: 99 613 049 568
EMAIL: admin@planitengineering.com.au

CLIENT: LIVING GEMS
C/- PLANNERS NORTH
3/ 69 CENTENNIAL CIRCUIT
BYRON BAY, NSW, 4281

LOCAL GOVERNMENT AUTHORITY: BALLINA SHIRE COUNCIL

PROJECT: 67 SKENNARS HEAD ROAD
DRAWING TITLE: PEDESTRIAN ACCESS PLAN

ORIGINAL SIZE:	PLANIT JOB No.:	DRAWING No.:	REV:
A1	J107	SK01	B

CAD FILE: T:\J107 - 67 SKENNARS HEAD ROAD - DAM - CAD\J107-ACCESS PLAN-REV B.DWG PLOTTED BY: STEPHENA PLOT DATE: 25/05/2018 10:07:02 AM

Appendix B

Bus Timetable
Blanch's Bus Company


Lennox Head
Byron Bay
Ballina
Regional Services
Bus Route
Route 637 Sunrise Beach - Byron Bay - Suffolk Park
Route 640 Ballina - Lennox Head - Suffolk Park - Byron Bay - Mullumbimby
Route 641 Ballina - Bangalow - Byron Bay
Route 654 Ballina - Northlakes - Ballina Heights
Route 655 Ballina - Angels Beach - Prospect Estate & Return
How to use this timetable
1. Using the route map provided, find the two timing points you are located between.
2. Locate these two timing points on the timetables.
3. Your bus is scheduled to arrive between the times shown for these points. For example, if your bus stop is situated between timing points A and G on the map, then the bus is scheduled to arrive between the time listed for A and the time listed for G.
Blanch's Bus Company
Bus Charter
Whether you belong to a school or social group, or require transport for your wedding or party, Blanch's can assist with your bus charter needs.
Vehicles range from 49 to 67 seats, and options include air conditioning, wheelchair access, cloth seats and radios.
For further information and quotations visit:
www.blanchs.com.au

Regional Services

Timetable Info Line 24 hours 7 days
6686 2144
www.blanchs.com.au

640 Ballina - Lennox Head - Suffolk Park - Byron Bay - Mullumbimby

Monday to Friday			BVC						BVC		Saturday						Sunday		
Route Number	640	640	645	640	640	640	640	640	645	640	640	640	640	640	640	640	640	640	640
	am	am	am	am	am	pm	pm	pm	pm	pm	am	am	am	pm	pm	pm	am	am	pm
A Ballina - Byron Gateway Airport	6.50	7.30	....	9.05	10.25	12.05	1.45	3.15	....	5.15	7.50	9.00	11.10	1.00	2.45	4.40	7.50	11.10	2.45
B Ballina - Kerr St (Hungry Jacks)	6.55	7.35	....	9.10	10.30	12.10	1.50	3.20	....	5.20	7.55	9.05	11.15	1.05	2.50	4.45	7.55	11.15	2.50
C Ballina - Tamar St	7.00	7.40	....	9.15	10.35	12.15	1.55	3.30	....	5.25	8.00	9.10	11.20	1.10	2.55	4.50	8.00	11.20	2.55
D Bayview Drive Estate - Old Coast Rd	7.05	7.45	....	9.20	10.40	12.20	2.00	3.38	....	5.30	8.05	9.15	11.25	1.15	3.00	4.55	8.05	11.25	3.00
E Headlands Dr	7.10	7.50	....	9.25	10.45	12.25	2.05	3.45	....	5.35	8.10	9.20	11.30	1.20	3.05	5.00	8.10	11.30	3.05
F Lennox Head - Ballina St (Prof Centre)	7.15	7.55	....	9.30	10.50	12.30	2.10	3.55	....	5.40	8.15	9.25	11.35	1.25	3.10	5.05	8.15	11.35	3.10
G Suffolk Park - Clifford St	7.40	8.20	....	9.55	11.15	12.55	2.35	4.20	....	6.05	8.40	9.50	12.00	1.50	3.35	5.30	8.40	12.00	3.35
H Byron Hills - Beech Dr	....	....	....	....	....	....	....	....	....	....	8.42	9.52	12.02	1.52	3.37	5.32	8.42	12.02	3.37
I Baywood Chase Estate - Teak Cct	....	....	....	....	....	....	....	....	....	....	8.45	9.55	12.05	1.55	3.40	5.35	8.45	12.05	3.40
J Opp. Byron Holiday Park- Broken Head Rd	7.43	8.23	....	9.58	11.18	12.58	2.38	4.23	....	6.08	8.47	9.57	12.07	1.57	3.42	5.37	8.47	12.07	3.42
K Byron Bay - Jonson St (Tourist Info)	7.55	8.40Y	9.05	10.05	11.25	1.05	2.45	4.30	5.10	6.15	8.55	10.05	12.15	2.05	3.50	5.45	8.55	12.15	3.50
L Sunrise Beach Estate - Julian Rocks Dr	....		....	....	....		....	....	....		8.58	10.08	12.18	2.08	3.53	5.48	8.58	12.18	3.53
M Elements of Byron	....		....	....	....		....	....	....		....	10.15	....	2.15	....		....		....
N McGettigans Lane - Parkway Dr Loop	....		....	....	....		....	4.35	....		....	....	....	....	....		....		....
● Ewingsdale - Byron Central Hospital	7.59		9.09	10.09	11.29		3.02	4.39	5.14		9.04		12.24		3.59		9.04		3.59
O Ewingsdale - cnr Pacific Hwy & Ewingsdale Rd	8.00		9.10	10.10	11.30		3.03	4.40	5.15		9.05		12.25		4.00		9.05		4.00
Q Mullumbimby - (River Tce Bus Zone)	8.25c		9.30	10.30c	11.50c		3.18	5.00	5.30		9.20c		12.40c		4.15c		9.20		4.15

640 Mullumbimby - Byron Bay - Suffolk Park - Lennox Head - Ballina

Monday to Friday							BVC			Saturday							Sunday		
Route Number	640	640	640	640	640	640	645	640	640	640	640	640	640	640	640	640	640	640	640
	am	am	am	am	pm	pm	pm	pm	pm	am	am	am	pm	pm	pm	pm	am	pm	pm
Q Mullumbimby - (River Ter B/ Zone)	....	....	8.35c	10.40c	12.00c	....	2.53	3.25	5.10	....	9.30c	....	1.00c	....	4.25c		9.30	....	4.25
O Ewingsdale - cnr Pacific Hwy & Ewingsdale Rd		....	8.48	10.53	12.13	....	3.06	3.38	5.23	....	9.43	....	1.13	....	4.38		9.43	....	4.38
● Ewingsdale - Byron Central Hospital		....	8.49	10.54	12.14	....	3.08	3.39	5.24	....	9.44	....	1.14		4.39		9.44	....	4.39
N McGettigans Lane - Parkway Dr Loop	....	....	8.53	....	....	....	....	....	....	....	....	....	....	....	....		....	....	....
M Elements of Byron	....	....	....	....	....	....	....	....	....	7.35	....	11.30	....	....	....		....	....	....
L Sunrise Beach Estate - Julian Rocks Dr	....	....	....	....	....	....	....	....	....	7.36	9.45	11.31	1.15	3.10	4.40		9.45	1.15	4.40
K Byron Bay - Jonson St (opp. Woolworths)	7.40	7.40	9.10	11.10	12.30	1.45	3.15	3.55	5.40	7.50	10.05	11.50	1.35	3.30	5.00		10.05	1.35	5.00
J Byron Holiday Park - Broken Head Rd	7.43	7.43	9.13	11.13	12.33	1.48		3.58	5.43	7.53	10.08	11.53	1.38	3.33	5.03		10.08	1.38	5.03
I Baywood Chase - Teak Cct	....	....	....	....	....	....		....	....	7.55	10.10	11.55	1.40	3.35	5.05		10.10	1.40	5.05
H Byron Hills - Beech Dr	....	....	....	....	....	....		....	....	7.58	10.13	11.58	1.43	3.38	5.08		10.13	1.43	5.08
G Suffolk Park - Clifford St Bus Zone	7.50	7.50	9.20	11.20	12.40	1.55		4.10	5.50	8.05	10.20	12.05	1.50	3.45	5.15		10.20	1.50	5.15
S Lennox Head - (Beachfront Bus Zone)	8.10	8.10	9.40	11.40	1.00	2.15		4.30	6.10	8.25	10.40	12.25	2.10	4.05	5.35		10.40	2.10	5.35
E Headlands Dr	8.15v	8.15r	9.45	11.45	1.05	2.20		4.35	6.15	8.30	10.45	12.30	2.15	4.10	5.40		10.45	2.15	5.40
D Bayview Dr Estate - Old Coast Rd	8.20v	8.30s	9.50	11.50	1.10	2.25		4.40	6.20	8.35	10.50	12.35	2.20	4.15	5.45		10.50	2.20	5.45
C Ballina - Tamar St Bus Zone	8.25v	8.40s	10.00	12.00	1.20	2.35		4.50	6.25	8.40	10.55	12.40	2.25	4.20	5.50		10.55	2.25	5.50
B Ballina - Kerr St (KFC)	8.30v	8.45s	10.05	12.05	1.25	2.40		4.55	6.30	8.45	11.00	12.45	2.30	4.25	5.55		11.00	2.30	5.55
A Ballina - Byron Gateway Airport	8.40v	8.58s	10.10	12.10	1.30	2.45		5.00	6.35	8.50	11.05	12.50	2.35	4.30	6.00		11.05	2.35	6.00

Wheelchair Accessible Services

Route usually serviced by a low floor wheelchair accessible vehicle.
Periodic maintenance may affect availability.
Please check prior to journey.

Explanations

- ♿ - Route usually serviced by a low floor wheelchair accessible vehicle. Periodic maintenance may affect availability. Please check prior to journey.
- B - Journey operates via Beach Drive only.
- C - Connects at Mullumbimby with BVC 645 Service travelling to and from Ocean Shores.
- Q - Bus travels via Hayters Hill to Byron Bay school days. Departs from Bangalow Hotel.
- S - Journey operates NSW school days only.
- V - Journey operates NSW school holidays only.
- X - Bus sets down at Swift St school days only.
- Y - Arrival time at Jonson St is 8.30am during school vacation.
- Z - Service commences from corner Bayshore Drive & Centennial Circuit on Saturdays.
- .... - Journey does not operate past this timing point.

