Geoff Smyth & Associates

TOWN PLANNING & DEVELOPMENT ADVICE

ABN 25 125 245 361
PO Box 1925, Coffs Harbour NSW 2450
E-mail: geoff.smyth@bigpond.com
Mobile: 0418 398 492

19 June 2015
Ref: GS1302.27

Ms Erin Fuller
Manager Development Assessment
Kempsey Shire Council
PO Box 3078
WEST KEMPSEY NSW 2440

Dear Erin

DA T6-14-62 Subdivision
Part Lot 35 DP 1167775
Waianbar Avenue, South West Rocks

In email received from you on 8 April you forwarded copies of responses from Government authorities together with a summary of public submissions received during the exhibition period for the above-mentioned subdivision. Your email acknowledged that there were still communications happening with some Government agencies and in this regard, Council could not provide a definitive list of issues at that stage. In letter dated 8 May Council provided the formal response identifying the critical issues that have been raised for which further information is required.

The purpose of this letter is to respond to the issues raised in the order identified in Councils letter to assist the Joint Regional Planning Panel to appreciate the manner in which each issue has been addressed. The issues are addressed as follows:

1. Integrated Development – Bushfire Safety Authority

Issue: The Rural Fire Service (RFS) has advised that it has insufficient information to assess the application and cannot provide general terms of approval for this Integrated Development application.

Comment: Discussions have been held with staff of the Service and a fire trail access is now proposed as the agreed solution. An amended subdivision plan is attached in Annexure A to this letter. This plan is supported by RFS however it will be necessary for Council to seek the formal written support of the Rural Fire Service as the Council is the referring authority.

2. Integrated Development – Interference with the Water Table

Issue: Council considers that the proposed works are likely to interact or intersect with the water table. Based on the information available and comments received from the NSW Office of Water (NOW) the implications trigger the Integrated Development provisions and general terms of approval for the development are required by NOW.

Comment: It is understood that the Integrated Development provisions were introduced to try to avoid the potential for a development consent to be granted by a Council but later refused by a relevant Government authority where a license or other permit is required from that authority. However, it is understood that it is the applicant's choice as to whether to identify the application to be processed as Integrated Development at the Development Application stage. The applicant can choose to apply for a relevant permit or licence after development consent has been granted. This is particularly relevant where construction details have not been finalised for a Development Application and a permit or licence may require that level of detail and expense when there is no certainty of development consent being granted. In addition, the construction details may be influenced by other considerations and conditions of consent. In this regard, the subject application was identified for the Integrated Development process for referral to the Rural Fire Service only.

It will be noted that the recommendations from the Office of Water express the need for certain requirements to be imposed in the design of bioretention basins and other facilities for the protection of groundwater. There is no inference that the Office of Water is opposed to the development and it is considered that the requirements could be satisfied by conditions imposed on the approval for the subdivision. In any event, the recommendations can be dealt with by way of detailed design at the Construction Certificate stage.

There is no justification for the application to be considered as Integrated Development at this stage and the application will be referred to the Office of Water by the applicant after consent is granted and as part of preparing plans for the Construction Certificate.

3. Threatened Species Development

Issue: Council considers it is unable to determine whether or not there is likely to be a significant impact on any threatened species based on the information submitted to date particularly in respect to the entire concept plan footprint. In addition, comments from the Office of Environment and Heritage (OEH) and a submission by Dr Arthur White are of concern.

Comment: Several extensive flora and fauna studies have previously been undertaken over the Saltwater development area. These studies resulted in an additional 35.06ha of land being included in an Environmental Protection zone for habitat protection.

The flora and fauna assessment submitted with the subdivision application drew on the findings of the previous studies and undertook additional site-specific detail for the Stage 1 subdivision area. The remainder of the site is a concept only at this stage and separate detailed applications are required before further subdivision consents can be granted. The extent of studies previously undertaken are sufficient for a conceptual level of development detail. The likely extent of impacts has been considered in previous studies for the entire concept plan footprint and the requirements of the DCP and LEP have been addressed. The consideration of potential impacts will be further refined in future subdivision applications.

The 35.06 ha of additional land zoned for Environmental Protection was based, in part, on the protection of the Wallum Froglet. The previous study undertaken by Connell Wagner was carried out at a favourable time of year and is a reliable source for considering impacts on the Wallum Froglet. The extent of studies undertaken are sufficient to establish that a Species Impact Statement is not required for a detail subdivision in Stage 1 and a conceptual layout for the residue of the property.

It will be noted that Connell Wagner undertook field assessment after heavy rain in April 2004 and the Wallum Froglet was located over an extensive area of the site. It was acknowledged that the Wallum Froglet is likely to be impacted by future development of the subject land, and accordingly more detailed investigations were undertaken. The final report was produced in 2008 and concluded that future development of the site was constrained by known and predicted Wallum

Froglet habitat and provided recommendations for the future zoning and management of the site to ensure maintenance of the local frog population. These recommendations included:

- Excluding development from areas of important Wallum Froglet habitat.
- Allocating appropriate buffers to maintain Wallum Froglet habitat.
- Retaining corridors and linkages between proximate sub-populations.
- Applying zonings appropriate for maintaining the population in perpetuity and
- Applying development design principles to minimise the impacts to retained Wallum Froglet habitat including:
  - Avoid habitat isolation.
  - Minimise traffic speed
  - Appropriate stormwater treatment and
  - Minimise habitat loss

Connell Wagner identified development exclusion areas for important Wallum Froglet habitat that have since been included within Zone E2. In addition a 50 m buffer to maintain Wallum Froglet habitat was also included within the Zone E2 boundary. The Zone E2 boundary aimed to maintain the population of the Wallum Froglet in perpetuity.

The concept layout for the area beyond Stage 1 does not support the location of the north south link road as identified in the DCP in order to retain corridors and linkages between proximate sub-populations and avoid habitat isolation as recommended in the Connell Wagner report. Appropriate stormwater controls have been identified by de Groot and Benson and the identified bioretention and swales will increase the habitat areas available to the Wallum Froglet within the Zone R2 area.

0EH Comments

Issue: Works proposed within 50 m of E2 zone boundary.

Comment: It was agreed by Council staff that there is a drafting error in Councils Development Control Plan and there is no justification for a 50 m buffer to the E2 zone as this buffer is already included within the E2 boundary. The Saltwater Creek Estuary Management Plan that was prepared for Kempsey Shire Council by WBM Pty Ltd in June 2006 includes a clear diagram at Figure 7.3 that shows the inclusion of a vertical buffer in addition to a horizontal buffer. The horizontal buffer extends 50 m beyond the vertical buffer. Both buffers are included within zone E2 and the Estuary Management Plan was the basis for the zone boundary.

Issue: Clearing of approximately 3.24ha of modified native vegetation should be mitigated by a biodiversity offset.

Comment: The flora and fauna assessment concluded that the loss of 3.24 ha of modified native vegetation would not be likely to have a significant impact and a Species Impact Statement is not required. There is no justification for a biodiversity offset in the circumstances.

It should be noted that the site currently has approval for and is operated as a tree farming enterprise. The area approved for this use extends into the E2 zone. The owner is prepared to consider abandoning the tree plantation area within Zone E2 and for this area to be rehabilitated if necessary. This is considered to be compensatory habitat for any loss within the Zone R2 area of the site.

Issue: The draft Vegetation Management Plan included with the subdivision application needs to be revised to use more definitive language.

Comment: A revised draft Vegetation Management Plan can be required as a condition of consent. It is understood that the need for more definitive language is required to ensure a commitment of the developer to the principles identified in the management plan. Please be assured that it is the developers intention to adhere to the identified principles.

Issue: The E2 zone should be retained for conservation values only.

Comment: The only works proposed as part of this application within zone E2 included some temporary sediment and erosion fencing during construction and an infiltration swale. These components have now been relocated outside the E2 zone as a result of discussions with the Rural Fire Service however, the location that was chosen for these works within the E2 zone is highly degraded. An amended subdivision plan is enclosed in Annexure A. Any consideration for pedestrian boardwalks or other facilities within Zone E2 are not part of this application.

Issue: Use of E2 zoned land near Sewage Treatment Plant for sporting fields.

Comment: This is shown as a concept for consideration in future stages and will be fully investigated at the appropriate time. The E2 zone to the north of the Sewage Treatment Plant is primarily identified as a buffer to the treatment plant against noise and odour impacts. If further ecological investigations demonstrate that additional Wallum Froglet habitat is needed then the drainage lines and bioretention basins will provide additional habitat in the concept subdivision area.

Dr Arthur White Comments

Comment: The summary of issues was forwarded to Flametree Ecological Consultancy and the following are the main points in response:

- Point 1: The scope of threatened fauna assessment is clearly stated in the report as dealing with threatened species impacts for the specific subdivision described.
- Point 2 & 3: The Flametree assessment only relied on relevant previous surveys. In particular the Connell Wagner study undertook surveys on the Wallum Froglet at a favourable time of year and in favourable conditions.
- Point 4: Cumulative impacts were considered as part of the overall rezoning of the Saltwater area.
- Point 5: A Wallum Froglet record on or near the site does not affect the conclusions of the Flametree assessment.
- Point 6 & 7: The report makes it clear that the subject site has been cleared for use as a tree plantation and subsequently slashed regularly. None of the vegetation at the site other than in the E2 zone is in a natural state or is likely to be critical to the long-term survival of the Wallum Froglet.
- Point 8: Nowhere does the report rely on assumptions. The seven part test assesses impacts in relation to the occurrence of species over a 2 km radius.
- Point 9: The Flametree assessment was based on the potential that the Wallum Froglet may occur on the site and the impact was assessed against the amount of habitat affected. .

4. Traffic and Roads

de Groot and Benson have reviewed this aspect of Councils letter and a formal response to the matters raised is included in a revised report attached as Annexure B to this letter. The response to the comments are summarised as follows:

a) Existing Traffic Volumes.

Issue: The source of the traffic data used has not been provided and does not reflect Councils traffic data.

Comment: At the time our application was prepared we were advised by Council that there were no traffic counts available and we could rely on the traffic volume data in the Traffic Impact Assessment prepared by Cardno in 2012. Additional traffic count information has now been supplied by Council that was obtained in earlier this year and the modelling and predictions adjusted in respect to this data. The conclusion is that the thresholds nominated and design standards proposed remain appropriate. Some amended design for the intersection of Waianbar Avenue and Phillip Drive has been included as a result of an increase in hourly traffic volumes.

b) Annual Growth Assumption

Issue: The annual growth figure used is lower than expected by Council.

Comment: de Groot and Benson have adjusted the modelling to reflect a growth figure of 3% rather than 2% as shown in Annexure B. The conclusion is that the thresholds nominated and design standards proposed remain appropriate and are adequate with some amended design for the intersection at Waianbar Avenue.

c) North - South Link Road

Issue: Strategic planning has identified the need for a north-south link road.

Comment: The only known planning document for the Saltwater precinct that references the link road is the Kempsey Development Control Plan 2013. A variation is sought to the requirement to provide a link road on the basis that it is unnecessary and could have an unreasonable and unnecessary impact on a vegetation/wildlife corridor based on the study findings by Connell Wagner in their 2008 Local Environmental Study. In addition the Mid North Coast Regional Strategy includes a clear intent in respect of roads in habitat areas (pages 11 & 30) and the provision of a north-south link road would be in direct contravention of that Regional Strategy. Given the significance of the regional strategy compared to Councils DCP the proposed subdivision has not proposed and does not support a north-south link. The Council should complete a strategic assessment and public consultation before any north-south link road is proposed.

It is understood that Roads and Maritime Services were invited to comment as part of the rezoning process and no response was provided in respect to the need for a link road.

The north-south link road was identified as a possible alternate route for traffic through the area however, the location required the traversing of Zone E2 Conservation land at a location that contained habitat for the Wallum Froglet and other wildlife species that could have a significant impact on this species and the integrity of the vegetation corridor. It should be noted that an alternate route around the South West Rocks central business area is currently provided by Arakoon Road and a further alternate route is proposed by the extension of Belle O'Connor Street in the future. It is understood that this latter option has been previously considered and provides a solution that does not contravene the Mid-North Coast Regional Strategy and should be a preferred option.

The de Groot and Benson assessment in Annexure B has considered the capacity of the existing roundabouts in the South West Rocks business area and verified that a link road connection to the south is not warranted for the traffic volumes to be generated from the residential development of the subject land. The assessment in Annexure B found for the t traffic in Gregory Street north of Belle O'Connor Street with or without the link road there is less than 2% difference. In addition, with alternative routes available for traffic to reduce demand and congestion on Gregory Street the potential environmental impact from a north-south link road cannot be supported.

It should be noted that the concept road layout for the residue land could accommodate a north south link road connection through the E2 zoned land if such a road link is well justified.

d) Waianbar Avenue

Issue: A higher standard for the upgrading of Waianbar Avenue is suggested.

Comment: It is considered that any upgrading of Waianbar Avenue that is considered necessary by Council can be imposed as a condition of consent for the subdivision. De Groot and Benson have included some additional intersection upgrading for the Waianbar Avenue and Phillip Drive intersection in Annexure B as a result of new traffic information provided from Council. Council staff have advised that the existing Waianbar Avenue was designed to cater for urban expansion into the subject land and that an alternative road to the east through the McNiven land was not supported.

e) Additional Access Points to Phillip Drive

Issue: A level of certainty for access to Phillip Drive has not been provided.

Comment: A meeting has been held with the Rural Fire Service and additional access points to Phillip Drive are not required for Stage 1 of the subdivision but will be required in the future. At this stage a series of options are shown for future connections to Phillip Drive. If Council requires a greater level of certainty then it could resolve to acquire a road corridor linkage and we could assist Council with an evaluation of the road standards requirements and standard of intersection etc.

It has been suggested that provision be made for an access road into Lot 509 DP 850963 for the future development of this land currently owned by McNiven. Providing an access to this adjoining land is acceptable and purchase and transfer arrangements can be made without altering the current subdivision layout for Stage I. One option to be considered would be a land swap of the existing road reserve at the end of Waianbar Avenue that comprises the bulk of the proposed Lot 20 in Stage I. The preferred location of an access to the McNiven land is on the eastern side of proposed Lot 24 within the Asset Protection Zone as this location would deliver a perimeter road to the E2 zoned land. Access to the McNiven land has previously been opposed by the owner due to the proximity of the road to an existing dwelling house. In addition an additional access point to Phillip Drive in proximity to Waianbar Avenue in this location is not considered ideal having regard to traffic safety.

f) Perimeter Roads

Issue: The Rural Fire Service requires perimeter roads to E2 zoned land.

Comment: The Rural Fire Service is now satisfied with the fire trail access for Stage I in accordance with the amended subdivision plan enclosed in Annexure A. Perimeter roads are generally provided throughout the concept plan area with the exception of two cul-de-sacs in the west. These cul-de-sacs can be eliminated and a perimeter road provided as a condition of consent for the future subdivision of the concept plan area.

5. Encroachment into the E2 Environmental Conservation Zone

All infrastructure has now been removed from the E2 zone and can be accommodated wholly within the residentially zoned area.

6. Integrated Water Cycle Management Strategy

Issue: An Integrated Water Cycle Management Strategy in accordance with 4.3 of the DCP is required.

Comment: The Integrated Water Cycle Management Strategy will comprise the following:

- All dwellings will be connected to a reticulated water supply system extending Councils existing water supply. If the water supply for later stages becomes unreliable then a trunk main will be extended from the south.
- Recycled water mains will be provided at the subdivision stage. As recycled water is currently not available at the site, these mains will be interconnected with the reticulated water supply.
- Sewerage will be collected and transferred to Councils treatment plant by a pressurised sewerage system.
- Stormwater from residential properties will variously pass to a piped drainage system located in the roadway. Roof water will be piped directly to the street. Surface water will pass through buffer strips before entering the streets. Stormwater from the streets will enter into a piped drainage system which will terminate in a bioretention basin. The outlet of the basin will discharge to a groundwater recharge area. The bioretention basins discharge will meet all the water quality requirements as set out in the DCP.
- Groundwater recharge will occur in two ways as follows:
  1) Initially the unpaved areas on the allotments and the verges to roadways will act as recharge areas. Excess run-off from these areas will be collected by the stormwater drainage system.
  2) A groundwater recharge area will be provided. Inflow to this area will be from the bioretention system. The recharge system will have sufficient capacity to accommodate 40% of the flow from an average daily rainfall event (approx.11 mm per day).

  The combination of the two infiltration systems will maintain existing groundwater inflows into Saltwater Lagoon.
- Groundwater monitoring will continue to be undertaken by Douglas Partners. When monitoring is completed some refining of the engineering solutions to minimise impacts may be required for future stages however, the principles detailed in this Strategy will not alter.