Timing Points

For your assistance, the symbols located in the timetables refer to corresponding locations on the route map.

* Weekends & Public Holidays

Route 641 operates weekdays. Route 637 operates weekdays and Saturday evenings. Routes 664 and 665 operate weekdays and Saturdays (not Easter Saturday). Route 640 operates on weekdays, Saturdays and Sundays. On public holidays the Route 640 Sunday timetable operates (not Christmas Day).

Fares

Passes must be produced for concession discounts each time a ticket is purchased. Unreadable passes are invalid. Passengers 16 years and over are required to pay full fare unless travelling to and from school, or upon presenting a valid school pass or other valid ID. Note health care cards do not entitle travellers to concession fares.

Lost Property

Please take all items with you before you leave the bus. If you find an item left on the bus, please hand it to the driver. Lost property enquiries for this service can be made at our depot, on 6686 2144. Please keep your bus ticket to help identify the bus involved.

Appendix C

Summary accessible pathways
AS 1428.1-2009

TABLE C1

SUMMARY OF SPECIFICATIONS FOR WALKWAYS, RAMPS AND LANDINGS

Component	Gradient	Width	Height	Length	Landing spacing		Maximum camber/crossfall	Clause/ Figure
Walkway (straight)	Not steeper than 1 in 20	1000 mm minimum unobstructed	N/A	N/A	**Walkway gradient** Less than 1 in 33 1 in 33 1 in 20 Between 1 in 33 and 1 in 20	**Landing spacing** N/A 25 m maximum 15 m maximum By interpolation	For walkway gradients shallower than 1 in 33; a camber or crossfall of not steeper than 1 in 40; or 1 in 33 where the surface is bitumen. Camber or crossfall not required where the walkway gradient is 1 in 33 or steeper	10.1 and 10.2
Walkway (curved)	Not steeper than 1 in 20	1500 mm minimum unobstructed	N/A	N/A	**Walkway gradient** Less than 1 in 33 1 in 33 1 in 20 Between 1 in 33 and 1 in 20	**Landing spacing** N/A 25 m maximum 15 m maximum By interpolation	For walkway gradients shallower than 1 in 33; a camber or crossfall of not steeper than 1 in 40; or 1 in 33 where the surface is bitumen. Camber or crossfall not required where the walkway gradient is 1 in 33 or steeper	10.1 and 10.4
Ramp (straight)	Steeper than 1 in 20 and not steeper than 1 in 14	1000 mm minimum unobstructed	See Premises Standards/BCA for maximum height of a series of connected ramps	N/A	**Ramp gradient** 1 in 14 1 in 20 Between 1 in 14 and 1 in 20	**Landing spacing** 9 m maximum 15 m maximum By interpolation	To be level	10.1 and 10.3
Ramp (curved)	Steeper than 1 in 20 and not steeper than 1 in 14	1500 mm minimum unobstructed	See Premises Standards/BCA for maximum height of a series of connected ramps	N/A	**Ramp gradient** 1 in 14 1 in 20 Between 1 in 14 and 1 in 20	**Landing spacing** 9 m maximum 15 m maximum By interpolation	N/A	10.1 and 10.4
Step ramp	Not steeper than 1 in 10	1000 mm minimum unobstructed	190 mm maximum	1900 mm maximum	N/A		To be level	10.1 and 10.6
Kerb ramp	Not steeper than 1 in 8	1000 mm minimum unobstructed	190 mm maximum	1520 mm maximum	N/A		To be level	10.1 and 10.7
Threshold ramp	Not steeper than 1 in 8	Minimum width of opening between door jambs unobstructed	35 mm maximum	280 mm maximum	N/A		N/A	10.5
Landing with no change of direction	Not steeper than 1 in 40 or 1 in 33 where the surface is bitumen	1000 mm minimum unobstructed	N/A	1200 mm minimum	Refer to walkways and ramps		A camber or crossfall not steeper than 1 in 40 or 1 in 33 where the surface is bitumen. At doorways no crossfall or camber	10.1 and 10.8
Landing with up to 90° change of direction	Not steeper than 1 in 40 or 1 in 33 where the surface is bitumen	1500 mm minimum unobstructed	N/A	1500 mm minimum	Refer to walkways and ramps for spacing of landings and Figure 13 for angle of approach requirements		A camber or crossfall of not steeper than 1 in 40 or 1 in 33 where the surface is bitumen. At doorways no crossfall or camber	10.1 and 10.8
Landing with between 90° to 180° change of direction	Not steeper than 1 in 40 or 1 in 33 where the surface is bitumen	1540 mm minimum unobstructed	N/A	2070 mm minimum	Refer to walkways and ramps for spacing of landings and Figure 13 for angle of approach requirements		A camber or crossfall of not steeper than 1 in 40 or 1 in 33 where the surface is bitumen. At doorways no crossfall or camber	10.1 and 10.8

Source: AS 1428.1-2009 Appendix C

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TECHNICAL REPORT 12

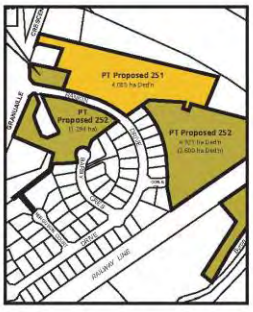
Acid Sulfate Soil Management Plan

Acid Sulfate Soil Management Plan

Living Gems

Skennars Head Road, Skennars Head

PLANNERS NORTH, April, 2017



COMPLIANCE AND USAGE STATEMENT

This Acid Sulfate Soil Management Plan has been prepared and submitted to accompany a Development Application made under Part 4 of the *Environmental Planning and Assessment Act 1979* by:

Preparation

Name:	Stephen Connelly
Company:	PLANNERS NORTH
Address:	3/69 Centennial Circuit, Byron Bay, NSW, 2478
Postal Address	P.O. Box 538, Lennox Head NSW 2478

Application

Proponent:	Living Gems
Address:	C/ - PLANNERS NORTH P.O. Box 538, Lennox Head NSW 2478
Land to be developed:	Lot 239 DP 1201225
Proposed development:	Seniors Living

Certificate

I certify that I have prepared the content of this Acid Sulfate Soil Management Plan and to the best of my knowledge:

- it is in accordance with the Act and Regulations, and
- it is true in all material particulars and does not, by its presentation or omission of information, materially mislead.

Notice

The plans to this document were prepared for the exclusive use of the proponent and are not to be used for any other purpose or by any other person or corporation. PLANNERS NORTH accepts no responsibility for any loss or damage suffered howsoever arising to any person or corporation who may use or rely on this document for purposes other than the proposed development.

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PLANNERS NORTH declares that it does not have, nor expects to have, a beneficial interest in the subject project. Nor does it have any reportable political donations within the meaning of Section 147(3) of the Act to declare.

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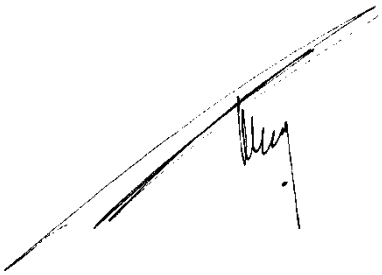

Stephen Connelly RPIA (Fellow)

PLANNERS NORTH

PIA Registered Planner Planning Institute Australia

ABN 56 291 496 553
3/69 Centennial Circuit
Byron Bay NSW 2481

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E: steve@plannersnorth.com.au
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Ref: 1522.1383
Date: April 2017

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LIST OF APPENDICES

1. INTRODUCTION

This section of the plan identifies the nature of client instructions, relevant background information and the structure of the report.

1.1 BACKGROUND

PLANNERS NORTH has been engaged by Living Gems to provide Town Planning advice with respect to DA 2016/524 lodged with Ballina Shire Council in regard to land described as Lot 239 DP 1201225. This Acid Sulfate Soil Management Plan (ASSMP) has been prepared to address requirements of Ballina Local Environmental Plan 2012 (BLEP12).

Plan 1.1 illustrates a site locality plan identifying the subject land.

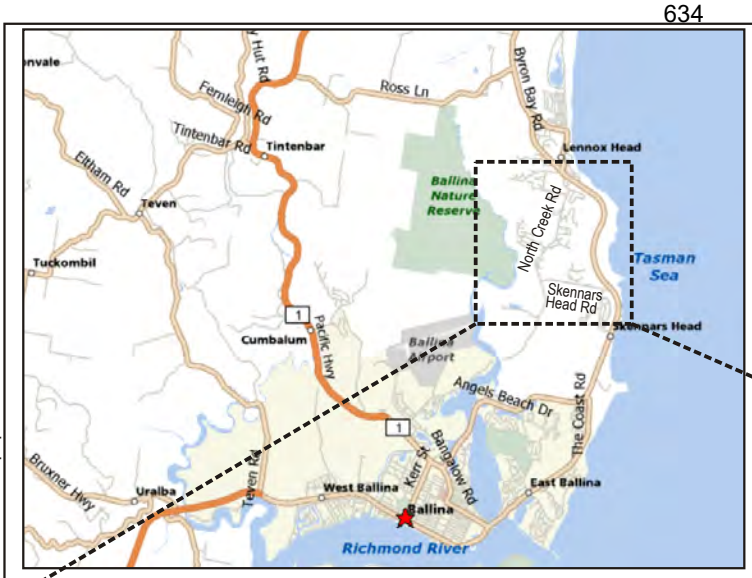
1.2 STRUCTURE OF REPORT

Section 2 of this report describes the structure and purpose of the report. Section 3 describes identification and assessment. Section 4 describes implementation and controls. The final section of the report describes the monitoring and review proposals.

Appendix A contains relevant background research report extracts.

1.3 FURTHER INFORMATION

Should Council require any additional information, or wish to clarify any matter raised by this proposal or submissions made to same, Council is requested to consult with **Stephen Connelly** on telephone **1300 66 00 87** prior to determination of this application.



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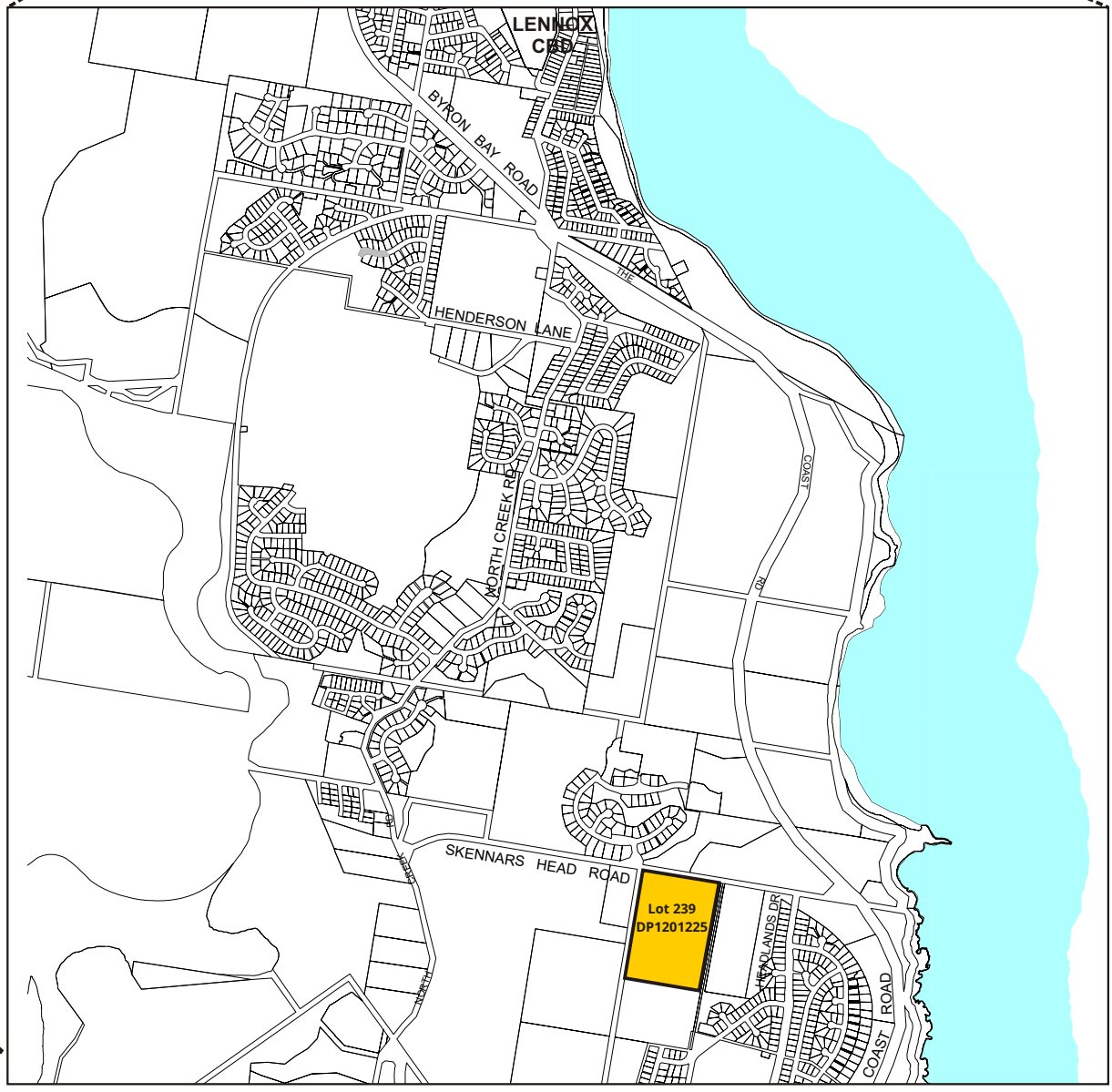

North

0 500m

1 : 25000 @ A4

Legend

Subject site

Plan 1.1

SITE LOCALITY

PLANNERS NORTH

1522.1

2. PURPOSE & SCOPE

This section of the plan defines the purpose of this ASSMP.

This Acid Sulfate Soil Management Plan (ASSMP) has been prepared by PLANNERS NORTH. Upon determination of DA 2016/524, and subject to any specific conditions of consent, the plan will be provided to the Civil Construction Contractor for implementation.

This ASSMP has been prepared to address Clause 7.1 of Ballina Local Environemtal Plan 2012, which provides:

"7.1 Acid sulfate soils

(1) The objective of this clause is to ensure that development does not disturb, expose or drain acid sulfate soils and cause environmental damage.

(2) Development consent is required for the carrying out of works described in the Table to this subclause on land shown on the Acid Sulfate Soils Map as being of the class specified for those works.

Class of land	*Works*
1	*Any works.*
2	*Works below the natural ground surface.*
	Works by which the watertable is likely to be lowered.
3	*Works more than 1 metre below the natural ground surface.*
	Works by which the watertable is likely to be lowered more than 1 metre below the natural ground surface.
4	*Works more than 2 metres below the natural ground surface.*
	Works by which the watertable is likely to be lowered more than 2 metres below the natural ground surface.
5	*Works within 500 metres of adjacent Class 1, 2, 3 or 4 land that is below 5 metres Australian Height Datum and by which the watertable is likely to be lowered below 1 metre Australian Height Datum on adjacent Class 1, 2, 3 or 4 land.*

(3) Development consent must not be granted under this clause for the carrying out of works unless an acid sulfate soils management plan has been prepared for the proposed works in accordance with the Acid Sulfate Soils Manual and has been provided to the consent authority.

(4) Despite subclause (2), development consent is not required under this clause for the carrying out of works if:

(a) a preliminary assessment of the proposed works prepared in accordance with the Acid Sulfate Soils Manual indicates that an acid sulfate soils management plan is not required for the works, and

(b) the preliminary assessment has been provided to the consent authority and the consent authority has confirmed the assessment by notice in writing to the person proposing to carry out the works.

(5) Despite subclause (2), development consent is not required under this clause for the carrying out of any of the following works by a public authority (including ancillary work such as excavation, construction of access ways or the supply of power):

(a) emergency work, being the repair or replacement of the works of the public authority, required to be carried out urgently because the works have been damaged, have ceased to function or pose a risk to the environment or to public health and safety,

(b) routine maintenance work, being the periodic inspection, cleaning, repair or replacement of the works of the public authority (other than work that involves the disturbance of more than 1 tonne of soil),

(c) minor work, being work that costs less than $20,000 (other than drainage work).

(6) Despite subclause (2), development consent is not required under this clause to carry out any works if:

(a) the works involve the disturbance of less than 1 tonne of soil, and

(b) the works are not likely to lower the watertable.

(7) Despite subclause (2), development consent is not required under this clause for the carrying out of works for the purpose of agriculture if:

(a) a production area entitlement is in force in respect of the land when the works are carried out, and

(b) the works are carried out in accordance with a drainage management plan, and

(c) the works are not carried out in respect of a major drain identified on the Acid Sulfate Soils Map, and

(d) the works are not carried out on land to which State Environmental Planning Policy No 14—Coastal Wetlands applies.

(8) In this clause:

***drainage management plan** means an irrigation and drainage management plan that:*

(a) is prepared in accordance with the NSW Sugar Industry Best Practice Guidelines for Acid Sulfate Soils (2005), and

(b) is endorsed by the Sugar Milling Co-operative as being appropriate for the land.

***NSW Sugar Industry Best Practice Guidelines for Acid Sulfate Soils (2005)** means the guidelines approved by the Director-General of the Department of Infrastructure, Planning and Natural Resources on 25 May 2005.*

***production area entitlement** means a contractual arrangement between the Sugar Milling Co-operative and a grower member of that cooperative for the production of sugar cane for milling.*

***Sugar Milling Co-operative** means the New South Wales Sugar Milling Co-operative Limited or its successor.*

Note.

The NSW Sugar Industry Best Practice Guidelines for Acid Sulfate Soils (2005) is available on the Department of Planning and Infrastructure's website."

2.1 BACKGROUND

A review of acid sulfate soil risk mapping indicates the presence of acid sulfate soils in the area. Field and laboratory tests by Coffey Geotechnics Pty Ltd confirmed this to be the case[1].

2.2 OBJECTIVES

The key objectives of this Plan are to:

- Ensure appropriate environmental controls and procedures are implemented during construction to minimise ASS impacts to the environment (in the event that ASS are encountered); and
- Ensure appropriate measures are implemented to comply with all relevant legislation.

[1] Coffey, Report for Living Gems Pty Ltd, Geotechnical, Acid Sulfate Soil and Phase 1 Environmental Site Assessments, Seniors Living Development, Skennars Head. 11 August 2016

2.3 RELEVANT LEGISLATIVE REQUIREMENTS AND GUIDELINES

ASS disturbance and management activities carried out for the project will comply with relevant legislation, regulations and guidelines. These include but are not limited to the legislation listed in **Table 2.1** and the guidelines following that table.

TABLE 2.1 KEY LEGISLATIVE AND REGULATORY REQUIREMENTS

Legislation / Policy	Relevance
NSW Environmental Planning and Assessment Act 1979 (EP&A Act)	The EP&A Act and Regulation include provisions to ensure that proposals which have the potential to impact the environment are subject to detailed assessment, and provide opportunity for public involvement. The EP&A Act requires compliance with the conditions of the development approval granted.
Protection of the Environment Operations Act 1997 (POEO Act)	The purpose of the POEO Act is to control pollution and set up a licensing regime for certain activities. The POEO ACT also regulates waste, including excavated soils.
Ballina Local Environmental Plan 2012	The Ballina LEP 2012 and Council DCP ASS Policy state that works to be undertaken on lands potentially at risk of ASS occurrence are not to proceed without an ASS investigation and implementation of an ASSMP (if required).