Some additional stormwater modelling has been undertaken by de Groot and Benson and the findings are included in the addendum report in Annexure B. A plan included in Annexure B identifies the proposed locations for stormwater run-off controls as well as water quality controls for the concept area of the site in future stages to minimise any impacts from stormwater leaving this site after development. The location of these controls will be wholly within Zone R2 and the anticipated area required to accommodate these controls is also identified on the plan.

7. Infrastructure servicing strategy

de Groot and Benson have included clarification of these aspects in their addendum report that is attached in Annexure B.. The responses to the specific comments made are summarised as follows:

a) *Issue:* No Integrated Water Cycle Management Strategy has been provided.

Comment: A revised Integrated Water Cycle Management Strategy is provided by de Groot and Benson in Annexure B. It should be noted that the principles adopted for Stage 1 will be continued for future stages and necessary controls for stormwater have been modelled. The results of water monitoring will only refine the engineering solution to minimise impacts. It will be noted that the Office of Water do not consider that impacts cannot be overcome but may require lining of bioretention basins etc.

b) Issue: Infrastructure required for each stage has not been addressed.

Comment: Details of the provision of infrastructure for Stage I have been included and a concept provided for the future concept stage. At this time it has not been determined as to how many stages there will be in the future however, there is nothing in Stage I that would require the subdivision to be altered to allow future stages to proceed in an orderly manner.

c) Issue: Capacity of water supply has not been determined.

Comment: It has been determined that there is sufficient water capacity for Stage I. A future trunk main is proposed to be extended from the south that will provide sufficient water capacity for future stages if the current capacity is exceeded. Some investigation has been undertaken by de Groot and Benson and included in Annexure B. It is estimated that a further 50 lots can be created before other options need to be considered.

d) Issue: Sewage pump station in Waianbar Avenue has no spare capacity.

Comment: We had understood that there was remaining capacity available in the existing sewage pump station in Waianbar Avenue. It had been intended that a pressurised sewerage system would be provided once the existing capacity has been exceeded. If it is necessary for the pressurised system to be provided at an earlier stage then this can be a condition of consent.

e) Issue: There are capacity issues with downstream pump stations.

Comment: It is proposed that a pressurised sewerage system will be provided to overcome any issues with the capacity of sewage pump stations.

f) Issue: The proposed sewer system to be used has not been clarified.

Comment: It is proposed that a pressurised sewerage system will be provided once the capacity of the existing pump stations has been exhausted.

g) Issue: Provision of rainwater tanks conflicts with Councils recycle water scheme.

Comment: de Groot and Benson have removed the provision for a 3 kL water tank for stormwater detention and adjusted the stormwater management assessment accordingly. The amended assessment is enclosed in Annexure B.

h) Issue: Piping for water and sewer infrastructure may require use of special materials.

Comment: It is considered that the standard of materials required for water and sewerage infrastructure can be imposed as a condition of consent and the cost of extending such infrastructure will be borne by the developer. It is acknowledged that special materials may be required.

i) Issue: A strategy is required for Essential Energy services.

Comment: The strategy for the extension of electricity services is that Essential Energy has confirmed that electricity services can readily be extended for the development of this property. The requirements will be detailed as part of the Construction Certificate. The extension of services is normally a condition of consent required to be satisfied prior to release of the Subdivision Certificate.

j) Issue: Assessment of potential burden to the community has not been provided.

Comment: The assessment of the potential burden to the community is that all costs associated with the development of the site will be borne by the developer. Council has existing contribution plans for the payment of any augmentation of services and community facilities off-site required as a result of this development.

k) Issue: A servicing and financial strategy is required.

Comment: The strategy for the extension of services necessary for the subdivision is that the subdivision will be financed by the developer with contributions paid to Council for any augmenting of community services and infrastructure.

Infrastructure servicing and financial strategy is as follows:

- All water supply and recycled water infrastructure will be supplied and installed within the subdivision by the developer. Contributions will be paid to Council under Section 64 for works external to the subdivision.
- A pressurised sewerage system is proposed to be used. The system will pump directly to the treatment plant. All costs will be borne by the developer. Any upgrades to the treatment plant would be included in contributions paid to the Council under Section 64.
- All electrical cabling for electricity supply will be provided underground for each stage of the development in accordance with Essential Energy requirements and the costs borne by the developer. Essential Energy has advised that they will provide the necessary infrastructure to service the residential development at Saltwater.
- All roads and drainage within the subdivision will be constructed by the developer. Upgrading will be provided by the developer for the intersection of Phillip Drive and Waianbar Avenue as required for Stage I and will provide the necessary connection with Phillip Drive for future stages.
- The developer will provide pit and pipes for use by Telstra or NBNCo. At this stage it is unclear which authority will be responsible. All cabling within the pit and pipe system will be provided by Telstra/NBNCo. NBNCo have right of first refusal. If the staging is too small for NBNCo, cabling will be undertaken by Telstra at their cost.
- Costing of all internal works has been budgeted for by the developer and is considered acceptable. The developers budgeting for external works other than intersections with Phillip Drive does not extend beyond the relevant Section 94 and Section 64 contributions levied by Council.

l) Issue: Infrastructure not to be located in zone E2.

Comment: All infrastructure is now contained wholly within the residential land.

8. Vegetation Management strategy

Issue: No Vegetation Management Strategy has been provided for the whole site.

Comment: The vegetation management plan provided primarily relates to Stage I but also included the strategy for the concept plan area. The strategy is that the principles for Stage 1 will be carried forward into later stages of development. The primary focus will involve weed removal and natural regeneration of native species within the E2 zone area. Further detail will be provided with each future subdivision application.

The regeneration of the E2 zone area will include existing vegetation character elements including mixed sedge heath, open forest and woodlands and shrublands where appropriate. Street tree planting details will be included as part of the Construction Certificate once construction details are finalised.

9. Open space

Issue: No open space management strategy has been provided.

Comment: The primary strategy is for public sporting fields and open space to be further considered as part of later stages of development as the Council is currently undertaking a review of the South West Rocks open space strategy and the outcomes of Councils strategy should be awaited. One concept option is shown on the northern side of the sewage treatment plant within the buffer area to that plant. The buffer area is required primarily for odour and noise control. It is considered likely that this location can accommodate sporting fields as well as to provide a buffer for odour and noise to the treatment plant. The area is currently degraded and generally clearer vegetation and it is considered that the Office of Environment and Heritage have incorrectly referred to the conservation values of this area.

The open space management strategy is for all of the land within Zone E2 will be dedicated to Council at some future stage as public reserve. In the interim the area will be managed and maintained by the developer. Discussions will continue with the Council regarding the potential for sporting fields to the north of the sewage treatment plant and if supported by Council the developer is prepared to contribute to the provision of appropriate sporting facilities.

Section 6.13 'Public Open Space'of Chapter D2 Saltwater Precinct of the DCP provides guidelines for the location and quantity of public open space. The DCP references a requirement for 1.3 ha per 1000 head of population to be provided for open space. Stage 1 will provide vacant lots residential housing for approximately 61 people (29 lots at 2.1 people per household) for which 780 m² of open space would be required. Stage I includes an area for a bio retention basin and infiltration swales that will provide sufficient open space for this stage.

For the remaining concept area there is potential for approximately 412 residential lots that would accommodate 865 people for which 1.1 ha of land is required for open space. Within this concept area there are extensive planted swale drains proposed particularly along the northern boundary and through the central part that will provide passive open space opportunities that are anticipated to exceed the 1.1 ha required. In addition, further consideration can be given to the need for sporting fields once the Council has completed its review of the South West Rocks open space strategy.

It should be noted that the site is surrounded by existing open space facilities in the form of the Hat Head National Park, the South West Rocks golf club and extensive beach areas.

10. Other matters raised in submissions

The other matters identified in Councils letter are addressed as follows:

a) Stormwater management

Issue: Office of Water comments need to be addressed.

Comment: The Office of Water has not raised any objections to the subdivision and as suggested refinements to the stormwater controls that can be included as conditions of approval.

b) Biodiversity

Issue: The Office of Environment and Heritage comments need to be addressed.

Comments: The comments of the Office of Environment and Heritage on biodiversity have been discussed in point 3 above under threatened species development.

c) Aboriginal archaeology

Issue: An updated Aboriginal heritage assessment is required.

Comment: The Office of Environment and Heritage acknowledges that the likelihood of Aboriginal objects being present could be considered as very low. It is difficult to appreciate how and archaeological assessment of potential deposits that date back thousands of years could become 'out of date'. In any event, the disturbed nature of the site and the high water table in this locality is likely to preclude any sites existing of burials, shell middens or other artefact deposits. More elevated topography in the surrounding area is considered to be more likely locations for Aboriginal heritage sites.

An archaeological assessment was undertaken for the entire Saltwater site by Jacqueline Collins Consultant Archaeologist to support the Local Environmental Study prepared for Council for the rezoning of the subject land. This previous study is adequate for an assessment of Aboriginal heritage sites for the subject land. Myall Coast Archaeological Services have reviewed the previous study and have prepared a 'due diligence' assessment. This assessment is enclosed in Annexure C.

d) Hat Head National Park and Saltwater Lagoon

Issue: Potential impacts on Hat Head National Park and Saltwater Lagoon need to be addressed.

Comment: It is considered that an adequate impact assessment has been undertaken for this Stage I application and further investigations will be undertaken as part of future applications. The mitigation measures aim to minimise impacts on any adjoining land including the Hat Head National Park and Saltwater Lagoon.

The strategy for the protection of these adjoining areas over the whole site will comprise the following:

- No bulk filling is proposed. Much of the development will be constructed on or close to the existing grade.
- A conventional kerb and gutter road system with conventional pipe and pit drainage is proposed. This is considered the most sustainable from an ongoing maintenance perspective however, due to the flat low topography, its reach will be limited to about 150 m of pipe run.
- Bio retention basins are to be provided on the boundary to the E2 zoned land within the R2 zoned land.
- Infiltration trenches and swales are proposed on the boundary of the E2 zone within zone R2 at appropriate locations.
- Infiltration trenches and swales will be designed to infiltrate the impervious area run-off and recharge the groundwater. The design and any necessity for lining will be undertaken in consultation with the Office of Water.

Water quality modelling using MUSIC software and calculations have been undertaken to support the concept design to satisfy the requirements of the DCP and included in the addendum report in Annexure B. Further detailed design, sizing and modelling will be undertaken as part of the Construction Certificate.

It is considered that all concerns raised in Councils letter and by relevant Government departments have been addressed in the foregoing letter and there is no issue that would prevent consent being granted.

Yours faithfully
GEOFF SMYTH & ASSOCIATES

GEOFF SMYTH
gs.jm

ANNEXURE A

Subdivision Plan Stage 1

509 DP 850963

WAIANBAR AVE

STAGE 1 B

STAGE 1 A

ROAD 1

ROAD 2

ROAD 3

1 627m²
2 707m²
3 641m²
4 641m²
5 641m²
6 641m²
7 604m²
8 641m²
9 787m²
10 630m²
11 968m²
12 968m²
13 616m²
14 1024m²
15 824m²
16 710m²
17 657m²
18 625m²
19 639m²
20 640m²
21 769m²
22 683m²
23 919m²
24 1183m²
25 640m²
26 640m²
27 640m²
28 636m²
29 640m²

21.0m

ZONING LINE

RESERVE (FOR WSUD PURPOSES)

PT LOT 30

LIMIT OF 21m ASSET PROTECTION ZONE

PT LOT 30

E2 – ENVIRONMENTAL PROTECTION (HABITAT) ZONE

VG LINE

NOTES:

- 1: ALL EASEMENTS ARE DESCRIBED ON PLAN OF SUBDIVISION ON DEPOSITED PLAN DP 1167775.
- 2: NO CHANGES PROPOSED TO EXISTING EASEMENTS FOR SUPERLOT CREATION

REV.	DATE	REVISION	DR.BY	AP.BY
DA5	19/06/15	LAYOUT AMMENDMENTS	APR	RDG
DA4	30/4/15	Minor Amendments throughout	APR	RDG

de Groot & Benson

Consulting Engineers & Planners

A.C.N. 052 300 571
236 Harbour Drive,
Coffs Harbour NSW 2450

Phone (02) 6652 1700
Fax (02) 6652 7418
Email email@dgb.com.au

Scale	1:500	Cad File No.	13056_Civil - APRIL 2015.dwg
Surveyed	MR	Datum	AHD
Drawn	APR	Designed	APR
Checked	RDG	Date	2013
		Approved	RDG
		No. of dwgs	---

Project: SALTWATER DEVELOPMENT SOUTH WEST ROCKS, NSW

Client: LEX TALL

Title: STAGE 1 CONCEPT PLAN

Project No. 13056

Drawing No. DA-10 CONCEPT - 7

Amendment No. DA5

ANNEXURE B

Stage 1 Drawings
Stormwater Management Plan
Water Supply Assessment
Traffic Impact Assessment & Traffic Study

Prepared by de Groot & Benson Pty Ltd

509 DP 850963

CONSTRUCTION ACCESS

WAIANBAR AVE

LOCALISED FILLING PROPOSED ON ALLOTMENTS TO ENSURE SITE DRAINAGE

ROAD 1

ROAD 2

ROAD 3

PT LOT 30

SEDIMENT FENCE COMPLIMENTED BY HAYBALES AT KEY LOCATIONS AS REQUIRED

LEGEND

SEDIMENT FENCE

HAY BALE CHECK DAM

TOPSOIL STOCKPILE

CONSTRUCTION ACCESS

NOTE:
FOR DETAILED NOTES AND STANDARD DETAILS REFER DRAWING 13056 DA-15

REV.	DATE	REVISION	DR.BY	AP.BY
DA5	19/06/15	LAYOUT AMMENDMENTS	APR	RDG
DA4	30/4/15	Minor Amendments throughout	APR	RDG

de Groot & Benson

Consulting Engineers & Planners

A.C.N. 052 300 571
236 Harbour Drive,
Coffs Harbour NSW 2450

Phone (02) 6652 1700
Fax (02) 6652 7418
Email: email@dgb.com.au

Scale	1:500	Cad File No.	13056_Civil - APRIL 2015.dwg
Surveyed	MR	Datum	AHD
Drawn	APR	Designed	APR
Checked	RDG	Date	2013
Approved	RDG	No. of dwgs	---

Project: SALTWATER DEVELOPMENT SOUTH WEST ROCKS, NSW

Client: LEX TALL

Title: STAGE 1 SEDIMENT AND EROSION CONTROL PLAN

Project No. 13056

Drawing No. DA-11 CONCEPT - 7

Amendment No. DA5

509 DP 850963

WAIANBAR AVE

4.16m

4.39m

CL=4.25m

ROAD 1

ROAD 2

ROAD 3

R9

R12

1 627m²
2 707m²
3 641m²
4 641m²
5 641m²
6 641m²
7 604m²
8 641m²
9 787m²
10 630m²
11 968m²
12 968m²
13 616m²
14 1024m²
15 824m²
16 710m²
17 657m²
18 625m²
19 639m²
20 640m²
21 769m²
22 683m²
23 919m²
24 1183m²
25 640m²
26 640m²
27 640m²
28 636m²
29 640m²

PT LOT 30

PT LOT 30

FIRE TRAIL - 4m WIDE
WITH 1m SHOULDERS

BIORETENTION BASIN

INFILTRATION SWALES

REV.	DATE	REVISION	DR.BY	AP.BY
DA5	19/06/15	LAYOUT AMMENDMENTS	APR	RDG
DA4	20/02/14	Minor Amendments throughout	APR	RDG

de Groot & Benson

Consulting Engineers & Planners

A.C.N. 052 300 571
236 Harbour Drive,
Coffs Harbour NSW 2450

Phone (02) 6652 1700
Fax (02) 6652 7418
Email: email@dgb.com.au

Scale 1:500	Cad File No. 13056_Civil - APRIL 2015.dwg		
Surveyed MR	Datum AHD		
Drawn APR	Designed APR	Approved RDG	
Checked RDG	Date 2013	No. of dwgs ---	

Project: SALTWATER DEVELOPMENT
SOUTH WEST ROCKS, NSW

Client: LEX TALL

Title: ROAD & DRAINAGE PLAN

Project No. 13056

Drawing No. DA-12
CONCEPT - 7

Amendment No. DA5

509 DP 850963

CONNECT TO EXISTING SYSTEM

WAIANBAR AVE

RECYCLED WATER MAIN

RECYCLED WATER MAIN

ø250 mm TRUNK WATER MAIN – SUBJECT TO COST SHARING WITH COUNCIL

ø100 WATER MAIN (TYPICAL)

ROAD 1

ROAD 2

ROAD 3

PROVIDE END CAP & THRUST BLOCK

PT LOT 30

PT LOT 30

1 627m²
2 707m²
3 641m²
4 641m²
5 641m²
6 641m²
7 604m²
8 641m²
9 787m²
10 630m²
11 968m²
12 968m²
13 616m²
14 1024m²
15 824m²
16 710m²
17 657m²
18 625m²
19 639m²
20 640m²
21 769m²
22 683m²
23 919m²
24 1183m²
25 640m²
26 640m²
27 640m²
28 636m²
29 640m²

NOTE:
1. WATER AND RECYCLED WATER MAINS TO BE LAID IN SAME TRENCH.
2. DIFFERENT COLOURED PIPES TO BE USED FOR EACH SUPPLY IN ACCORDANCE WITH WSAA STANDARDS
3. RECYCLED WATER TO B ECROSS CONNECTED WITH POTABLE WATER UNTIL SUCH TIME AS SUPPLY IS AVAILABLE FROM THE SOUTH.,

REV.	DATE	REVISION	DR.BY	AP.BY
DA5	19/06/15	LAYOUT AMMENDMENTS	APR	RDG
DA4	20/02/14	Minor Amendments throughout	APR	RDG

de Groot & Benson
Consulting Engineers & Planners
A.C.N. 052 300 571
236 Harbour Drive,
Coffs Harbour NSW 2450
Phone (02) 6652 1700
Fax (02) 6652 7418
Email: email@dgb.com.au

Scale	1:500	Cad File No.	13056_Civil - APRIL 2015.dwg
Surveyed	MR	Datum	AHD
Drawn	APR	Designed	APR
Checked	RDG	Date	2013
Approved	RDG	No. of dwgs	---

Project: SALTWATER DEVELOPMENT SOUTH WEST ROCKS, NSW

Client: LEX TALL

Title: WATER & RECYCLED WATER RETICULATION PLAN

Project No. 13056

Drawing No. DA-13 CONCEPT - 7

Amendment No. DA5

509 DP 850963

CONNECT TO EXISTING SYSTEM

EXISTING SEWER PUMP STATION (R13)

PRESSURE RISING MAIN TO SEWAGE TREATMENT PLANT. FINAL ROUTE TO BE DETERMINED AS PART OF CC.