Guidelines and standards relevant to ASS management include:

- Acid Sulfate Soil Manual, NSW Acid Sulfate Soil Management Advisory Committee, 1998;
- Australian and New Zealand Guidelines for Assessment and Management of Contaminated Sites, ANZECC/NHMRC, 1992; and
- Assessment Classification and Management of Liquid and Non-Liquid Waste (EPA), 1999.

2.4 RESPONSIBILITIES

Key Contractor personnel responsible for implementation of the measures set out in this ASSMP are:

- Project Manager
- Site Manager
- Site Supervisor
- Project Superintendent (i.e. the civil engineer administering the construction contract)

3. IDENTIFICATION AND ASSESSMENT

This section of the plan reviews the characteristics of acid sulfate soils and identifies potential impacts as well as requirements for training.

3.1 ASS AND PASS

Acid sulfate soils are the common name given to naturally occurring sediments and soils containing iron sulphides (principally iron sulphide or iron disulphide or their precursors). The exposure of the sulphide in these soils to oxygen by drainage or excavation leads to the generation of sulphuric acid.

"acid sulfate soils" include actual acid sulfate soils or potential acid sulfate soils. Actual and potential acid sulfate soils are often found in the same soil profile, with actual acid sulfate soils generally overlying potential acid sulfate soil horizons.

"*actual acid sulfate soils*" are soils containing highly acidic soil horizons or layers resulting from the aeration of soil materials that are rich in iron sulphides. This oxidation produces hydrogen ions in excess of the sediment's capacity to neutralise the acidity resulting in soils of pH of 4 or less when measured in dry season conditions. These soils can usually be identified by the presence of pale yellow mottles and coatings of jarosite.

"*potential acid sulfate soils*" are soils which contain iron sulphides or sulphidic material which have not been exposed to air and oxidised. The field pH of these soils in their undisturbed state is pH 4 or more and may be neutral or slightly alkaline. However, they pose a considerable environmental risk when disturbed, as they will become severely acid when exposed to air and oxidised.

3.2 ASS OCCURRENCES

The Ballina Council ASS Risk Mapping indicates the following ASS conditions across the area of the development application as:

Extract from Acid Sulfate Soil Mapping

3.3 CONSTRUCTION ACTIVITIES

Construction activities which have the potential to cause ASS related impacts include:

- Shallow excavations;
- Deep excavations; and
- Dewatering.

3.4 POTENTIAL ENVIRONMENTAL IMPACTS

Potential ASS/PASS impacts from construction activities include:

- Uncontrolled surface runoff in areas of exposed actual ASS, causing the release of acid into the environment;
- Changes to surface run-off patterns promoting the release of acid into the environment;
- Leaching of acid into the environment at treatment sites;

- Exposing ASS at/near drains or streams, thus causing the release of acid into the environment in the short and long term; and

Exposure of PASS to the air, in drains or water courses, thus causing increased oxidisation and increased release of acid into the environment.

3.5 TRAINING AND AWARENESS

All Project personnel will undergo a general project induction prior to commencing work with the Contractor. This will include an ASS component to reinforce the importance of management and the measures that will be implemented to address ASS and PASS issues.

4. ASS MITIGATION AND MANAGEMENT MEASURES

Project mitigation and management measures and responsibilities are outlined in this Section of the plan.

4.1 IDENTIFICATION OF ACID SULFATE SOILS

The preliminary visual checking of potential ASS will be based on material type, colour and consistency. Dark grey and black, very soft to soft, occasionally firm clays and sandy and dark grey to grey clayey sands and sands will be classified as suspected acid sulfate soils. It should be noted that sands, with only minor amounts of silt and clay, can contain pyrite and therefore acidify upon exposure.

A field screening test using hydrogen peroxide (H2O2) should be performed regularly on excavated soils in areas where ASS or PASS is anticipated, or on suspect soils. The peroxide screening test should be undertaken based on Appendix I of the Acid Sulfate Soils Assessment Guidelines (Ahern et al, 1998). Soils that record a pH of below 4, following oxidation with H2O2, should be managed as acid sulfate soils.

Based on the results of pH monitoring, visual assessment and field screening, selected soils samples (at a minimum rate of 10% of screened samples) will be sent for laboratory analysis using the chromium reducible suite (Scr) method to confirm the peroxide screening test results to confirm the required liming rate.

4.2 ASS MITIGATION AND MANAGEMENT

A range of ASS management measures have been developed to be undertaken as part of the Project. **Table 4.1** describes the management and mitigation measures which will be initiated during various activities across the Project.

TABLE 4.1 ASS MANAGEMENT AND MITIGATION MEASURES

Activity	Management and Mitigation Measures	Responsibility
General	Minimise disturbance and exposure of ASS.	Site Supervisor
Site Preparation	Ensure appropriate areas are set aside for the treatment of ASS. These areas should be adequately barricaded and marked with appropriate signage. Sediment controls (such as silt fences or hay bales) should be established around the perimeter of these areas.	Site Supervisor
Excavation and Stockpiling of ASS	Investigations indicate that soils below 1m in depth are AASS. These soils should be excavated and stockpiled separately from other materials. These stockpiles should be placed in the designated areas. Stockpiles should be placed on an impermeable barrier and surrounded with appropriate sediment controls. Bund areas where ASS are exposed to prevent leachate entering the wider environment. Temporary stockpiling of untreated ASS should not exceed 5 days (for fine textured soils). Medium term stockpiles should not exceed 28 days (for fine textured soils) with provision for collection of leachate and	Site Supervisor

Activity	Management and Mitigation Measures	Responsibility
	run-off water. Stockpiling timeframes are based on Table 4 and Table 5, page 50 of Queensland ASS Technical Manual, presented in Figures 3 and 4. Store excavated ASS in conditions that simulate its natural state, or treat and store away from water bodies and drainage lines. Store PASS capable of producing leachate within lined bunds.	
Treatment of ASS	Undertake any potential ASS remediation works in accordance with the Acid Sulfate Soils Manual (ASSMAC, 1998). ASS and/or PASS can be placed directly back within the trench, with no treatment, within four days of excavation provided there is no evidence of oxidation. To assess if oxidation has occurred the stockpile should be visually assessed for jarosite staining, and field pH testing carried out. If there is evidence of oxidation (i.e. jarosite staining or pH less than 4), or the material has been excavated for longer than 4 days, than the following treatment will be required: A treatment pad is required in general accordance with the Figure 5, page 24 of Queensland ASS Technical Manual (shown in Figure 5-4). A guard layer should also be provided. The treatment pad should be located at least 40m from a permanent waterway or creek and if possible placed in a topographically high area to avoid inundation following heavy rain. Stockpiled soil should be spread in thin (<200mm) layers on impervious pads within the boundary of the site works. Lime should be added by hand or light weight truck followed by mixing, using light weight rotovators or similar tools. Appropriate records should be maintained regarding the treatment of ASS.	Site Supervisor
Importation of Lime for ASS Treatment	In order to neutralise ASS, lime should be imported onto the site. Lime imported should be accompanied with an appropriate Material Safety Data Sheet (MSDS). This MSDS procedure should be observed by personnel who be expected to handle the lime. Ensure that the lime is imported for direct use on ASS stockpiles, or is placed in a suitable designated area for later use.	Site Supervisor

Activity	Management and Mitigation Measures	Responsibility
	Ensure an appropriate lime register is maintained, listing the source of lime, quantity imported and where it is used on site.	
Dewatering	Ensure that an appropriate dewatering system is established to minimise the risk of impacted runoff water on the remainder of the site. Stormwater that collects in pits should be tested for pH and total dissolved solids. If the pH is above 6, and total dissolved solids are below 1500mg/L, than the water is suitable for use as dust suppression or to be irrigated over vegetated areas. If pH is less than 6, lime should be added to the water until the pH is above 6. If water is proposed to be discharged to nearby surface water bodies, then the surface water body should also be tested, and the results compared. If the results are similar, than the water may be suitable for discharge. Permission from the NSW Office of Water must be obtained before disposal.	Site Supervisor
Contingency	Materials encountered during construction works that is suspected of being ASS (material that is dark grey in colour and has a high organic odour) should be stockpiled separately and advice from a suitably qualified environmental consultant should be sought.	Site Supervisor
Reporting	ASS monitoring records; Excavation records; Stockpile tracking records; Register of lime used for ASS treatment; and Records of any offsite disposal of treated stockpiles (i.e. landfill waste disposal dockets).	Site Supervisor

5. MONITORING AND REVIEW

This section of the plan describes monitoring and inspection reporting matters which will occur for the duration of the project construction.

5.1 MONITORING, INSPECTION AND REPORTING

ASS monitoring and reporting of levels of impact will occur for the duration of the Project.

Daily visual inspections of the construction site will be undertaken to identify actual or potential ASS concerns.

Documented weekly environmental inspections of the construction site will also be undertaken using a weekly environmental inspection checklist. The weekly checklist includes a section on ASS.

The ASS monitoring, inspection and reporting program is shown in **Table 5.1** following.

TABLE 5.1 ASS MONITORING AND REPORTING PROGRAM

Activity	Area/ Parameter	Resources	Responsibility	Frequency	Reported To
ROUTINE MONITORING					
Monitoring of disturbed soil for ASS	Field pH, 30% peroxide, chromium suite if required.	ASS Chance Find Procedure	Site Supervisor	As required, as soil is disturbed	Site Manager
Monitoring of treated ASS	pH, chromium suite	Treatment of ASS Procedure	Site Supervisor	Weekly pH monitoring, chromium suite monthly to confirm neutralisation	Site Manager
ROUTINE INSPECTIONS					
Daily Environmental Inspection	All	Site Diary	Site Supervisor	Daily	Site Manager
Activity	Area/ Parameter	Resources	Responsibility	Frequency	Site Manager
Weekly Environmental Inspection	All	Weekly Environmental Inspection Checklist	Site Supervisor	Weekly	Site Manager

External Audits	All	External Audit Checklist	Environmental Representative	Quarterly	Held by the Project Superintendent for the supply to Council if requested
REPORTING					
Monthly Environmental Reports	All	Weekly Environmental Checklist	Site Supervisor	Monthly	Site Manager
Six Monthly Compliance Tracking Report	All	Six Monthly Compliance Tracking Report	Site Manager	Six Monthly	Project Superintendent
Six Monthly Performance Against Targets	All	Six Monthly Environmental Performance Report	Project Manager	Six Monthly	Project Superintendent

Table 5.2 below summarises specific inspection and monitoring requirements associated with ASS management controls.