WAIANBAR AVE

ROAD 1

ROAD 2

ROAD 3

RM

R9

R12

1 627m²
2 707m²
3 641m²
4 641m²
5 641m²
6 641m²
7 604m²
8 641m²
9 787m²
10 630m²
11 968m²
12 968m²
13 616m²
14 1024m²
15 824m²
16 710m²
17 657m²
18 625m²
19 639m²
20 640m²
21 769m²
22 683m²
23 919m²
24 1183m²
25 640m²
26 640m²
27 640m²
28 636m²
29 640m²

PT LOT 30

PT LOT 30

PRESSURE SEWERAGE PUMPING UNIT AND BOUNDARY KIT.
– TO BE INSTALLED WITH DWELLING CONSTRUCTION

NOTE:
FINAL BOUNDARY BETWEEN PRESSURE SEWERAGE AND GRAVITY SEWERAGE TO BE DETERMINED AS PART OF CC. DECISION TO BE BASED ON DETERMINATION OF CAPACITY OF WAINBAR PUMPING STATION AND ITS AUGMENTATION OPTIONS.

REV.	DATE	REVISION	DR.BY	AP.BY
DA5	19/06/15	LAYOUT AMMENDMENTS	APR	RDG
DA4	20/02/14	Minor Amendments throughout	APR	RDG

de Groot & Benson
Consulting Engineers & Planners
A.C.N. 052 300 571
236 Harbour Drive,
Coffs Harbour NSW 2450
Phone (02) 6652 1700
Fax (02) 6652 7418
Email: email@dgb.com.au

Scale 1:500	Cad File No. 13056_Civil - APRIL 2015.dwg		
Surveyed MR	Datum AHD		
Drawn APR	Designed APR	Approved RDG	
Checked RDG	Date 2013	No. of dwgs ---	

Project: SALTWATER DEVELOPMENT SOUTH WEST ROCKS, NSW

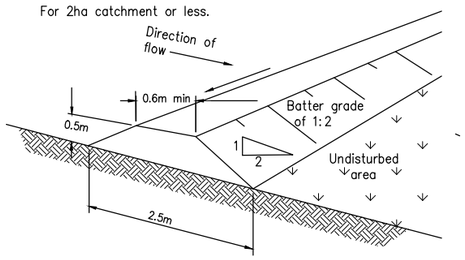
Client: LEX TALL

Title: SEWER PLAN

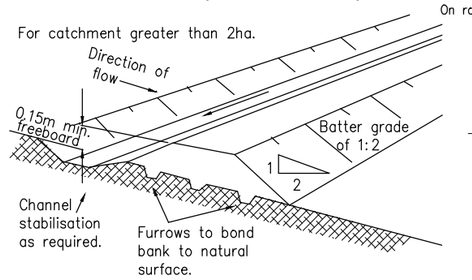
Project No. 13056

Drawing No. DA-14 CONCEPT - 7

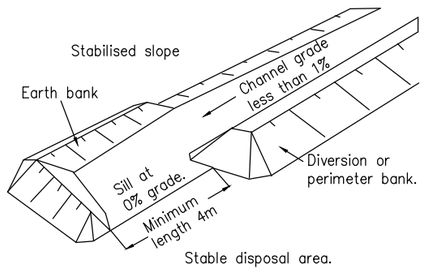
Amendment No. DA5



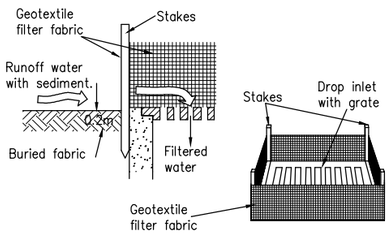
Perimeter Bank (without channel)



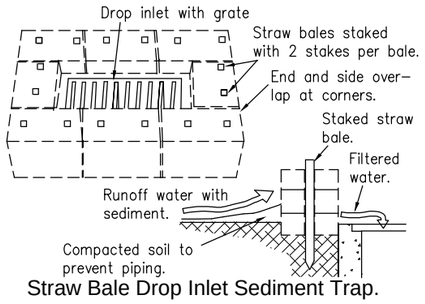
Perimeter Bank (with channel)



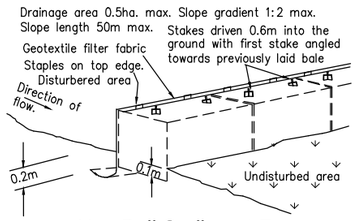
Level Spreader (or Sill)



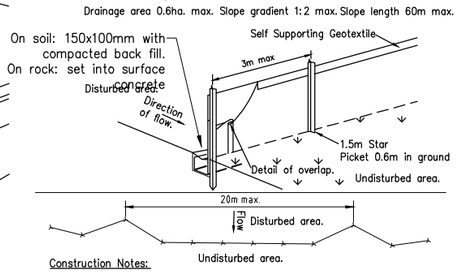
Geotextile Filter Fabric Drop Inlet Sediment Trap.



Straw Bale Drop Inlet Sediment Trap.



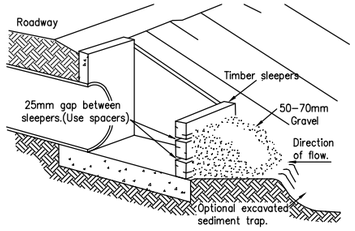
Hay Bail Sediment Fence.



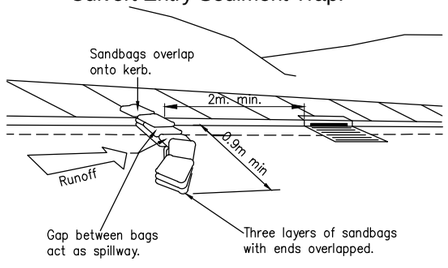
Construction Notes:

1. Construct sediment fence as close as possible to parallel to site contours.
2. Drive 1.5m star pickets into ground 3m apart.
3. Dig 150mm deep trench along upslope line of fence for the bottom of the fabric to be entrenched.
4. Backfill trench over base of fabric.
5. Fix self supporting Geotextile to upslope side of posts with wire ties or as recommended by Geotextile manufacturer.
6. Join sections of fabric at a support post with a 150mm overlap.

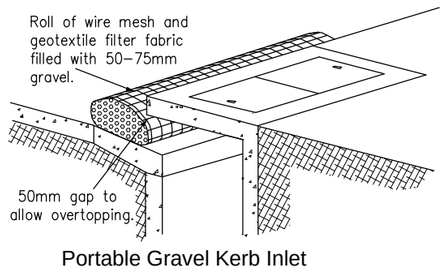
Sediment Fence.



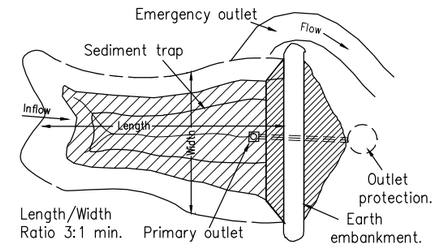
Culvert Entry Sediment Trap.



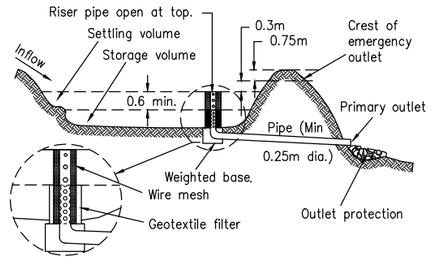
Sandbag Kerb Inlet Sediment Trap.



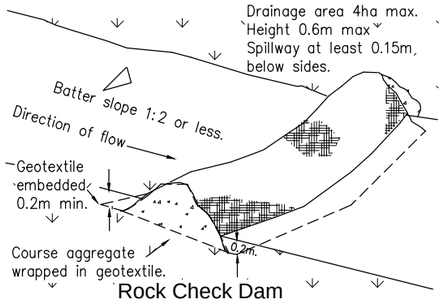
Portable Gravel Kerb Inlet Sediment Trap



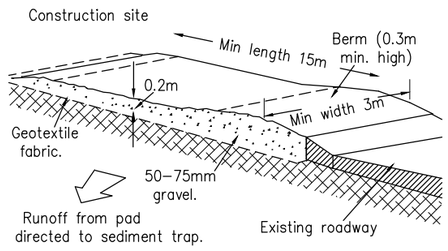
Plan View of Typical Sediment Basin



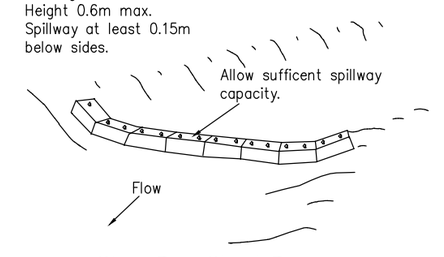
Cross Section of Typical Sediment Basin.



Rock Check Dam



Temporary Construction Exit



Straw Bale Check Dam

SEDIMENT AND EROSION CONTROL NOTES

GENERAL

1. ALL WORK IS TO BE IN ACCORDANCE WITH THE PLAN AND CONSISTENT WITH NSW LANDCOM PUBLICATION "MANAGING STORMWATER; SOILS & CONSTRUCTION" (THE "BLUE BOOK" 4th EDITION 2004)
2. THE NOMINATED PROJECT MANAGER (OR EARTHWORKS CONTRACTOR) SHALL BE RESPONSIBLE FOR THE IMPLEMENTATION OF THE EROSION AND SEDIMENT CONTROL PLAN
3. THE PROJECT MANAGER SHALL INFORM ALL CONTRACTORS AND SUB CONTRACTORS OF THEIR OBLIGATIONS UNDER THE ESCP
4. THE PROJECT MANAGER SHALL PROVIDE APPROPRIATE ENVIRONMENTAL INDUCTION TO ALL STAFF
5. THE PROJECT MANAGER SHALL PROVIDE APPROPRIATE ENVIRONMENTAL TRAINING TO ALL STAFF
6. THE PLAN SHALL INCLUDE A WORKS PROGRAM (E.G GANTT CHART) INCLUDING ACCOUNTABILITY FOR EACH ACTION (I.E RESPONSIBILITY / SIGN OFF)
7. CONTROL MEASURES SHALL BE IN PLACE PRIOR TO EACH SITE DISTURBANCE
8. SITE DISTURBANCE SHALL BE STAGED WHERE POSSIBLE
9. WORK SHALL BE RESTRICTED TO THE WELL DEFINED WORKS ZONES
10. ALL WORKS ARE TO BE INSPECTED, AND MAINTAINED WHERE NECESSARY, ON A WEEKLY BASIS AND AFTER EACH RUNOFF EVENT
11. FAILURE TO IMPLEMENT ANY PART OF THE PLAN WILL CONSTITUTE A HOLD POINT (THIS WOULD ALSO CONSTITUTE A BREACH OF THE PROTECTION OF THE ENVIRONMENT OPERATIONS ACT).

SITE INFRASTRUCTURE

12. THE SITE SUPERVISOR SHALL ENSURE ALL MATERIALS REQUIRED FOR EROSION AND SEDIMENT CONTROL, INCLUDING REHABILITATION WORKS, SHALL BE ON-SITE PRIOR TO IMPLEMENTATION DATES
13. ALL PROJECT MATERIALS SHALL BE CORRECTLY LOCATED AND PROTECTED TO AVOID ANY ADVERSE ENVIRONMENTAL IMPACT
14. ALL WEATHER AND SAFE SITE ACCESS SHALL BE IDENTIFIED
15. A SOIL RETENTION SYSTEM (E.G.. GRAVEL SHAKEDOWN ZONE) SHALL BE PROVIDED AT ALL SITE ACCESSES
16. ANY SOIL MATERIAL TRACKED OFF-SITE ONTO ROADWAYS SHALL BE IMMEDIATELY REMOVED
17. ALL CHEMICAL STORAGE SHALL BE MANAGED (E.G BUNDED) IN ACCORDANCE WITH WORKCOVER OR EPA GUIDELINES

CLEARING

18. NO-GO AREAS SHALL BE CLEARLY MARKED BY MEANS OF APPROPRIATE MARKINGS.
19. VEGETATION TO BE CLEARED SHALL BE CLEARLY MARKED USING APPROPRIATE MARKINGS
20. MACHINERY CUTTING EDGES SHALL NOT CONTACT THE SOIL (GRASS, SMALLER SHRUBS, AND ROOTS ETC. WILL BE INCORPORATED INTO THE TOPSOIL WHEN STRIPPED)
21. MINIMUM FORWARD CLEARING SHALL BE ADOPTED. CLEARING OF WATERCOURSES WILL NOT BE CARRIED OUT UNTIL THE ASSOCIATED WORK COMMENCES
22. LOGS SHALL BE SALVAGED OR REPLACED AS HABITAT. REMAINING VEGETATION SHALL BE USED AS MULCH, REMOVED TO AN AUTHORISED WASTE STATION OR BURNED IN PITS UNDER A LICENCE FROM THE EPA
23. VEGETATION WINDROWS SHALL BE LOCATED OUT OF FLOW LINES AND AWAY FROM UNDISTURBED VEGETATION
24. TEMPORARY OR PERMANENT STABILISATION (E.G.. SOWING OF COVERCROP) SHALL BE IMPLEMENTED WITHIN 1 WEEK ON SECTIONS OF CLEARED ZONES NOT FURTHER SUBJECT TO WORKS.

TOPSOIL STRIPPING

25. TOPSOIL SHALL INCLUDE A MINIMUM OF THE FIRST 100-150 MM OF THE SOIL SURFACE.
26. ALL TOPSOIL SHALL BE STRIPPED FROM ALL AREAS THAT ARE TO BE CUT OR FILLED AND STOCKPILED IN AREAS INDICATED ON THE PLAN, AWAY FROM DRAINAGE FLOWPATHS OR STORMWATER INLETS
27. TOPSOIL STOCKPILES SHALL BE LIMITED TO 1.5M IN HEIGHT, TRACK ROLLED AND WHERE STOCKPILED FOR PERIODS GREATER THAN 6 WEEKS FURTHER STABILISED (E.G.. EROSION PROTECTION BLANKET, VEGETATIVE COVER CROP (SEE BELOW) OR MULCHED).