TABLE 5.2 ADDITIONAL INSPECTION AND MONITORING REQUIREMENTS

Management Practice	Monitoring	Responsibility	Reported To
Carry out visual checks and field testing for potential ASS	Daily inspections during work	Site Supervisor	Site Manager
Keep working face and areas of open excavation to a minimum	Daily inspections during work	Site Supervisor	Site Manager
Stabilise disturbed areas as soon as possible	Weekly inspections	Site Supervisor	Site Manager
Minimise stockpiling by coordinating excavation, spreading, regarding, and compaction activities	Weekly inspections	Site Supervisor	Site Manager
Cover/vegetate stockpiles where material is to remain exposed for a long period of time	Daily inspections of stockpiles	Site Supervisor	Site Manager

Management Practice	Monitoring	Responsibility	Reported To
Prevent the movement of sediment away from stockpiles and construction areas by installing erosion and sediment control structures	Daily inspections of sediment controls	Site Supervisor	Site Manager
Restrict traffic to defined roads	Daily inspections	Site Supervisor	Site Manager
Minimise on-site vehicle activity on disturbed surfaces during and after rain events	Daily inspections during and for a period after rain events	Site Supervisor	Site Manager
Monitoring of ASS stockpiles after treatment	pH monitoring after initial treatment event. If pH values are <4, additional treatments will be required. The results of ASS monitoring events should be reported to The Project Manager in a timely manner so work stoppages are kept to a minimum.	Site Supervisor	Site Manager
Management of treated ASS by appropriate and timely on-site re-use or offsite disposal	During daily works	Site Supervisor	Site Manager

APPENDIX A

Report Extracts

6. Acid Sulfate Soil Assessment

6.1. Definition of Coastal Acid Sulfate Soils

Coastal Acid Sulfate Soils (ASS) are soils containing significant concentrations of pyrite, which when exposed to oxygen in the presence of sufficient moisture, oxidises, resulting in the generation of sulfuric acid. Unoxidised pyritic soils are referred to as **Potential** ASS (PASS). When the soils are exposed, the oxidation of pyrite occurs and sulfuric acids are generated, at which stage the soils are said to be **Actual** ASS (AASS).

Pyritic soils typically form as waterlogged, saline sediments rich in iron and sulfate. Typical coastal environments leading to the formation of these soils include tidal flats, salt marshes and mangrove swamps below about RL5m AHD. They can also form as bottom sediments in coastal rivers and creeks.

Pyritic soils of concern on low lying NSW and coastal lands have mostly formed in the Holocene Period (ie: 10,000 years ago to present day), predominantly in the 7,000 years since the last rise in sea level. It is generally considered that pyritic soils which formed prior to the Holocene (ie: >10,000 years ago) would have already oxidised and leached during periods of low sea level which occurred during ice ages, exposing pyritic coastal sediments to oxygen. This may not have occurred in every case, however, and some older ASS is known to contain unoxidised pyrite.

6.2. Significance of ASS

Disturbance or poorly managed development and use of ASS can generate significant amounts of sulfuric acid, which can lower soil and water pH to extreme levels (generally pH <4) and produce acid soils, resulting in high salinity.

The low pH, high salinity soils can reduce or altogether preclude vegetation growth and can produce aggressive conditions which may be detrimental to concrete and steel components of structures, foundations, pipelines and other engineering works.

Generation of acid conditions often releases aluminium, iron and other naturally occurring elements from the otherwise stable soil matrices. High concentrations of such elements, coupled with low pH and alterations to salinity, can be detrimental to aquatic life. In severe cases, affected waters flowing off site into nearby waterways can have a detrimental effect on those aquatic ecosystems.

6.3. Review of Acid Sulfate Soil Risk Maps

A review of the Department of Land and Water Conservation (DLWC) Edition 2 (1997) Lismore-Ballina Acid Sulfate Soil Risk Map indicates that there are three zones of ASS risk mapped across the site.

- The elevated terrain at the north-west of the site is not susceptible to the presence of ASS, given the residual nature of the subsurface soils being derived from Lismore Basalts. These soils could however be naturally slightly acidic.
- Across the lower-lying terrain, the following mapping of ASS risk is present:
    - Typically across the eastern half of the site towards the coast, the land is mapped as Wa2 – indicating wind-blown deposits, with a low probability of ASS soil at depths of around 1m to 3m. A low risk is therefore shown, although localised occurrences of ASS may be present.

- Typically across the western half of the site towards the wetland landform, the land is mapped as Es1 – indicating estuarine swamp deposits, with a high probability of ASS soil within 1m of the ground surface. There is a severe environmental risk if ASS material is disturbed, for instance through shallow drainage, excavation or clearing.

The boundaries of the risk mapping and description of the location of the risk mapping should be considered approximate only.

The geology of the site is noted in Section 4.1 for reference.

6.4. Regulatory Background and Applicable Guidelines

The action criteria for acid sulfate soils assessments are provided in Acid Sulfate Soils Manual (ASSMAC 1998).

The action criteria presented in Table 6-1 trigger the need for development activities to prepare a management plan and obtain development consent. The action criteria are based on the percentage of oxidisable sulfur (or equivalent) for different soil types. It is understood that planned earthworks within the site are likely to disturb over 1,000 tonnes of soil. For projects that disturb over 1,000 tonnes the action criteria for oxidisable sulfur (SPOS) is 0.03%S (net acidity).

Table 6-1 includes criteria for smaller disturbances of three broad soil texture categories.

Table 6-1: ASS Action Criteria

Type of Material		**Action Criteria 1-1,000 tonnes disturbed**		**Action Criteria if more than 1,000 tonnes disturbed**	
Texture range. McDonald *et al.* (1990)	**Approx. Clay content** (%<0.002mm)	**Net Acidity Sulfur trail** % S oxidisable (oven-dry basis) eg S_{TOS} or S_{POS}	**Net Acidity Acid Trail** mol H+/ Tonne (oven-dry basis) eg. TPA or TSA	**Net Acidity Sulfur trail** % S oxidisable (oven-dry basis) eg S_{TOS} or S_{POS}	**Net Acidity Acid Trail** mol H+/ Tonne (oven-dry basis) eg. TPA or TSA
Coarse Texture **Sands to loamy Sands**	≤ 5	0.03	18	0.03	18
Medium Texture **Sandy loams to light clays**	5 – 40	0.06	36	0.03	18
Fine Texture **Medium to heavy clays and silty clays**	≥ 40	0.1	62	0.03	18

Source: ASSMAC (1998) Acid Sulfate Soils Manual

6.5. Laboratory Test Results

The results of ASS peroxide field screen tests are shown in Table 6-2.

Values in bold indicate that the relevant samples were submitted for additional Chromium Suite tests to assess the proportion of inorganic reducible sulfur within the soil. The results of Chromium Suites of tests are shown in Table 6-3. The laboratory certificates of analysis are included in Appendix C.

Table 6-2: Peroxide Screen Test Results Summary

Location and Depth	pH_{field}	$pH_{field,oxidised}$	Reaction Rating
BH1 0 – 0.5m	5.5	3.3	None to slight
BH1 0.5 – 1.0m	5.5	3.9	None to slight
BH1 1.0 – 1.5m	4.5	3.3	None to slight
BH1 1.5 – 2.0m	4.6	2.3	Strong with froth
BH1 2.0 – 2.5m	**5.3**	**1.3**	**Extreme**
BH2 0 – 0.5m	5.9	4.1	Moderate
BH2 0.5 – 1.0m	6.3	4.6	None to slight
BH2 1.0 – 1.5m	**6.1**	**4.4**	**Strong with froth**
BH2 1.5 – 2.0m	6.2	4.4	Strong with froth
BH2 2.0 – 2.5m	**6.0**	**3.1**	**Extreme**
BH3 0 – 0.5m	5.8	4.1	Moderate
BH3 0.5 – 1.0m	4.9	3.9	None to slight
BH3 1.0 – 1.5m	4.9	3.7	None to slight
BH3 1.5 – 2.0m	4.8	3.5	None to slight
BH3 2.0 – 2.5m	4.6	3.5	None to slight
BH4 0 – 0.5m	4.8	1.8	Strong with froth
BH4 0.5 – 1.0m	4.8	2.7	Strong with froth
BH4 1.0 – 1.5m	**4.9**	**2.4**	**Strong with froth**
BH4 1.5 – 2.0m	5.0	2.5	Strong with froth
BH4 2.0 – 2.5m	5.8	2.2	Moderate
BH5 0 – 0.5m	5.6	3.3	Strong with froth
BH5 0.5 – 1.0m	5.5	3.7	None to slight
BH5 1.0 – 1.5m	5.6	3.5	Strong with froth
BH5 1.5 – 2.0m	**5.9**	**3.5**	**Extreme**
BH5 2.0 – 2.5m	6	3.6	Extreme
BH6 0 – 0.5m	4.4	3.1	Strong with froth
BH6 0.5 – 1.0m	**4.9**	**2.6**	**Strong with froth**
BH6 1.0 – 1.5m	4.4	2.9	None to slight
BH6 1.5 – 2.0m	5.0	2.4	Strong with froth

Location and Depth	pH_{field}	$pH_{field,oxidised}$	Reaction Rating
BH6 2.0 – 2.5m	5.6	3.3	Strong with froth
BH7 0 – 0.5m	6.2	3.8	Strong with froth
BH7 0.5 – 1.0m	6.0	4.1	Strong with froth
BH7 1.0 – 1.5m	6.5	4.3	Strong with froth
BH7 1.5 – 2.0m	6.6	4.0	Strong with froth
BH7 2.0 – 2.5m	**6.1**	**2.1**	**Strong with froth**
BH8 0 – 0.5m	**5.1**	**2.0**	**Strong with froth**
BH8 0.5 – 1.0m	5.5	3.5	Moderate
BH8 1.0 – 1.5m	6.0	3.6	Strong with froth
BH8 1.5 – 2.0m	6.1	3.7	Strong with froth
BH8 2.0 – 2.5m	6.1	3.1	Strong with froth

Table 6-3: Chromium Suites Test Results Summary

Location and Depth	Titratable Actual Acidity mol H^+ per tonne	Chromium Reducible Sulfur (CRS) % S	Acid Neutralising Capacity % S	Liming Rate kg CaCO3 per tonne dry weight
BH1 2 – 2.5m	**76**	< 0.005	0	5.7
BH2 1.0 – 1.5m	17	0.01	0	1.7
BH2 2.0 – 2.5m	14	**0.16**	0	8.6
BH4 1.0 – 1.5m	**250**	0.024	0	20
BH5 1.5 – 2.0m	**30**	**0.05**	0	5.3
BH6 0.5 – 1.0m	4	< 0.02	0	< 1
BH7 2.0 – 2.5m	**19**	0.03	0	7.0
BH8 0 – 0.5m	**83**	**0.13**	0	6.3

Note to Table 6-2: Values highlighted in bold exceed the adopted Action Criteria for ASS.