EROSION CONTROL

28. THE EXTENT OF CUT AND FILLS SHALL BE MINIMISED
29. CUT AND FILL BATTER GRADES SHALL IDEALLY BE AT 1:3
30. OVER FILLING OF BATTERS SHALL BE AVOIDED
31. BARRIER OR SIMILAR FENCING SHALL BE USED TO PROTECT NO-GO AREAS
32. DISTURBED SOIL AREAS SHALL BE EFFECTIVELY MANAGED BY STAGING, MINIMISING AREA EXPOSED AT ANY ONE TIME AND MINIMISING THE EXPOSURE TIMEFRAME OF EACH
33. CATCHMENTS SHALL BE BROKEN INTO SMALLER SUB-CATCHMENTS THEREBY REDUCING RUNOFF VOLUMES E.G.:
    - DIVERTING CLEAN 'RUN-ON' WATER SAFELY AROUND THE SITE USING CATCH DRAINS OR BANKS (GRADES GENERALLY 1-2%, TO STABLE OUTLET AREAS), OR THROUGH THE DISTURBED WORK SITE TEMPORARILY LINING DESIGNATED FLOW PATHS
    - REDUCING SLOPE LENGTHS USING DIVERSION DRAINS (GRADES GENERALLY 3-4%) AT REGULAR INTERVALS ACROSS THE SLOPE) GENERALLY LOCATED AT EVERY LM FALL IN LONG GROUNDSLOPE) TO SUITABLE SEDIMENT TRAPS / ENERGY DISSIPATERS
    - MINIMISING THE STEEPNESS OF DISTURBED SLOPES
34. SOIL MATERIAL STOCKPILES (EXCAVATED AND IMPORTED) SHALL BE LOCATED OUT OF FLOW LINES
35. TEMPORARY OR PERMANENT SOIL COVERING SHALL BE PROVIDED WHERE APPROPRIATE TO REDUCE EROSION
36. ALL CONTROL MEASURES SHALL BE APPROPRIATELY DESIGNED, SIZED, LOCATED AND INSTALLED
37. ALL PERMANENT EROSION CONTROL MEASURES SHALL BE INSTALLED AS EARLY AND AS SOON AS THEIR EARTHWORKS ARE COMPLETED.

SEDIMENT CONTROL

38. THE NEED FOR SEDIMENT CONTROL MEANS THAT EROSION CONTROL HAS NOT BEEN ACHIEVED.
39. SEDIMENT FILTERS (E.G.. SEDIMENT FENCE) SHALL BE USED TO FILTER ALL 'SHEET FLOW' RUNOFF FROM DISTURBED AREAS. SEDIMENT FENCING SHALL BE INSTALLED TO THE MANUFACTURERS SPECIFICATIONS AND:
    - BE SPACED SUCCESSIVELY SPACED DOWNSLOPE NO GREATER THAN 50 M APART AND APPROXIMATELY AT EVERY 1 M FALL IN GROUNDSLOPE
    - BE INSTALLED TO THE CONTOUR
    - HAVE THE ENDS TURNED UPSLOPE 500 MM WHERE APPROPRIATE TO CREATE STORAGE
    - WHERE SEDIMENT FENCING CANNOT BE PLACED ON THE CONTOUR, SMALL CHECK DAMS OR FENCE RETURNS SHALL BE INCORPORATED AT REGULAR INTERVALS ALONG THE FENCE LINE TO SLOW RUNOFF

SEDIMENT CONTROL (Cont)

40. SEDIMENT TRAPS (E.G EXCAVATIONS, BARRIERS) SHALL BE USED TO POND 'CONCENTRATED' RUNOFF THEREBY ALLOWING SETTLEMENT AND RETENTION OF SEDIMENT. SEDIMENT TRAPS SHALL BE INSTALLED IN ACCORDANCE WITH PLAN DETAILS OR NOTE 1. THEY WILL:
    - BE AS LARGE AS PRACTICAL
    - BE CONSTRUCTED TO SUIT EXPECTED FLOW CONDITIONS
    - BE LOCATED APPROXIMATELY EVERY 1 M FALL IN GROUNDSLOPE
    - PROVIDE FOR SAFE OVERFLOW
41. SEDIMENT CONTROLS SHALL BE LOCATED AS CLOSE TO DISTURBED AREAS AS PRACTICAL
42. TRAPPED SEDIMENT SHALL BE REMOVED TO AN APPROPRIATE NOMINATED LOCATION
43. TEMPORARY CONTROL MEASURES SHALL REMAIN IN PLACE UNTIL THE CATCHMENT THEY ARE SERVICING IS STABILISED (FOR GRASS THIS WILL MEAN 70% GROUNDCOVER).

DUST CONTROL

44. ALL SOIL LOADED TRUCKS LEAVING OR ENTERING THE SITE SHALL BE TARPED
45. A WATER CART SHALL BE CONTINUALLY PROVIDED TO AVOID DUST GENERATION
46. WATERING, WIND FENCING, MANUFACTURED COVERINGS AND/OR MULCH SHALL BE PROVIDED WHERE COVERCROP STRIKE IS INHIBITED

TOPSOIL REPLACEMENT

47. TOPSOIL SHALL BE RE-SPREAD OVER ALL EXPOSED SOIL SURFACES WHERE VEGETATION IS REQUIRED. A MAXIMUM DEPTH OF 50 MM SHALL BE PLACED ON SLOPES STEEPER THAN 1:3 AND A MINIMUM DEPTH OF 100 MM SHALL BE PLACED ON SLOPES LESS THAN 1:3
48. WHERE CUT BATTERS ARE TO BE SEEDED, SLOPES EXCEEDING 1:2.5 (H:V) SHALL BE ROUGHENED HORIZONTALLY TO ENHANCE THE RETENTION OF TOPSOIL
49. SOIL AMELIORANTS SHALL BE PROVIDED WHERE REQUIRED AS DETERMINED BY THE PROJECT MANAGER.
50. SEEDBED PREPARATION SHALL BE PROVIDED WHERE TOPSOIL HAS BEEN OVERLY COMPACTED.

REVEGETATION

51. REVEGETATION SHALL BE ON-GOING AND PROGRESSIVE
52. WHERE ANY BREAK IN OPERATIONS, OR WHERE WORK IS CEASED IN AN AREA FOR LONGER THAN 4 WEEKS, THE EXPOSED AREAS SHALL BE STABILISED (E.G.. TEMPORARY TOPSOILING AND SEEDING WITH AN APPROPRIATE COVERCROP, MULCHES, BLANKETS / MATTINGS)
53. TOPSOILED AREAS SHALL BE SEEDED WITH THE FOLLOWING COVERCROP SPECIES:
    - SEPTEMBER TO FEBRUARY JAPANESE MILLET (15 KG/HA)
    - MARCH TO AUGUST ANNUAL RYEGRASS OR CEREAL RYE OR OATS (15 KG/HA)
54. FROM LATE FEBRUARY TO EARLY MARCH AND LATE AUGUST TO EARLY SEPTEMBER A COMBINATION OF SPECIES CAN BE USED
55. PERMANENT GRASS SPECIES SHALL COMPRISE:
    - PRE CONSTRUCTION OR NOMINATED SPECIES.
56. PERMANENT SHRUB AND TREE SPECIES SHALL COMPRISE:
    - AS PER LANDSCAPE PLAN;
    - IN ABSENCE OF LANDSCAPE PLAN, LOCAL NATIVE SPECIES. NOMINATE PLANT SPECIES, ITS FORM (SEED OR SEEDLING), PLANTING RATES, REGIMES, MATRICES,
57. AN NPK 11-34-11 FERTILISER OR SIMILAR AS APPROPRIATE SHALL BE APPLIED AT A RATE OF 200-400 KG/HA. CARE IS TO BE TAKEN TO AVOID ANY FERTILISER DIRECTLY ENTERING WATERCOURSES.
58. SCARIFYING OR DIRECT DRILLING SHOULD BE USED TO IMPROVE SEED STRIKE RATES
59. REVEGETATION WORKS SHALL BE MAINTAINED / ENHANCE (E.G.. RESEEDING, FERTILISING, WATERING) UNTIL A MINIMUM OF 70% GROUND COVER IS ESTABLISHED.
60. ADDITIONAL PROTECTION MEASURES (E.G ORGANIC MATTING / BLANKETS) SHALL BE PROVIDED (NOMINATE)
61. A STRIP OF TURF SHALL BE PROVIDED AND MAINTAINED IMMEDIATELY BEHIND KERB WHERE FOOTPATH AND SITE DISTURBANCE HAS OCCURRED AND COMPLIMENTED BY ADDITIONAL STRIPS ACROSS THE FOOTPATH AT REGULAR INTERVALS WHERE RUNOFF IS EXPECTED TO FLOW ALONG THE SAID FOOTPATH.
62. STOCKPILE SITES, BORROW PITS ETC. SHALL BE REVEGETATED IMMEDIATELY UPON DECOMMISSION.

MONITORING

63. THE WORKS SUPERVISOR SHALL BE RESPONSIBLE FOR:
    AUDIT OF THE ESCP
    - MONITORING OF ESCs
    - MAINTENANCE OF ESCs
    - MANAGEMENT OF ANY NON-CONFORMANCES

MAINTENANCE

64. THE WORKS SUPERVISOR SHALL BE RESPONSIBLE FOR ENSURING CONTROL MEASURES ARE CHECKED WEEKLY AND AFTER EACH RAINFALL EVENT INSPECTION AND MAINTENANCE PROVIDED WHERE REQUIRED.
65. TEMPORARY CONTROL MEASURES SHALL BE MAINTAINED UNTIL A MINIMUM OF 70% GROUND COVER IS ACHIEVED
66. WATER QUALITY ASSESSMENT SHALL BE PROVIDED PRIOR TO DISCHARGE OF ANY CONTAMINATED SITE STORMWATER INTO EITHER SURFACE OR GROUND WATERS
67. REHABILITATED AREAS SHALL BE MONITORED PERIODICALLY TO CHECK FOR THE POSSIBLE ONSET OF SOIL EROSION AND/OR WEED PROBLEMS.

AT COMPLETION

68. THE WORKS SUPERVISOR SHALL ENSURE THAT:
    - ALL PERMANENT ESC WORKS ARE CORRECTLY INSTALLED
    - ALL TEMPORARY CONTROL MEASURES ARE REMOVED, BUT ONLY WHEN AT LEAST 70% GROUND COVER HAS BEEN ACHIEVED

EVALUATION

69. THE WORKS SUPERVISOR SHALL ENSURE THE PLAN IS CONTINUALLY EVALUATED AND AMENDMED WHERE REQUIRED.

REV.	DATE	REVISION	DR.BY	AP.BY
DA5	19/06/15	LAYOUT AMMENDMENTS	APR	RDG
DA4	30/4/15	Minor Amendments throughout	APR	RDG

de Groot & Benson
Consulting Engineers & Planners
A.C.N. 052 300 571
236 Harbour Drive,
Coffs Harbour NSW 2450
Phone (02) 6652 1700
Fax (02) 6652 7418
Email: email@dgb.com.au

Scale: AS SHOWN	Cad File No.: 13056_Civil - APRIL 2015.dwg		
Surveyed	Datum: AHD		
Drawn: APR	Designed: APR	Approved: RDG	
Checked: RDG	Date: 2013	No. of dwgs: ---	

Project: SALTWATER DEVELOPMENT SOUTH WEST ROCKS, NSW

Client: LEX TALL

Title: SEDIMENT & EROSION CONTROL DETAILS

Project No. 13056

Drawing No. DA-15

Amendment No. DA5

509 DP 850963

4.16m

WAIANBAR AVE

4.39m

PLANTED SWALE DRAIN

C4

C3

C2

C1

ROAD 1

ROAD 2

ROAD 3

CL=4.25m

1 627m²
2 707m²
3 641m²
4 641m²
5 641m²
6 641m²
7 604m²
8 641m²
9 787m²
10 630m²
11 968m²
12 968m²
13 616m²
14 1024m²
15 824m²
16 710m²
17 657m²
18 625m²
19 639m²
20 640m²
21 769m²
22 683m²
23 919m²
24 1183m²
25 640m²
26 640m²
27 640m²
28 636m²
29 640m²

TK 4.05 SAG 0.7%
TK 4.45 CREST 0.7%
TK 4.25 IL 3.30 SAG 0.7%
TK 4.25 IL 3.25 SAG 0.7%
TK 4.40 CREST 0.7%
TK 4.00 0.7%
TK 3.80 IL 2.85
IL 2.85 IL 2.75 SAG
TK 4.20 CREST 0.7%
TK 3.90
TK 3.55 IL 2.45 SAG R9
IL 2.77
TK 4.40 CREST
IL 3.07 SAG 0.7%
TK 4.15 IL 3.00
TK 4.40 CREST
IL 2.90 0.81%
GL 3.95 IL 3.20
GL 3.85 IL 3.35
GL 3.80 IL 3.40
GL 3.80 IL 3.10
GL 3.60 IL 2.90
GL 3.60 IL 3.20
GL 3.60 IL 3.40
GL 3.60 IL 3.20
GL 3.60 IL 3.05
GL 3.60 IL 2.90
GL 3.60 IL 2.65
FLOOR 2.55
R12

TEMPORARY SOAK-A-WAYS UNTIL ROAD IS EXTENDED

CONVENTIONAL K&G AND PIPE AND PIT DRAINAGE

PIPE & PIT INTERALOTMENT DRAINAGE FOR LOTS THAT DON'T DRAIN TO THE STREET

BIO-RETENTION BASIN C21, FLOOR AREA 40 sq.m AT RL 2.55m

INFILTRATION SWALE FLOOR 0.6m WIDE AT RL 2.70m 0.6m WIDE INFILTRATION TRENCH AT RL 2.0m

BIO-RETENTION BASIN C1, FLOOR AREA 250 sq.m AT RL 2.55m

OVERFLOW STRUCTURE TO EXISTING DRAIN

PT LOT 30

PT LOT 30

ZONING LINE

ZONING LINE

E2 - ENVIRONMENTAL PROTECTION (HABITAT) ZONE

STORMWATER MANAGEMENT

1. ALL DWELLINGS ASSUMED TO HAVE A 3kL MINIMUM RAINWATER TANK DRAINING AVE 200 sq.m OF ROOF.
2. WATER QUALITY TREATMENT MEASURES (ROOFWATER TANKS, SWALE, TEMP SOAK AWAY AND BIO-RETENTION BASINS HAVE BEEN SIZED BY MUSIC MODELLING TO ENSURE POLLUTANTS ARE LESS THAN THAT FROM THE PRE-DEVELOPMENT AGRICULTURAL SITE.
3. THE WATER QUALITY TREATMENT MEASURES ARE ALL LOCATED OUTSIDE THE 7A ENVIRONMENTAL ZONING.
4. THE WATER QUALITY TREATMENT MEASURES IN COMBINATION WITH THE INFILTRATION SWALE HAVE BEEN SIZED TO ENSURE GROUND WATER RECHARGE AND TO REPLICATE THE EXISTING GROUNDWATER REGIEM OUTSIDE OF THE SITE BOUNDARIES

10 0 10 20 30 40 50

SCALE OF METRES 1:1000

REV.	DATE	REVISION	DR.BY	AP.BY
DA5	19/06/15	LAYOUT AMMENDMENTS	APR	RDG
DA4	20/02/14	Minor Amendments throughout	APR	RDG

de Groot & Benson
Consulting Engineers & Planners

A.C.N. 052 300 571
236 Harbour Drive,
Coffs Harbour NSW 2450

Phone (02) 6652 1700
Fax (02) 6652 7418
Email: email@dgb.com.au

Scale	1:1000 @ A3	Cad File No.	13056_Civil - APRIL 2015.dwg
Surveyed	MR	Datum	AHD
Drawn	APR	Designed	APR
Checked	RDG	Date	2013
Approved	RDG	No. of dwgs	---

Project: SALTWATER DEVELOPMENT SOUTH WEST ROCKS, NSW

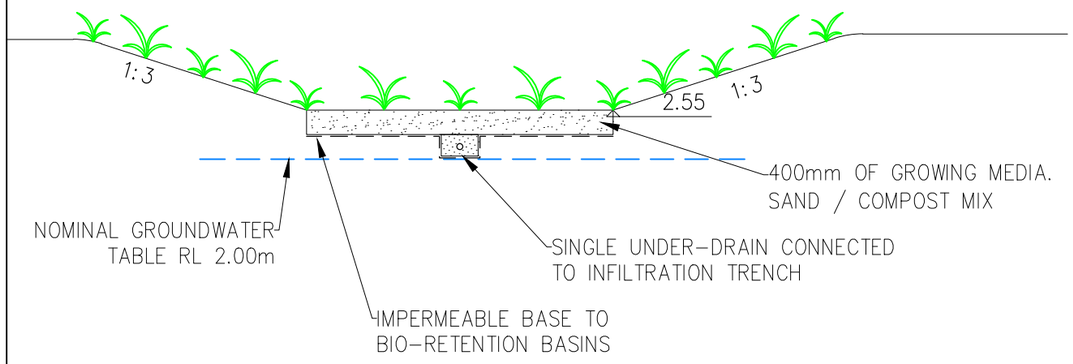
Client: LEX TALL

Title: STORMWATER MANAGEMENT PLAN

Project No. 13056

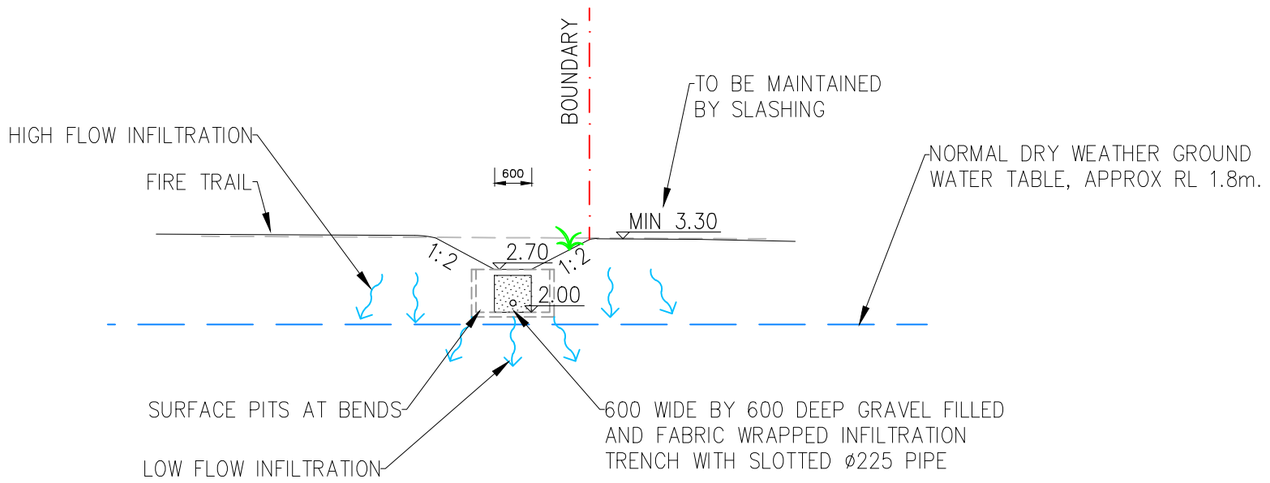
Drawing No. DA-16 CONCEPT - 7

Amendment No. DA5



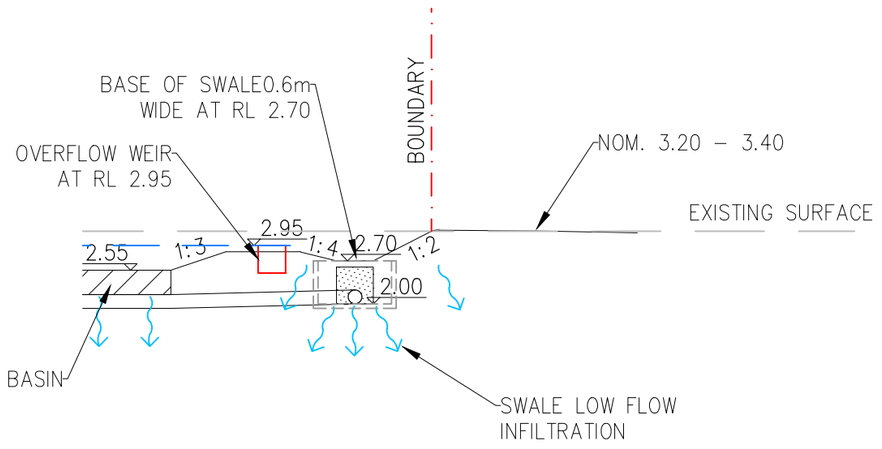
BIORETENTION BASIN DETAIL

SCALE 1:100



INFILTRATION SWALE DETAIL

SCALE 1:100



BIORETENTION AND INFILTRATION SECTION

SCALE 1:100

10 0 10 20 30 40 50

SCALE OF METRES 1:1000

REV.	DATE	REVISION	DR.BY	AP.BY
DA5	19/06/15	LAYOUT AMMENDMENTS	APR	RDG
DA4	20/02/14	Minor Amendments throughout	APR	RDG

de Groot & Benson

Consulting Engineers & Planners

A.C.N. 052 300 571
236 Harbour Drive,
Coffs Harbour NSW 2450

Phone (02) 6652 1700
Fax (02) 6652 7418
Email: email@dgb.com.au

Scale 1:1000 @ A3	Cad File No. 13056_Civil - APRIL 2015.dwg		
Surveyed MR	Datum AHD		
Drawn APR	Designed APR	Approved RDG	
Checked RDG	Date 2013	No. of dwgs ---	

Project: SALTWATER DEVELOPMENT
SOUTH WEST ROCKS, NSW

Client: LEX TALL

Title: STORMWATER DETAILS

Project No. 13056

Drawing No. DA-17
CONCEPT - 7

Amendment No. DA5

REV.	DATE	REVISION	DR.BY	AP.BY
DA5	19/06/15	LAYOUT AMMENDMENTS	APR	RDG
P2	28/10/14	MINOR AMENDMENTS	APR	RDG

de Groot & Benson

Consulting Engineers & Planners

A.C.N. 052 300 571
236 Harbour Drive,
Coffs Harbour NSW 2450

Phone (02) 6652 1700
Fax (02) 6652 7418
Email: email@dgb.com.au

Scale: AS SHOWN	Cad File No.: 13056_Civil - APRIL 2015.dwg		
Surveyed: MR	Datum: AHD		
Drawn: APR	Designed: APR	Approved: RDG	
Checked: RDG	Date: 2013	No. of dwgs: ---	

Project:
SALTWATER DEVELOPMENT
SOUTH WEST ROCKS, NSW

Client:
LEX TALL

Title:
SITE CONTEXT

Project No. 13056

Drawing No. MP1

Amendment No. DA5

REV.	DATE	REVISION	DR.BY	AP.BY
DA5	19/06/15	LAYOUT AMMENDMENTS	APR	RDG
P2	28/10/14	MINOR AMENDMENTS	APR	RDG

de Groot & Benson

Consulting Engineers & Planners

A.C.N. 052 300 571
236 Harbour Drive,
Coffs Harbour NSW 2450

Phone (02) 6652 1700
Fax (02) 6652 7418
Email: email@dgb.com.au

Scale: AS SHOWN	Cad File No.: 13056_Civil - APRIL 2015.dwg		
Surveyed: MR	Datum: AHD		
Drawn: APR	Designed: APR	Approved: RDG	
Checked: RDG	Date: 2013	No. of dwgs: ---	

Project: SALTWATER DEVELOPMENT SOUTH WEST ROCKS, NSW

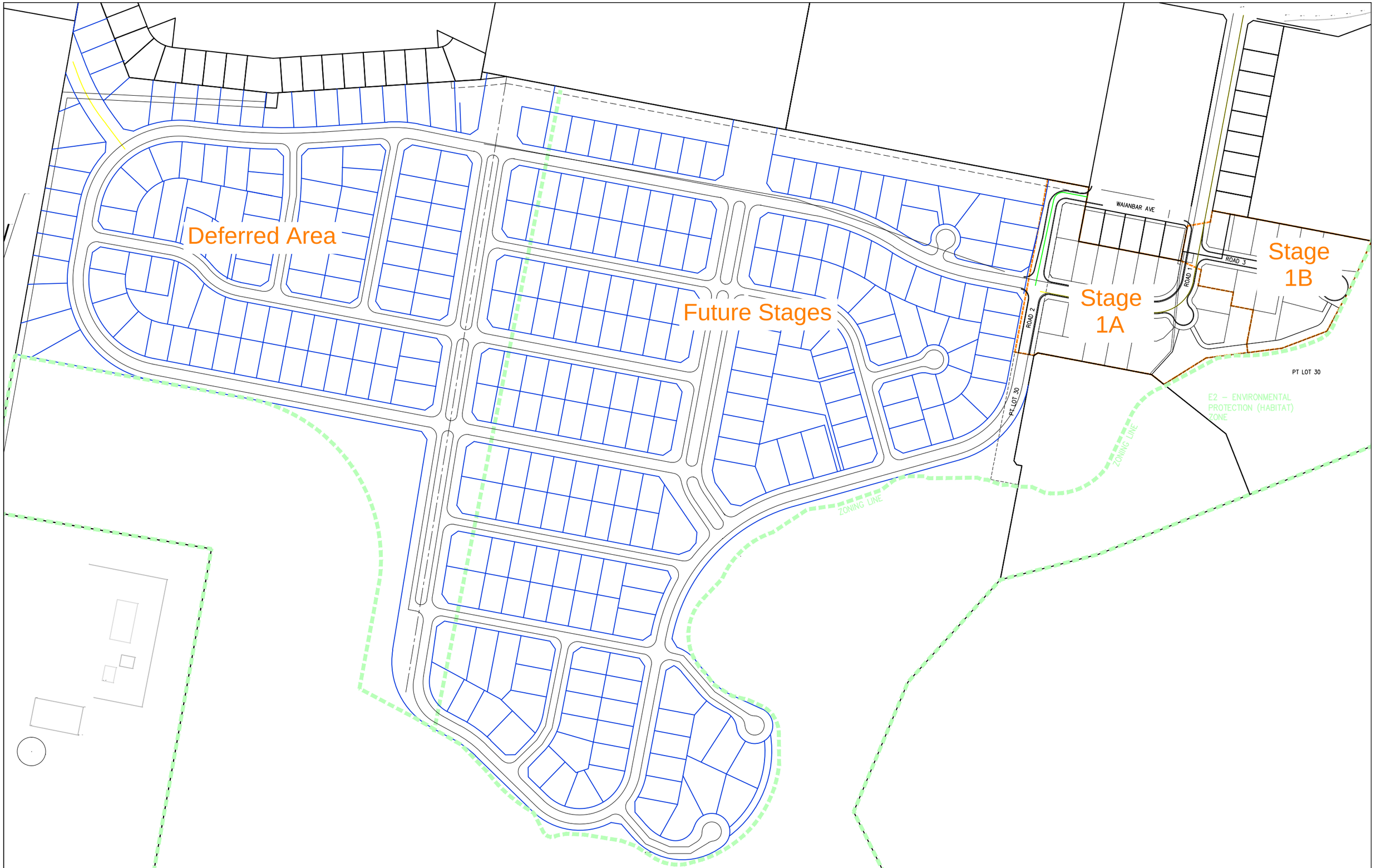
Client: LEX TALL

Title: CONCEPT MASTER PLAN with aerial photo underlay

Project No. 13056

Drawing No. MP2

Amendment No. DA5



REV.	DATE	REVISION	DR.BY	AP.BY
DA5	19/06/15	LAYOUT AMMENDMENTS	APR	RDG
P2	28/10/14	MINOR AMENDMENTS	APR	RDG

de Groot & Benson

Consulting Engineers & Planners

A.C.N. 052 300 571
236 Harbour Drive,
Coffs Harbour NSW 2450

Phone (02) 6652 1700
Fax (02) 6652 7418
Email: email@dgb.com.au

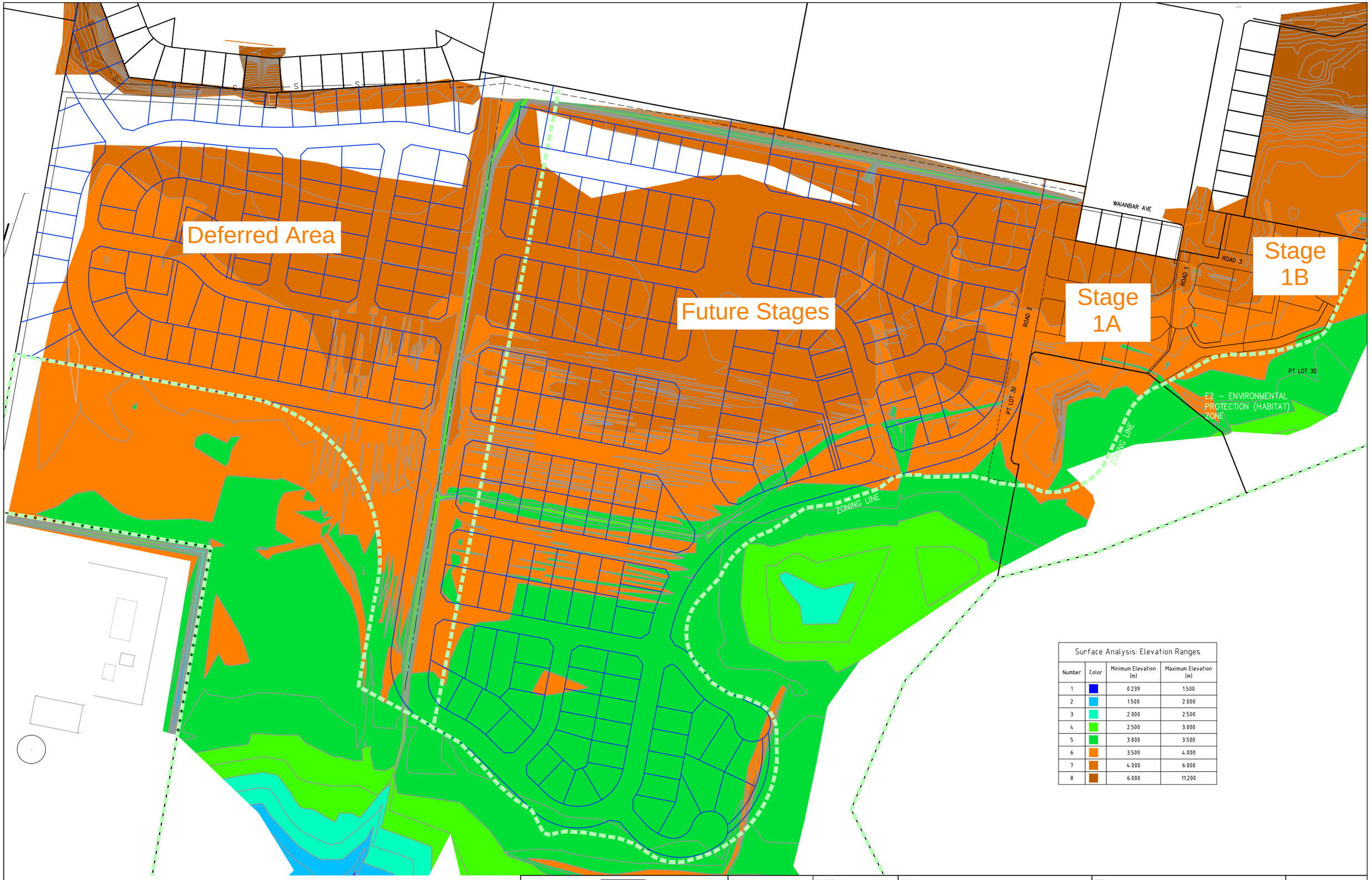
Scale: AS SHOWN	Cad File No.: 13056_Civil - APRIL 2015.dwg		
Surveyed: MR	Datum: AHD		
Drawn: APR	Designed: APR	Approved: RDG	
Checked: RDG	Date: 2013	No. of dwgs: ---	

Project: SALTWATER DEVELOPMENT SOUTH WEST ROCKS, NSW

Client: LEX TALL

Title: CONCEPT MASTER PLAN

Project No.	13056
Drawing No.	MP3
Amendment No.	DA5



Surface Analysis: Elevation Ranges			
Number	Color	Minimum Elevation (m)	Maximum Elevation (m)
1		0.239	1.500
2		1.500	2.000
3		2.000	2.500
4		2.500	3.000
5		3.000	3.500
6		3.500	4.000
7		4.000	6.000
8		6.000	11.200

REV.	DATE	REVISION	DR.BY	AP.BY
DA5	19/06/15	LAYOUT AMMENDMENTS	APR	RDG
P2	28/10/14	MINOR AMENDMENTS	APR	RDG

de Groot & Benson

Consulting Engineers & Planners

A.C.N. 052 300 571
236 Harbour Drive,
Coffs Harbour NSW 2450

Phone (02) 6652 1700
Fax (02) 6652 7418
Email: email@dgb.com.au

Scale: AS SHOWN	Cad File No.: 13056_Civil - APRIL 2015.dwg		
Surveyed: MR	Datum: AHD		
Drawn: APR	Designed: APR	Approved: RDG	
Checked: RDG	Date: 2013	No. of dwgs: ---	