6.6. Interpretation of Acid Sulfate Soil Results

The level of disturbance of the existing soil for the proposed filling of the site is expected to be limited to less than 1m by depth. The disturbance may involve clearing soft and compressible surface materials in preparation for receiving controlled fill for the development platform. For the purposes of the assessment we have adopted the criteria of 0.03% CRS (18 mole TAA) for granular materials notwithstanding the quantum of disturbance to the existing ground.

The test results are interpreted as follows:

- The site soils are considered to be Potential Acid Sulfate Soils (PASS) on the basis of a number of samples returning a proportion of inorganic and reducible sulfur in excess of the 0.03% CRS criteria at the levels tested, including within 0 – 0.5m of the ground surface.

- BH4 1 – 1.5m is considered to be an Actual Acid Sulfate Soil (AASS) evidenced by the high current acidity and some remaining presence of CRS, indicating that the oxidation of the sulfur may have already occurred due to natural process (i.e. groundwater level movements).

- A liming rate of up to 20 kg per dry tonne of material disturbed has been calculated by the laboratory.

Based on the test results and the interpretation we recommend that an Acid Sulfate Management Plan (ASSMP) be developed for the proposed works once site preparation and filling strategies have been considered further by the civil designers, in order to manage any material removed for site preparation or lowering of the groundwater where required.

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TECHNICAL REPORT 13

Post Construction Waste Management Plan

PLANNERS NORTH

1522.2383

Updated Post Construction Waste Management Plan

GemLife

Skennars Head Road

Skennars Head

PLANNERS NORTH, May, 2018

COMPLIANCE AND USAGE STATEMENT

This Updated Post Construction Waste Management Plan has been prepared and submitted in support of Ballina Shire Council Development Application 2016/524 made under Part 4 of the *Environmental Planning and Assessment Act 1979* by:

Preparation

Name:	Stephen Connelly
Company:	PLANNERS NORTH
Address:	3/69 Centennial Circuit, Byron Bay, NSW, 2478
Postal Address	P.O. Box 538, Lennox Head NSW 2478

Application

Proponent:	GemLife
Address:	C/ - PLANNERS NORTH P.O. Box 538, Lennox Head NSW 2478
Land to be developed:	Lot 239 DP 1201225
Proposed development:	Seniors Living

Certificate

I certify that I have prepared the content of this Updated Post Construction Waste Management Plan and to the best of my knowledge:

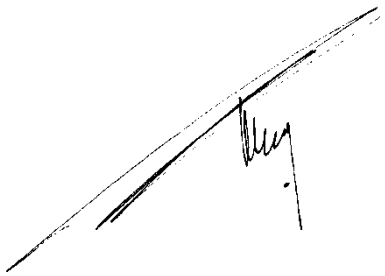
- it is in accordance with the Act and Regulations, and
- it is true in all material particulars and does not, by its presentation or omission of information, materially mislead.

Notice

The plans to this document were prepared for the exclusive use of the proponent and are not to be used for any other purpose or by any other person or corporation. PLANNERS NORTH accepts no responsibility for any loss or damage suffered howsoever arising to any person or corporation who may use or rely on this document for purposes other than the proposed development.

Plans accompanying this document may not be reproduced, stored or transmitted in any form unless this note is included.

PLANNERS NORTH declares that it does not have, nor expects to have, a beneficial interest in the subject project. Nor does it have any reportable political donations within the meaning of Section 147(3) of the Act to declare.



Stephen Connelly RPIA (Fellow)

PLANNERS NORTH

PIA Registered Planner Planning Institute Australia

ABN 56 291 496 553
6 Porter Street,
Byron Bay NSW 2481

T: 1300 66 00 87
E: steve@plannersnorth.com.au
W: plannersnorth.com.au

Ref: 1522.1384
Date: May 2018

TABLE OF CONTENTS

LIST OF PLANS

LIST OF TABLES

LIST OF APPENDICES

1. INTRODUCTION

This section of the plan identifies the nature of client instructions, relevant background information and the structure of the report.

1.1 BACKGROUND

PLANNERS NORTH has been engaged by GemLife to provide Town Planning advice with respect to DA 2016/524 lodged with Ballina Shire Council in regard to land described as Lot 239 DP 1201225. This Post Construction Waste Management Plan is to be read in conjunction with Construction Waste Management Plan lodged as Technical Report #3 to the Development Application.

Plan 1.1 illustrates a site locality plan identifying the subject land.

1.2 STRUCTURE OF REPORT

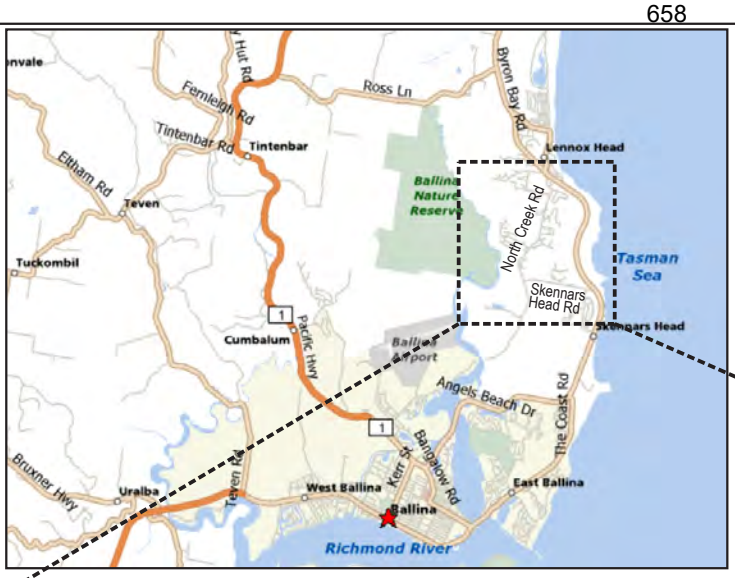
Section 2 of this report describes the purpose and scope of this Plan. Section 3 describes waste management proposals for GemLife Seniors Living Development.

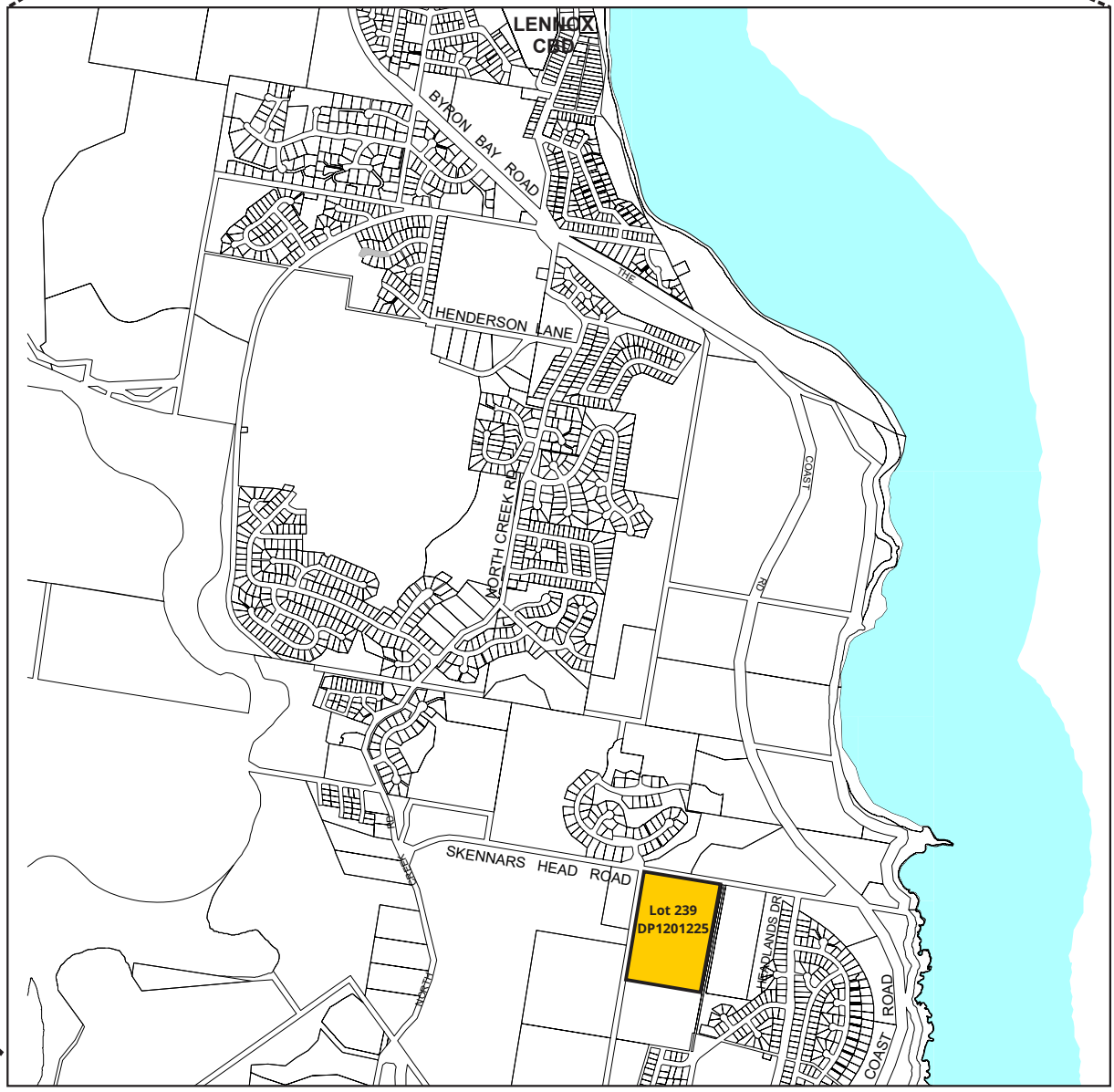
Appendix A contains relevant plans.

1.3 FURTHER INFORMATION

Should Council require any additional information, or wish to clarify any matter raised by this Post Construction Waste Management Plan, Council is requested to consult with **Stephen Connelly** on **1300 66 00 87** prior to determination.

Source: Mapquest website





North

0 500m

1 : 25000 @ A4

Legend

Subject site

Plan 1.1

SITE LOCALITY

PLANNERS NORTH

1522.2383

2. PURPOSE & SCOPE

This section of the plan sets out the purpose and scope of the Management Plan defining the relevant project objectives, statutory requirements, implementation and responsibilities.

2.1 BACKGROUND

Pursuant to Chapter 2, Section 3.7 of Ballina Development Control Plan 2012, Ballina Shire requires the preparation of Waste Management Plans for certain developments. A Construction Waste Managment Plan accompanied the Development Application 2016/524. This plan supplements that documentation with post construction proposals for waste management.

2.2 OBJECTIVES

The key objectives of this plan are to:

- ensure that waste is disposed in accordance with development legislation and Council's collection and disposal services; and
- ensure that wate management practives are based on minimising waste and maximising reuse and recycling of materials.

2.3 RELEVANT REQUIREMENTS

This plan has been prepared having regard to the requirements of Chapter 2, Section 3.7 of the Ballina Shire Development Control Plan 2012.

2.4 RESPONSIBILITIES

The onsite manager will be responsible for the implementation of the measures set out in this plan.

3. WASTE MANAGEMENT

This section of the plan generally describes the way in which waste is intended to be managed at GemLife Seniors Living Development, Skennars Head.

3.1 GENERAL OPERATIONS

Each seniors living site will be serviced via a 80L refuse bin and 40lt recycling bins (see plans at **Appendix A**). A site protocol will be established by the site manager in conjunction with the contractual agreements for private collection of waste to refine the best process for the site.

The contractor (operating within a medium rigid vehicle) will enter the site and attend to all refuse and recycling bins from each seniors dwelling and the nominated waste collection points. The internal road system ensures no limitations prevent internal access by contracted waste management companies. Refuse and recycling cubic bins will be provided, the location shown on the plans at **Appendix A**.

With reference to Council's Policy Construction Site Waste Minimisation and Management, the following comments are provided:

3.2 WASTE STORAGE

The following storage volumes have been calculated in accord with Councils requirements. Given that Seniors Living is not specifically identified within Council's policy, it is envisaged that the typical waste generation of Seniors Living would be similar to that of a unit within a Multi Dwelling Housing Development. It is noted the storage rates are based on a once weekly collection for refuse and fortnightly collection of recyclables.

TABLE 3.1 REFUSE

	Storage Rate	Units	Volume Required	Volume Provided
Residential	80L/Dwelling/Week	147	11,760L	147 x 80L refuse bins for each allotment emptied weekly + 5 x 80L at clubhouse

TABLE 3.2 RECYCLING

	Storage Rate	Units	Volume Required	Volume Provided
Residential	40L/Dwellings/Week	147	5,880L	147 x 40L recycle refuse bins for each allotment emptied fortnightly + 5 x 80L at clubhouse

Each seniors living dwelling has sufficient area to accommodate their individual bins. It is anticipated that recycling be collected fortnightly.

3.3 Collection Points

The contractor (operating within a medium rigid vehicle) will enter the site and attend to all refuse and recycling bins from each sitey. The road system ensures no limitations prevent internal access by contracted waste management companies.

3.4 Contractor Access

The contractor (operating within a medium rigid vehicle) will enter the site and attend to all refuse and recycling bins from each allotment and the nominated waste collection points for general waste from the community facility. The internal road system ensures no limitations prevent internal access by contracted waste management companies.

3.5 Ongoing waste management

The private waste services will be used on a contract basis.

SCALE 1:1500 @ A3

PROPERTY INFORMATION

LOT 239 ON DP1201225 P

TOTAL SITE AREA - 11.61ha

HOMES - 147

MANAGERS RESIDENCE - 1

EMERGENCY EXIT

BUILDER: GTH PROJECT NO 4 PTY LTD
WMS CHARTERED ACCOUNTANTS
SUITE 1401, LEVEL 14, THE ROCKET,
203 ROBINA TOWN CENTRE DRIVE, ROBINA QLD 4226
PO BOX 8087, GOLD COAST MAIL CENTRE QLD 9726
PH (07) 3804 7833
EMAIL: ADRIAN@GEMLIFE.COM.AU
QBCC LICENCE NUMBER: 15029129

AMENDMENTS: DATE/ ISSUE

A. 04.11.17 G. 19.03.18 M. 23.04.18
B. 06.11.17 H. 22.03.18 N. 11.05.18
C. 06.11.17 I. 28.03.18 O. 21.05.18
D. 23.02.18 J. 07.04.18
E. 24.02.18 K. 09.04.18
F. 01.03.18 L. 10.04.18

GENERAL NOTES

ALL WORK TO COMPLY WITH THE POSITIONS OF THE BCA AND NCC OF AUSTRALIA, AUSTRALIAN STANDARDS AND ANY BYLAWS OR REQUIREMENTS OF THE LOCAL AUTHORITY.

USE FIGURED DIMENSIONS ONLY.
DO NOT SCALE - VERIFY ALL DIMENSIONS PRIOR TO ORDERING OR SHOP FABRICATION.
IF IN DOUBT ASK.

PLEASE READ CAREFULLY

THIS PLAN CERTIFIED CORRECT IS THE ONE REFERRED TO IN THE CONTRACT & SPECIFICATIONS AND I UNDERSTAND CHANGES HEREAFTER MAY NOT BE POSSIBLE. THESE SUPERCEDE ALL OTHER PREVIOUS PLANS OR SKETCHES.

OWNER/S _______________

WITNESS _______________ DATE _______

CLIENT: GemLife

SITE: 67 SKENNARS HEAD ROAD LENNOX HEAD

MODEL: SITE PLAN

ISSUE: O

JOB NO.: LH-01

SHT NO.: 1 OF 1

ISSUE DATE: 21/05/18

DRAWN: FJ

GemLife LENNOX HEAD

APPENDIX 1 - SITE PLAN

TECHNICAL REPORT 14

Heritage Assessment

EVERICK
Heritage Consultants Pty Ltd
PO Box 200 COFFS HARBOUR 2450
Head Office: PO Box 146 Red Hill Q. 4059
t: 1300 124 356
info@everick.com.au
www.everick.com.au
ABN 78 102 206 682

29 May 2017 Our Ref: EV.537

Steve Connelly
Planners North
3/69 Centenial Circuit
BYRON BAY NSW 2481

Dear Steve,

RE: 67 SKENNARS HEAD ROAD, SKENNARS HEAD NSW.
ABORIGINAL HERITAGE ASSESSMENT.

Thank you for the opportunity to provide advice on Aboriginal Heritage for the proposed development application located at Lot 239 DP1201225, 67 Skennars Head Road, Skennars Head NSW (the 'Project Area'). This investigation is in response to written correspondence from the Office of Environment and Heritage ('OEH') requiring additional investigation into any 'intangible' heritage within the Project Area and documentation of consultation with Aboriginal people.

Please find **enclosed**:

a) Attachment A: Literature review of stories associated with 'Goanna Headland' (Appendix 1);

b) Attachment B: outcomes of consultation with Ms Lois Cook regarding the proposal (Appendix 2);

c) Attachment C: A map of the Project Area and proposed development design (Appendix 3);

d) Attachment D: Field photos (Appendix 4);

e) Attachment E: Due Diligence statements (Appendix 5); and

f) Attachment F: Recommendations (Appendix 6).

Initial consultation over the cultural values of the Project Area was made with the Jali LALC CEO Mikael Smith and long standing Sites Officer Marcus Ferguson. They both were of the opinion that Lois Cook was the most appropriate cultural knowledge holder for the area subject to the Development Application.

Everick Senior Archaeologist, Mr Adrian Piper, met with Ms Cook at Lennox Head and at 67 Skennars Head Road on May 1st 2017 to discuss the significance of the site. We can confirm that as a result of the study, there is no

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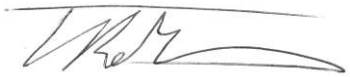
information which indicates that the Project Area contains any significant 'intangible' cultural heritage or any Aboriginal objects. Ms Cook raised no concerns about the potential for the Project to result in harm to significant cultural values.

Please contact Senior Archaeologist Tim Hill on 0422 309 822 or t.hill@everick.com.au to further discuss the results of the site inspection and recommendations.

Yours faithfully,



Tim Robins
Director
Everick Heritage Consultants

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APPENDIX 1: LITERATURE REVIEW.

The most complete literary source as to the Aboriginal values of the Lennox Head area between Lennox Head and Ballina is entitled: *Angels Beach Development Area, Traditional and Contemporary Significance. Prepared for Jali Local Aboriginal Land Council and Ballina Shire Council by Laila Hagland 1991.* In compiling the report in relation to the Angels Beach development, wide ranging interviews were held with members of the Bundjalung people representing a wide range of age groups. Central areas of the investigation were evidence of traditional, that is, remembered use of the study area, prehistoric use, stories relating to massacres and mythology. This included information regarding an extensive increase site for sand goannas. The brief version of the story of the Goanna increase site behind Angels Beach was told to Lois Ansell by her uncle, the late Doug Cook (Hagland Summary 1991: i).