Project: SALTWATER DEVELOPMENT SOUTH WEST ROCKS, NSW

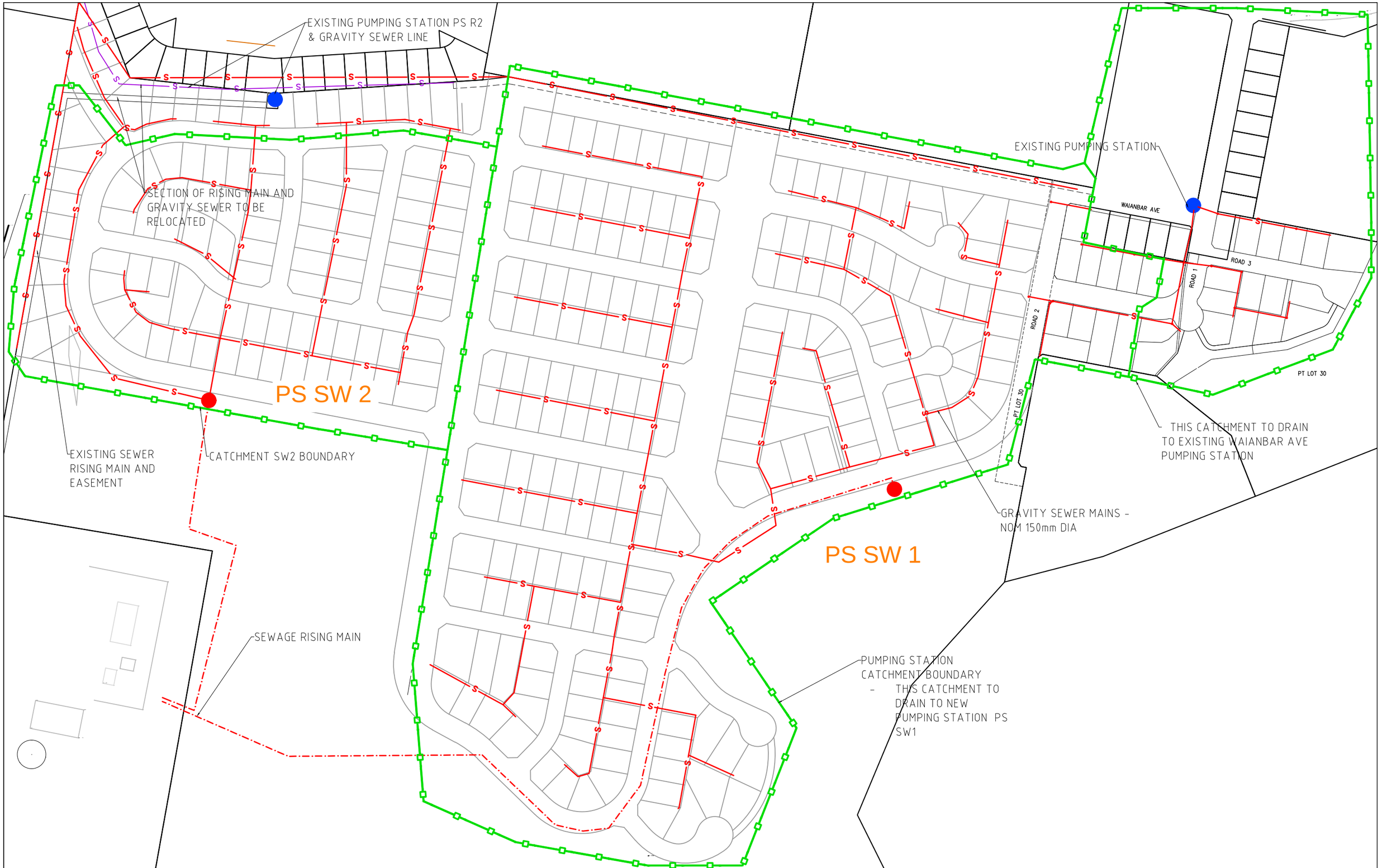
Client: LEX TALL

Title: SITE ELEVATION PLAN

Project No. 13056

Drawing No. MP4

Amendment No. DA5



REV.	DATE	REVISION	DR.BY	AP.BY
DA5	19/06/15	LAYOUT AMMENDMENTS	APR	RDG
P2	28/10/14	MINOR AMENDMENTS	APR	RDG

de Groot & Benson

Consulting Engineers & Planners

A.C.N. 052 300 571
236 Harbour Drive,
Coffs Harbour NSW 2450

Phone (02) 6652 1700
Fax (02) 6652 7418
Email: email@dgb.com.au

Scale: AS SHOWN	Cad File No.: 13056_Civil - APRIL 2015.dwg		
Surveyed: MR	Datum: AHD		
Drawn: APR	Designed: APR	Approved: RDG	
Checked: RDG	Date: 2013	No. of dwgs: ---	

Project: SALTWATER DEVELOPMENT
SOUTH WEST ROCKS, NSW

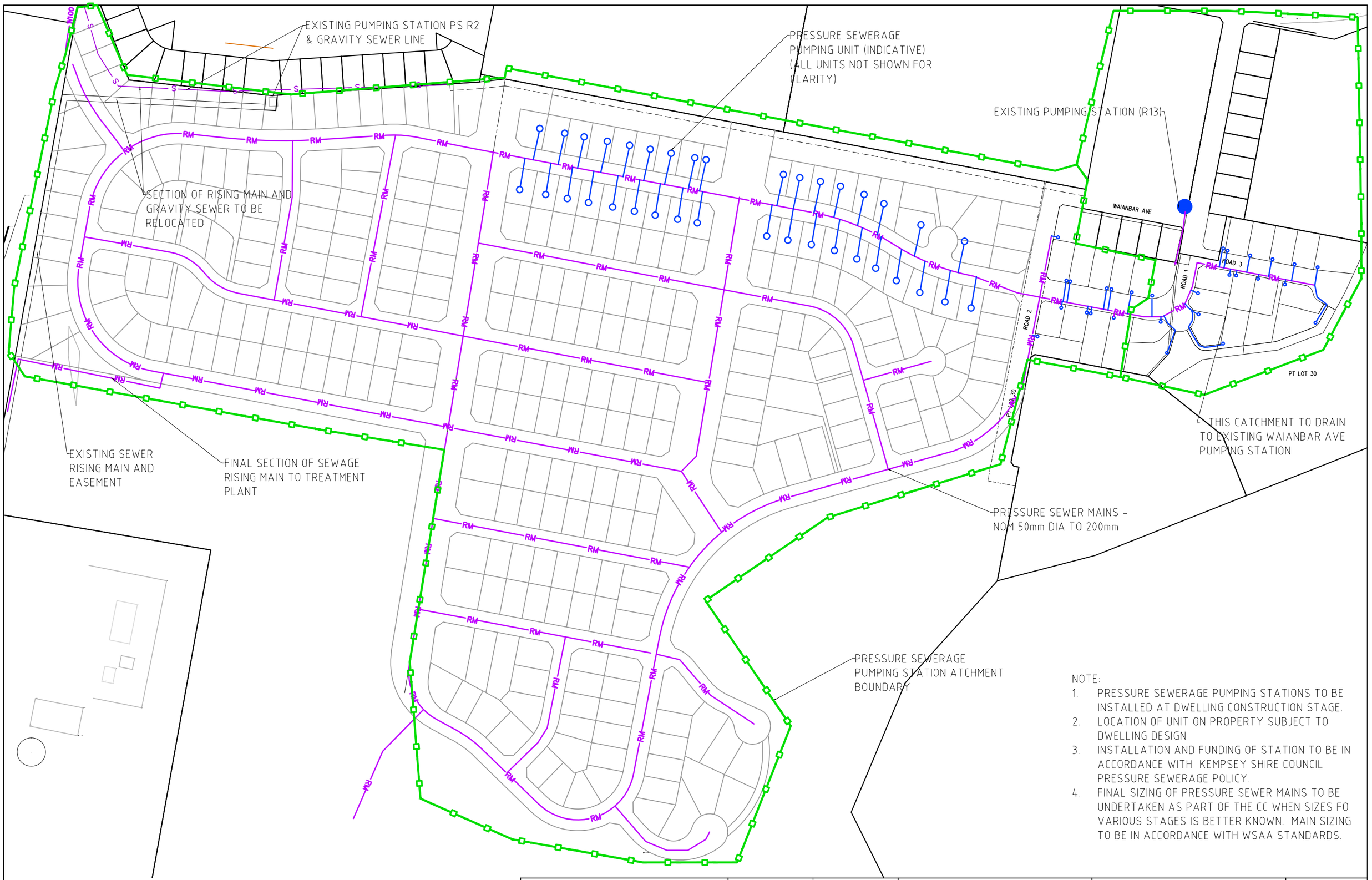
Client: LEX TALL

Title: CONCEPT MASTER PLAN
OPTION 1 -
GRAVITY SEWER OPTION

Project No. 13056

Drawing No. MP5-1

Amendment No. DA5



NOTE:

1. PRESSURE SEWERAGE PUMPING STATIONS TO BE INSTALLED AT DWELLING CONSTRUCTION STAGE.
2. LOCATION OF UNIT ON PROPERTY SUBJECT TO DWELLING DESIGN
3. INSTALLATION AND FUNDING OF STATION TO BE IN ACCORDANCE WITH KEMPSEY SHIRE COUNCIL PRESSURE SEWERAGE POLICY.
4. FINAL SIZING OF PRESSURE SEWER MAINS TO BE UNDERTAKEN AS PART OF THE CC WHEN SIZES FO VARIOUS STAGES IS BETTER KNOWN. MAIN SIZING TO BE IN ACCORDANCE WITH WSAA STANDARDS.

REV.	DATE	REVISION	DR.BY	AP.BY
DA5	19/06/15	LAYOUT AMMENDMENTS	APR	RDG
P2	28/10/14	MINOR AMENDMENTS	APR	RDG

de Groot & Benson
Consulting Engineers & Planners
A.C.N. 052 300 571
236 Harbour Drive,
Coffs Harbour NSW 2450
Phone (02) 6652 1700
Fax (02) 6652 7418
Email: email@dgb.com.au

Scale: AS SHOWN	Cad File No.: 13056_Civil - APRIL 2015.dwg		
Surveyed: MR	Datum: AHD		
Drawn: APR	Designed: APR	Approved: RDG	
Checked: RDG	Date: 2013	No. of dwgs: ---	

Project: SALTWATER DEVELOPMENT
SOUTH WEST ROCKS, NSW

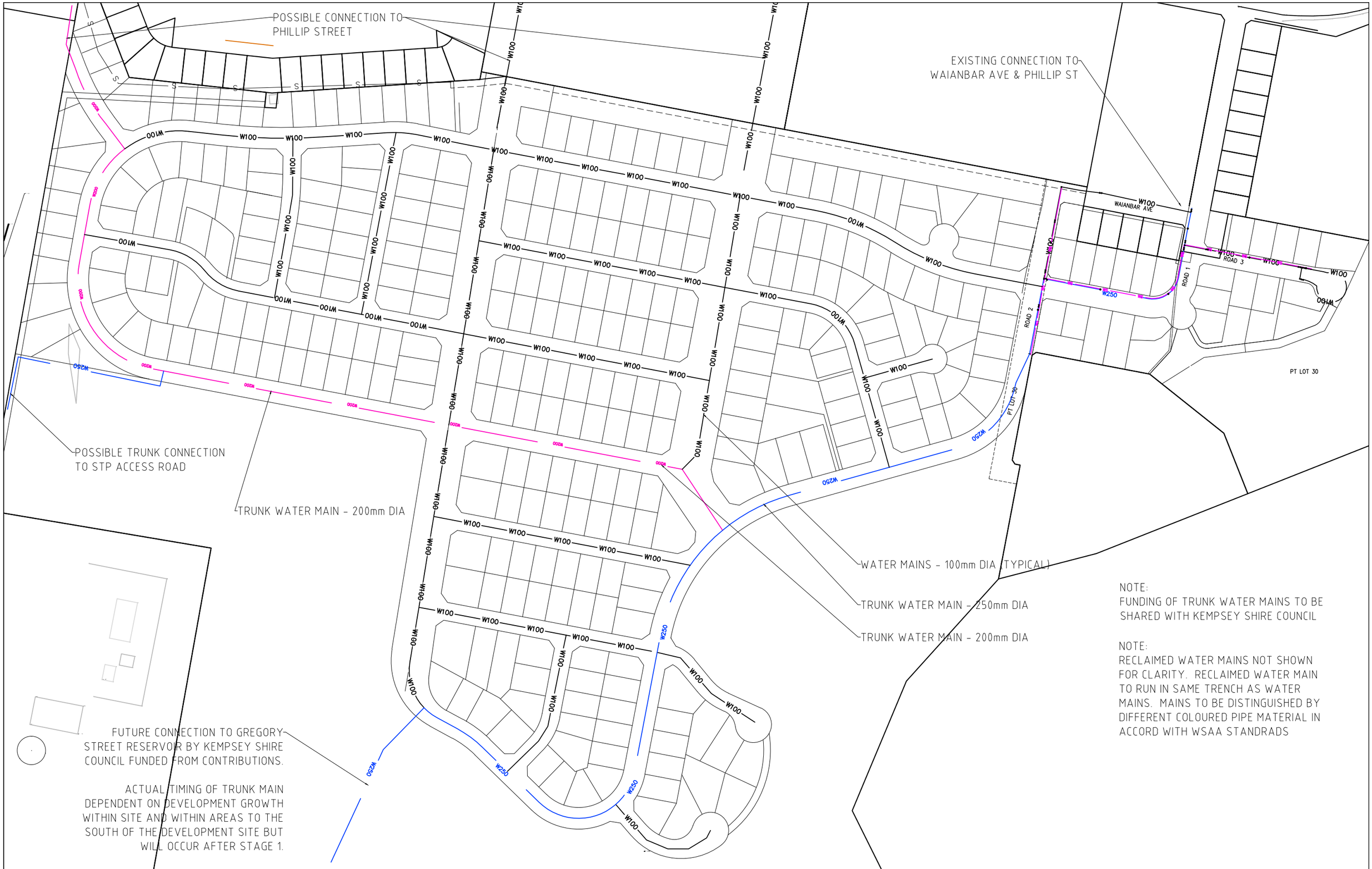
Client: LEX TALL

Title: CONCEPT MASTER PLAN
OPTION 2 -
PRESSURE SEWER OPTION

Project No. 13056

Drawing No. MP5-2

Amendment No. DA5



NOTE:
FUNDING OF TRUNK WATER MAINS TO BE SHARED WITH KEMPSEY SHIRE COUNCIL

NOTE:
RECLAIMED WATER MAINS NOT SHOWN FOR CLARITY. RECLAIMED WATER MAIN TO RUN IN SAME TRENCH AS WATER MAINS. MAINS TO BE DISTINGUISHED BY DIFFERENT COLOURED PIPE MATERIAL IN ACCORD WITH WSAA STANDRADS

REV.	DATE	REVISION	DR.BY	AP.BY
DA5	19/06/15	LAYOUT AMMENDMENTS	APR	RDG
P2	28/10/14	MINOR AMENDMENTS	APR	RDG

de Groot & Benson
Consulting Engineers & Planners
A.C.N. 052 300 571
236 Harbour Drive,
Coffs Harbour NSW 2450
Phone (02) 6652 1700
Fax (02) 6652 7418
Email: email@dgb.com.au