> *The Goanna and the Poison Snake had a fight and the Poison Snake crawled between the Goanna and her eggs and kept them apart. The eggs are on Boulder Beach, near a small lagoon.*
> *This Goanna is female. Her head is formed by Black Head. The rocks at Whites Head and Skenners Head are her tail. The headland at Sand Point and the ridge going westward towards Chickiba Creek are part of her body and limbs. The poison snake is curled up at Rocky Point (Ibid: iii).*

Hagland noted at the time that due to the young age (17 to 18) of Lois Ansell (nee Cook) the version as related by the late Doug Cook to his niece was:

> *"a children's version of the Goanna story. This, however, implies the former existence of stories at a higher level of sacred significance, told only to persons properly initiated, and the continued existence of the Goanna djurebil. There are no known defined borders to this site… The goanna is known to have played an important role in Bundjalung religious beliefs as well as the beliefs of Aboriginal groups over a wide area. The opposition goanna/snake is widespread in totemic symbolism. Goannas have been mentioned as important in Bundjalung initiation ceremonies, including the initiation of the so called clever-men i.e. a higher than normal degree of initiation (Ibid v-vi)".*

Everick understand the primary living Aboriginal knowledge holder of the mythology in this locality remains Ms Lois Cook. The cultural value of this area is also widely known within the local Aboriginal community. For example, whilst working near Angels Beach Mr Ferguson described how as school children they would remark that they were going over the goanna as they travelled to local football games (Ferguson *pers. comm.* 2013).

The Hagland report contains many other references to Bundjalung mythology, fragments held by families such as the Cook family of sites where ceremonies could be performed to increase certain foods such as fish or yams. In

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Bundjalung language these sites are called *djurebil.* Chickiba Creek appears to have been a centre for such sites and ceremonies. Many of the knowledge holders who informed the 1990 study have passed away.

It is uncertain whether information provided by Bundjalung informants in 1991 would have the same public accessibility today, as many Aboriginal communities and individuals now place restrictions on accessibility to traditional knowledge. Therefore those references are not quoted here.

However Lois Cook provided a publication of which she is the author (*Goori Gimung Aboriginal Spirit*) which provides publically accessible illustrated stories of the creation as told by the Cook family.

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APPENDIX 2: CONSULTATION WITH MS LOIS COOK

Initial consultation was made with the Jali LALC CEO Mikael Smith and long standing Sites Officer Marcus Ferguson as to the correct approach to the request by the OEH. They both were of the opinion that Lois Cook was the most appropriate cultural knowledge holder for the area subject to the Development Application. I met Ms Cook at Lennox Head on May 1st 2017 where we discussed the significance of the site and also drove to the site where further discussion took place.

In terms of mythology Lois stated *Goanna Dreaming is Flat Rock where there was once a stone arrangement that may have been destroyed by sand mining. There are some writings about stone arrangements not far from the Goanna site…they could have been the hexagonal* stones, quartz or *opal depending on where they (the people) came from. Boulder Beach is a mythological space of the Poison Snake Dreaming…Because of the significance of this space, two sacred spaces the Goanna and The Poison Snake, the area was very important…it celebrates the coming together of these two stories…the sites represent the coming together of people to celebrate.*

In terms of the physical attributes of the site Lois was of the view: *its about what other resources there are than the beach… mullet and the Australian salmon which have come back… the site is one of those back burner areas when the seas are up. There will be usage of the creek* (an ephemeral watercourse through the site) *preparation areas… a kitchen. They would have had wells in the creek for dry times. The creek flows to a women's area over* there (to the north in the dune across The Coast Road). *There will be ceremonial grounds nearby.*

In answer to the question how far west would the 'influence' of the Goanna Poison Snake mythology extend, Lois' reply was all encompassing: the coastline and all of the creeks and streams were the result of the movements of the Goanna and the Rainbow Serpent.

In reference to the Development Application Lois noted the heavy grass cover, due to which it was agreed unlikely that any cultural heritage could be found. I pointed out that to my knowledge a 'walk over' had not been conducted in relation to this Application. However former Jali Sites Officer Artie Ferguson (deceased) and I had inspected the property in 1994 in relation to a rezoning proposal and had found nothing. Lois suggested that a 'walk over be conducted after the grass had been slashed to a low level. I pointed out that cultural heritage was unlikely to be impacted as the majority of building areas would need to be filled to at least a metre. The stream line and vegetation on the western side of the property would be retained.

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APPENDIX 3: PROJECT AREA LOCATION

APPENDIX 4. FIELD PHOTOGRAPHS

Project Area view south.

Project Area view south west.

APPENDIX 5: DUE DILIGENCE STATEMENTS.

The purpose of the Due Diligence Assessment is to determine if there are areas that have a particular potential to contain Aboriginal cultural heritage and to assess whether the proposed development will destructively impact upon known and or concealed heritage sites. The Due Diligence Code recommends a staged analysis of cultural and archaeological factors. This section discusses the analysis of the Project Area when compared against these guidelines.

3.1 Step 1: Will the activity disturb the ground surface?

Yes, the proposed works will disturb the ground surface. The nature of this disturbance will include excavation (cutting and filling) of footings for essential utilities. The site is low lying former melaleuca swamp and a small area of littoral rainforest in the north-west sector. Therefore filling with introduced materials will be required over the majority of the site to raise RL levels to regulation heights.

Approximately 20% of the site will be retained by other constraints such as drainage, flora and fauna.

3.2 Step 2a: Search of AHIMS Database

A search of the Aboriginal Heritage Information Management System (AHIMS) was undertaken (Client Service ID281297) for Lot 239 DP1201225. The search revealed that no Aboriginal Sites have been recorded within the Project Area.

3.3 Step 2b: Is the activity in an area where landscape features indicate the presence of Aboriginal cultural heritage?

Having regard to:

a) the nature of Aboriginal occupation in the region;

b) the Project Area's proximity to resources; and

c) the Project Area's original vegetation, soils and topography.

The Project Area is within a coastal landscape which is identified by the Due Diligence Code of Practice as having the potential to contain Aboriginal objects, being within 200m of a watercourse. There are no dune formations. However, it is noted that the water course through the site, is non-perennial carrying occasional runoff from

nearby low hills. The site is what can be described as back swamp that is former wetland entrapped between coastal dune-fields and hills.

Drainage works have altered the course of the watercourse. In terms of resources, the site may have provided alternatives to the marine resources of the coastline in the form of aquatic plants and animals.

3.4 Step 2c: Is there evidence of past ground disturbance?

Yes. It is reasonable to form the conclusion that the entire site is disturbed through land clearing and possibly drainage excavations. How the land was cleared is unknown be it by hand or mechanically, although in the low lying conditions hand clearing is the more likely method. The higher elevation in the north-west of the site, has no doubt been rock picked of its basalt stone/boulder cover to facilitate grass growth for grazing purposes. The use of the site for grazing purposes for many years would no doubt cause artefacts, had they existed, to be trampled into the soft substrates over the majority of the site and therefore undetectable to surface inspection.

3.5 Additional Steps

The Project Area has undergone land uses constituting 'disturbance' under the meaning of the Due Diligence Code and has a low potential to contain Aboriginal objects. As such it is reasonable to conclude that proposed earthworks will not impact on Aboriginal archaeological objects. Based on the results of the Due Diligence assessment further archaeological investigation is not considered necessary.

APPENDIX 6: RECOMMENDATIONS

The Consultant is of the opinion that given the low lying nature of the site and historic ground disturbances with the potential to disturb or destroy Aboriginal objects had they existed, the Project is highly unlikely to result in harm to Aboriginal Heritage. However as precautionary measures the following recommendations should be considered.

Recommendation 1: Aboriginal Objects Find Procedure

It is recommended that if suspected Aboriginal material has been uncovered as a result of development activities within the Project Area:

a) work in the surrounding area is to stop immediately;

b) a temporary fence is to be erected around the site, with a buffer zone of at least 10 metres around the known edge of the site;

c) an appropriately qualified archaeological consultant is to be engaged to identify the material; and

d) if the material is found to be of Aboriginal origin, the Aboriginal community is to be consulted in a manner as outlined in the OEH guidelines: *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (2010).

Recommendation 2: Aboriginal Human Remains

Although it is unlikely that Human Remains will be located at any stage during earthworks within the Project Area, should this event arise it is recommended that all works must halt in the immediate area to prevent any further impacts to the remains. The Site should be cordoned off and the remains themselves should be left untouched. The nearest police station, the Jali Local Aboriginal Land Council and the OEH Regional Office (Coffs Harbour) are all to be notified as soon as possible. If the remains are found to be of Aboriginal origin and the police do not wish to investigate the Site for criminal activities, the Aboriginal community and the OEH should be consulted as to how the remains should be dealt with. Work may only resume after agreement is reached between all notified parties, provided it is in accordance with all parties' statutory obligations.

It is also recommended that in all dealings with Aboriginal human remains, the Proponent should use respectful language, bearing in mind that they are the remains of Aboriginal people rather than scientific specimens.

Recommendation 3: Notifying the OEH

It is recommended that if Aboriginal cultural materials are uncovered as a result of development activities within the Project Area, they are to be registered as Sites on the AHIMS, managed by the OEH. Any management outcomes for the site will be included in the information provided to the AHIMS.

Recommendation 4: Conservation Principles

It is recommended that all effort must be taken to avoid any impacts on Aboriginal Cultural Heritage values at all stages during the development works. If impacts are unavoidable, mitigation measures should be negotiated between the Proponent, OEH and the Aboriginal community.

Recommendation 5: Cultural Recognition

It is recommended the Proponent consider recognition of the intangible Aboriginal cultural heritage of the surrounding area through its mythological links to the landscape, by using appropriate Bundjalung language in signage, street names, parks and the like. Advice as to appropriate language could be sought from the Jali LALC and Ms Lois Cook.