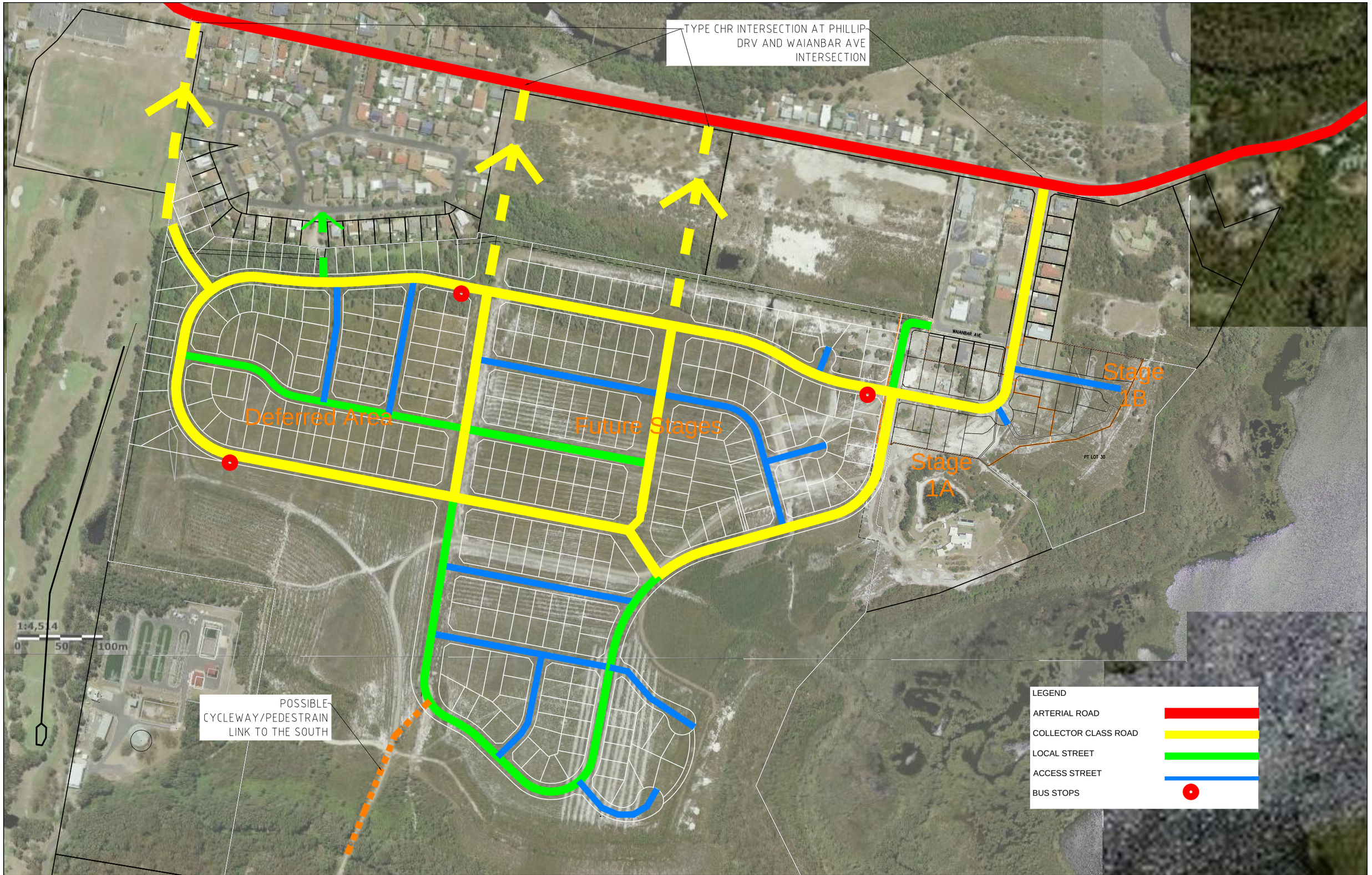
Scale: AS SHOWN	Cad File No.: 13056_Civil - APRIL 2015.dwg		
Surveyed: MR	Datum: AHD		
Drawn: APR	Designed: APR	Approved: RDG	
Checked: RDG	Date: 2013	No. of dwgs: ---	

Project: SALTWATER DEVELOPMENT SOUTH WEST ROCKS, NSW

Client: LEX TALL

Title: CONCEPT MASTER PLAN WATER SUPPLY & RECLAIMED WATER STRATEGY

Project No. 13056
Drawing No. MP6
Amendment No. DA5



REV.	DATE	REVISION	DR.BY	AP.BY
DA5	19/06/15	LAYOUT AMMENDMENTS	APR	RDG
P2	28/10/14	MINOR AMENDMENTS	APR	RDG

de Groot & Benson
Consulting Engineers & Planners

A.C.N. 052 300 571
236 Harbour Drive,
Coffs Harbour NSW 2450

Phone (02) 6652 1700
Fax (02) 6652 7418
Email: email@dgb.com.au

Scale: AS SHOWN	Cad File No.: 13056_Civil - APRIL 2015.dwg		
Surveyed: MR	Datum: AHD		
Drawn: APR	Designed: APR	Approved: RDG	
Checked: RDG	Date: 2013	No. of dwgs: ---	

Project: SALTWATER DEVELOPMENT SOUTH WEST ROCKS, NSW

Client: LEX TALL

Title: CONCEPT TRAFFIC STRATEGY

Project No.: 13056

Drawing No.: MP7

Amendment No.: DA5

STORMWATER MANAGEMENT

The Stormwater Management will comprise:

1. Conventional road Kerb & Gutter, pipe and pits. Due to flat topography such drainage will be limited to approximately 200m of pipe run maximum.
2. Piped interalotment drainage where lots do not fall to kerbs.
3. The piped systems will discharge into a network of open infiltration bio-retention swales. Bioretention filter media and planting will be located at pipe outlets as per concept design for Stage 1.
4. Swales will be laid at very flat grades with a base level above the normal dry weather ground water table.
5. Swales will include a low flow infiltration trench to assist in distributing infiltration and reducing standing water, allowing the swale to be mowable in dry weather.
6. High flow infiltration will be direct from the swale.
7. Water quality treatment will be sized to reduce pollutants from the pre-development agriculture case.
8. For future stages, the area required for bio-retention is about 2.0% of the catchment areas. These bio-retention areas will then drain to infiltration galleries which will recharge groundwater.

GROUNDWATER MANAGEMENT

The Groundwater Management will comprise:

1. Groundwater Water infiltration areas are to be provided.
2. The system is to have sufficient storage volume for 40% of the average daily rainfall (excluding non-rain days).
3. Analysis shows that the average daily rainfall is about 11mm per day.
4. On the assumption that the developable area outside of Stage 1 is approximately 34.5 ha, then a storage volume of approximately 1,520 cubic metres is required.
5. With an average depth of 400 mm – the total surface area required is about 3,800 square metres or 1.1% of the catchment area.

REV.	DATE	REVISION	DR.BY	AP.BY
DA5	19/06/15	LAYOUT AMMENDMENTS	APR	RDG
P3	05/06/15	WSUD AMENDMENTS	TJP	RDG
P2	28/10/14	MINOR AMENDMENTS	APR	RDG

de Groot & Benson
Consulting Engineers & Planners
A.C.N. 052 300 571
236 Harbour Drive,
Coffs Harbour NSW 2450
Phone (02) 6652 1700
Fax (02) 6652 7418
Email: email@dgb.com.au

Scale: AS SHOWN		Cad File No.: 13056_Civil - APRIL 2015.dwg	
Surveyed: MR		Datum: AHD	
Drawn: APR	Designed: APR	Approved: RDG	
Checked: RDG	Date: 2013	No. of dwgs: ---	

Project: SALTWATER DEVELOPMENT SOUTH WEST ROCKS, NSW

Client: LEX TALL

Title: CONCEPT STORMWATER AND GROUNDWATER PLAN

Project No.: 13056

Drawing No.: MP8

Amendment No.: DA5

"Saltwater"
South West Rocks

Stage 1 - Stormwater Management Plan

for

S W Rocks Developments P/L

June 2015

de Groot & Benson Pty Ltd

ACN 052 300 571
Ph 02 6652 1700
Fax 02 6652 7418
Email: email@dgb.com.au

236 Harbour Drive
PO Box 1908
Coffs Harbour NSW 2450

TABLE OF CONTENTS

TABLE OF CONTENTS **1**

DOCUMENT CONTROL STATUS **2**

1 SUMMARY **3**

2 OBJECTIVES **4**

3 EXISTING CATCHMENT **5**

3.1 Existing Site 5

3.2 Existing Stormwater Behaviour 5

4 BACKGROUND **6**

4.1 Kempsey Coastal Processes and Hazards Definition Study – June 2013 6

4.2 Saltwater Creek & Lagoon Estuary Management Study and Plan 8

4.3 Water Sensitive Urban Design, Planning and Technical Guidelines for Saltwater Precinct 9

5 PROPOSED STORMWATER MANAGEMENT **10**

5.1 Water Quality Modelling 11

5.2 Water Quality Treatment Measures 12

5.3 MUSIC Model Results 13

6 PROPOSED GROUNDWATER MANAGEMENT **13**

6.1 Catchments C1 and C2 14

6.2 Catchment C3 15

6.3 Catchment C4 15

7 STORMWATER MASTER PLAN **16**

7.1 General Description 16

7.2 Stormwater Quality Management of Future Stages 16

7.3 Groundwater Management of Future Stages 18

7.4 Stormwater Management Plan for Future Stages 18

8 RESPONSE TO PLANNING CONTROLS **20**

8.1 Compliance to Saltwater Creek & Lagoon Estuary Management Study and Plan 20

8.2 Compliance with Kempsey Development Control Plan – Section D2 – Saltwater Precinct. 21

9 REFERENCES **24**

DRAWINGS **25**

DOCUMENT CONTROL STATUS

Issue	Rev.	Issued To	Qty	Date	Reviewed	Approved
Revision 0		-Geoff Smyth	1	April 2014	RDG	RDG
Revision 1		Geoff Smyth-	1	Oct 2014	RDG	RDG
Revision 2		Geoff Smyth-	1	June 2015	RDG	RDG
Revision 3		Geoff Smyth-	1	June 2015	RDG	RDG

Printed:	19 June, 2015 8:30 AM
Last Saved:	12 June 2015 4:12 PM
File Name:	S:\13\13056 Saltwater - Waianbar Ave South West Rocks\WP\13056 SWMP 2015-06-05 Rev 2.docx
Project Manager:	Rob de Groot
Name of Organisation:	de Groot & Benson Pty Ltd
Name of Project:	
Name of Document:	Stormwater Management Plan – Revision 2
Job Number:	13056

1 SUMMARY

This report presents the proposed stormwater and groundwater management for stage 1 of the Saltwater residential subdivision.

The proposed stormwater management has been designed to meet the objectives of the Kempsey Development Control Plan 2013 – Section D2 – Saltwater Precinct (ref 1). The site presents certain constraints and challenges, specifically:

- Near level land with little fall;
- Sand soils of high infiltration capacity;
- High ground water;
- The need to improve stormwater quality above that from the existing agriculture land use;
- The need to maintain the existing groundwater behaviour beyond the footprint of the development (to protect the Saltwater Lagoon to the east of the development).

A concept stormwater drainage and groundwater infiltration design has been prepared as shown on drawings 13056-DA16. The design utilises:

- No bulk filling. Much of the development will be constructed on or close to the existing grade;
- A conventional kerb & gutter road system with conventional pipe and pit drainage. This being considered the most sustainable from an ongoing maintenance perspective. However, due to the flat low topography, its reach will be limited to about 150 m of pipe run;
- Two bio-retention basins along the stage's eastern boundary;
- An infiltration trench and swale along the eastern boundary designed to infiltrate the impervious area runoff and recharge the groundwater;
- Two small temporary soak away infiltration basins. These will be replaced in latter stages;
- Minor works to an existing northern swale drain

Water quality modelling using MUSIC software and calculations support the concept design. These demonstrate that it can meet the requirements of the DCP. It is considered that the concept design has been developed sufficiently to prove its viability for development approval. Further detailed design, sizing and modelling will be required before construction approval.

As part of this revision, changes were made to the proposed stormwater treatment train of the development, and MUSIC modelling used to ensure compliance of the latest WSUD strategy with the applicable standards and policies. These changes involved the removal of the proposed rainwater tanks, changing the base of each bio-retention system to be impermeable and including the previously proposed infiltration swale as part of the stormwater treatment train.

2 OBJECTIVES

The key objectives for the development's stormwater management are given in the section 2.0, e) of the Saltwater DCP (Ref 1). In more specific terms these can be distilled to:

i. Stormwater volume leaving the site is not to be increased (note, wording is volume and not flow rate);

ii. Include water re-use;

iii. Provide a reduction in pollutants leaving the site from predevelopment levels in events of up to 2-year ARI. Specific pollutants are not stated;

iv. Ensure no change to natural groundwater that could affect the adjacent Saltwater Lagoon and creek;

v. WSUD water quality treatment to be located within the development and outside the 7a zone.

vi. Manage biting insects through control of free water surfaces.

3 EXISTING CATCHMENT

3.1 Existing Site

For the purposes of this report, the 'Site' is the footprint of land proposed for stage 1 of the development. It covers some 3.9 Ha of land proposed for roads, residential lots and stormwater management. The footprint is shown on drawing 13056-DA16. The site is part of the larger proposed Saltwater Development, for which a concept stormwater management master plan has been prepared as presented in Chapter 6.

The site at present is mostly cleared land used for agriculture, being a Farm Forestry plantation. Although a significant portion contains a gravelled yard and shed. The ground level typically lies between RL 3.5 and 4.5mAHD. There is a slight fall to the east and south. Beyond the development footprint to the east, the land continues to fall through land zoned 7A environmental to Saltwater Lagoon. The normal dry weather water level of the lagoon is approximately RL 1.2mAHD.

The soil profile of the site and surrounding area is predominantly free draining sand soils. These and the existing groundwater behaviour are described in detail in Ref 2 and 3. The free draining sand is interrupted at various depths and various locations by less permeable indurated sands (coffee rock) and clay layers. While these significantly reduce the overall permeability of the site from that of pure clean sand, in general terms the site is highly permeable with high rainfall infiltration potential.

The existing stormwater behaviour is predominantly that of infiltration. The vast majority of rainfall infiltrates the free draining sand soil, where it either subsequently evaporates through evapotranspiration, or follows the ground water profile, seeping to Saltwater Lagoon. In fact, the majority of flow into the lagoon is by groundwater seepage, refer to Ref 2.

3.2 Existing Stormwater Behaviour

Under the existing conditions, where there is currently minimal impervious area and no continuous drainage system, there is little surface runoff. There are two circumstances that will produce surface runoff:

- **An intense rainfall burst**. Only an intense rainfall burst will deliver rainfall in excess of the surface soil's infiltration potential, and thus produce surface runoff. This runoff will follow the fall of the land, mostly to the south and east and potentially reach Saltwater Lagoon as surface flow. However, as a portion of total rainfall, this runoff component would be very minor, a few percent at most.

- **Prolonged heavy rainfall**. Surface runoff will also occur during prolonged heavy rainfall where the ground water table reaches the surface. In accordance with Ref 2, the groundwater level rises from RL 1.2 mAHD at the lagoon to 3.0 mAHD under the western third of the site. This was measured on 24 July 2007 and 14 August 2007, after several weeks of dry weather. For the purpose of this assessment the measured ground water profile is considered the 'dry weather' or 'normal' ground water level. The ground water level will rise during heavy rainfall. And, after prolonged dry weather, it is likely to drop further below the 'normal' level, although its vertical movement at depth is significantly impeded by the more impermeable

layers of indurated sand (coffee rock) and clay layers. These layers assist in holding the groundwater up in dry times, refer to ref 2 & 3.

The normal ground water level, is typically 0.5 to 2.0 m below the surface, and the void space of the sand soil is approximately 20% (Ref 2). Heavy rainfall, in excess of 100mm, is likely to bring the groundwater level to the surface in low lying places. Any further rainfall will produce runoff in these locations. In major rainfall events of several hundred mm, the groundwater may reach the surface over a substantial portion of the site, leading to significant surface runoff. Again, this would follow the natural fall of the land and generally flow south and east into the Lagoon. Note, the very north-western corner of the site would drain to an existing open drain that, via a circuitous route, also reaches the lagoon.

While these circumstances will lead to surface runoff, they are relatively rare. Only events greater than about 2-year ARI are expected to produce any significant runoff. The majority of rainfall volume will infiltrate where it will be lost to evapotranspiration or percolate down to the shallow ground water and seep laterally to saltwater lagoon.

4 BACKGROUND

The proposed stormwater management system must recognise additional background information relevant to the development site. In particular:

- Kempsey Coastal Processes and Hazards Definition Study – June 2013
- Saltwater Creek & Lagoon Estuary Management Study and Plan
- Water Sensitive Urban Design, Planning and Technical Guidelines for Saltwater Precinct.

4.1 Kempsey Coastal Processes and Hazards Definition Study – June 2013

This report, the Kempsey Coastal Processes and Hazards Definition Study, describes the coastal processes and interactions operating on the Kempsey Local Government Area (LGA) coastline (the Kempsey coastline) and the extent of the coastal hazards arising from these processes. This report documents a summary of coastal processes, the methodology used to assess the coastal hazards, approach to hazards definition mapping, and a beach by beach summary of analyses and outcomes (focussing on the coastal villages of Kempsey).

The report presented Hazard Mapping for the Immediate Planning Horizon, and the 2050 and 2100 Planning Horizons.

Extracts from the mapping as they apply to the site are contained in Figures 4.1, 4.2 and 4.3

The Legend for each figure is shown at right:

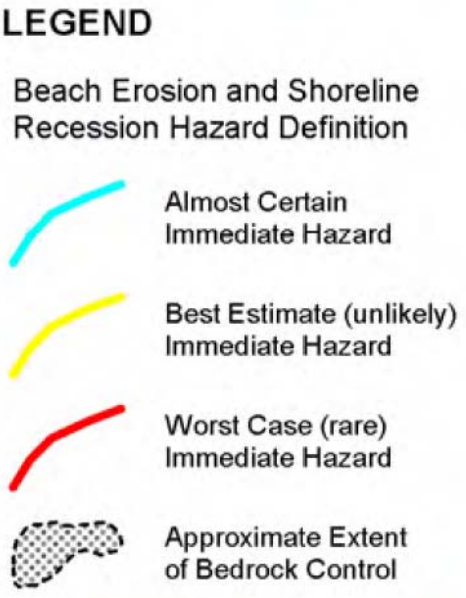


Figure 4.1 – Immediate Planning Horizon

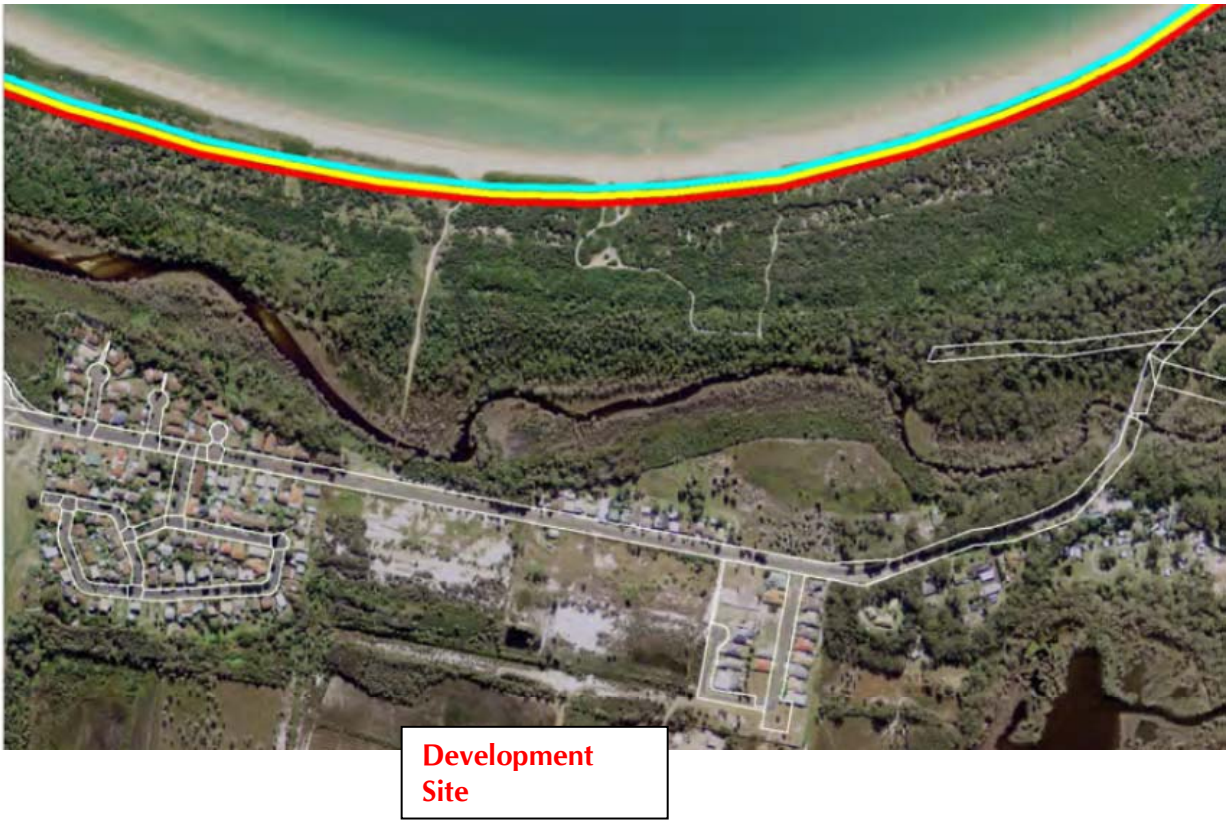


Figure 4.2 – 2050 Planning Horizon

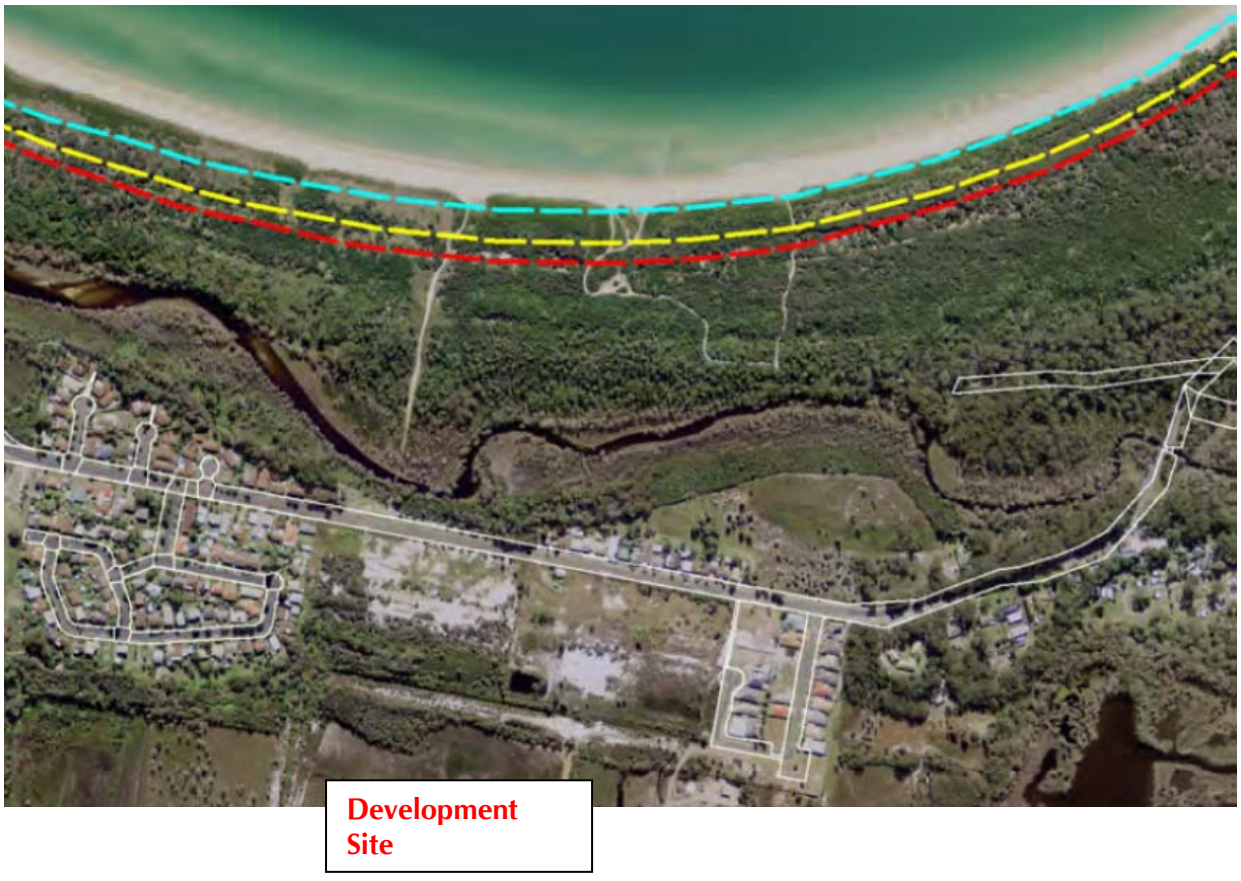
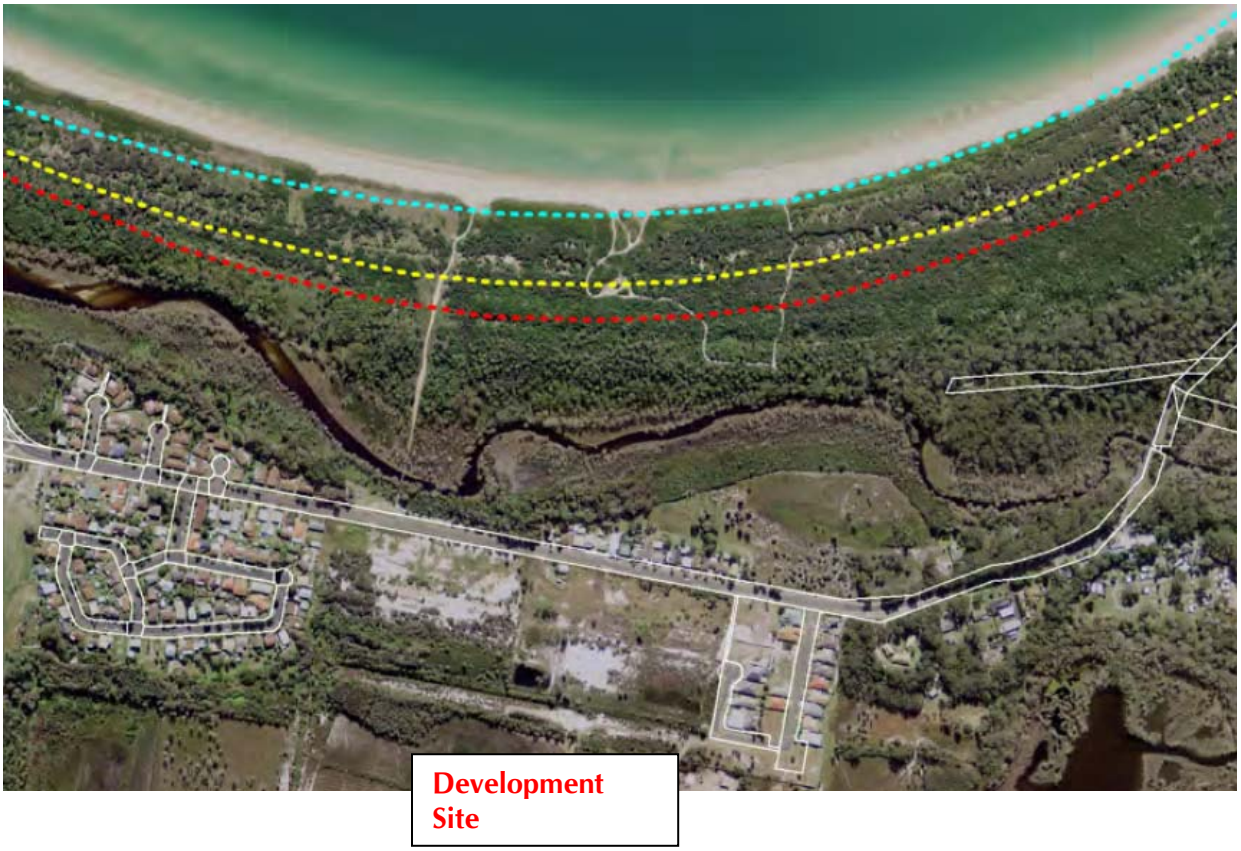


Figure 4.3 – 2100 Planning Horizon



The Figures show that even up to the Year 2100, Erosion and Recession of the Trial bay beach does not present a threat to the development site.

4.2 Saltwater Creek & Lagoon Estuary Management Study and Plan

The Estuary Management plan developed 14 objectives. How the current proposal addresses these options is discussed in Section 7.1.

(1) Reduce the urban stormwater pollutant loads entering Saltwater Creek and Lagoon;
(2) Ensure that the water quality of Saltwater Creek and Lagoon is compatible with the recreational uses of the estuary;
(3) Ensure that the contamination of the former oil terminal site does not degrade the existing or future estuarine environment of Saltwater Creek and Lagoon;
(4) Reduce the impact of on-site sewage treatment systems on the surface water quality of Saltwater Creek and Lagoon;
(5) Prevent the generation of acidic runoff resulting from activities carried out on potentially acid sulfate soils surrounding Saltwater Creek and Lagoon;
(6) Prevent any further loss or damage to the habitats around the lagoon that are valued by the local ecological communities, including the vegetation that provides an important buffer between the estuary and existing development, and enhance existing habitats through targeted restoration and rehabilitation;
(7) Ensure fire and weeds are managed appropriately on private properties surrounding Saltwater Creek and Lagoon;

(8) Ensure that water levels in Saltwater Creek and Lagoon do not compromise the functioning of existing assets around the estuary;
(9) Ensure that any artificial manipulation of the Saltwater Creek entrance does not adversely affect the value or health of the estuarine environment of Saltwater Creek and Lagoon;
(10) Ensure that water levels in the estuary do not unduly compromise the recreational opportunities offered by the Saltwater Creek / South West Rocks area;
(11) Ensure that all entrance works are carried out by authorized persons or their representatives only;
(12) Allow for selective temporary access across creek entrance during particular circumstances when the creek is open;
(13) Ensure that all future development does not place any additional stress on the existing natural environment of Saltwater Creek and Lagoon; and
(14) Ensure that all future development controls consider the environmental sensitivity of Saltwater Lagoon and Creek.

4.3 Water Sensitive Urban Design, Planning and Technical Guidelines for Saltwater Precinct

Council advise that at present these guidelines are being prepared. When available the WSUD proposals for the site will need to conform to these guidelines. This will be dealt with at CC stage.

5 PROPOSED STORMWATER MANAGEMENT

The proposed stormwater management strategy is to provide effective low maintenance stormwater drainage that meets the DCP objectives. Specifically that proposed is:

- The provision of a conventional kerb and gutter urban road system with conventional kerb inlet pits and piped road drainage plus piped interallotment drainage where lots do not fall to the street. **Such a conventional system is the most sustainable in terms of maintenance requirements for both Council and individual property owners.** Careful design is required here. The flat and low topography of the site limits the "reach" attainable by a conventional pipe & pit system when laid at minimum grades.

- The inclusion of two bio-retention basins, a planted swale drain and temporary "soak-away" infiltration basins to treat stormwater quality and meet the DCP objectives. The sizing of these elements was undertaken through computer modelling using the industry accepted software MUSIC.

- The inclusion of an infiltration trench and swale to replicate the existing groundwater regime as far as practicable.

Large scale filling of the development is not proposed although minor regrading with typically cuts and fills of less than 0.2m, will be necessary to adequately grade and drain the lots and roads. As such, the proposed drainage system must deal with the existing constraints of fairly low lying and near level topography with a high water table. A residential flood planning level of RL 3.5m AHD applies to the site, with minimum residential floor levels of RL 4.0 mAHD.

Subject to achieving flood protection levels, roads and lots are to be constructed close to "on grade", being at or near the existing level of the land. To achieve the minimum floor level of RL 4.0m with conventional slab on ground construction, the building envelope level within the lots should ideally be no lower than RL 3.7 mAHD. This can generally be achieved, although some minor filling may be necessary in some locations.

A conceptual kerb & gutter, pipe and pit drainage system has been designed as shown on drawing 13056-DA16. This has minimum pipe grades of 0.5% and minimum kerb and gutter grades of 0.7%. The piped system is to be kept as shallow as possible with pipes at the most upstream pits having minimum acceptable cover of 600mm under kerbs. The pipe system will be sized for 5 - year ARI flows. The vertical alignment of road will be a series of crests and sags, but with an overall fall following the drainage system, thus providing an overflow path for larger events. The depth of sags will be limited to keep flooding depth to acceptable levels. A conventional pipe and pit interallotment drainage system is proposed where lot do not fall to the street.

Under these conditions there is a limit as to how far the pipe and pit system can reach before the pipe system becomes too deep. A minimum level of RL 2.6 mAHD was adopted for the pipe system's outlet. This is to allow sufficient height and hydraulic head to install effective water quality treatment devices at the pipe outlets and minimise standing water to reduce biting insect nuisance.
The topography of the site plus the limited reach of a pipe and pit system (about 150 m in this case) results in the site being divided into four sub-catchments, as shown on drawing 13056-DA16. These sub catchments are summarised below in table 4.1

Table 4.1 - Drainage Catchments

Sub-Catchment	Pre development	Post Development C1	C2	C3	C4
Type	Agricultural	Urban	Urban	Urban	Urban
Area	3.315 Ha	2.109	0.797	0.122	0.208
Number of Lots	n/a	21	7	0	1
Roof area (nominal 200 m² per dwelling)	0%	18%	18%	0%	11%
Remaining impervious area (roads, paving other roofs etc)	3%	34%	30%	56%	33%
Pervious area (nature strip, yards, gardens etc)	97%	48%	52%	44%	56%

5.1 Water Quality Modelling

The key requirement from the DCP (Ref 1) with respect to water quality is that there is a net reduction in pollutants for events of up to 2-year ARI. While not stated in the DCP, the standard pollutants of nitrogen, phosphorus, suspended solids and gross pollutants have been assumed. The software MUSIC was used to model the pre and post development cases and to size water quality treatment elements.

A 12 minute time step rainfall and evaporation data set was compiled from the Bureau of Meteorology gauges at Kempsey for the period April 2002 to June 2008. The soil parameters adopted were based on the MUSIC Modelling Guidelines (Ref 4) recommendations, but were modified to better reflect the high infiltration capacity of the site's sand soils, as summarised in Table 4.2.

Table 4.2 - Adopted Soil Parameters for MUSIC

Soil Parameter	Value Adopted	Comment
Impervious Rainfall Threshold	1.0 mm	As recommended
Soil storage capacity	270 mm	Based on average 1.35m depth to water table and 0.2 porosity of sand soil (Ref 2)
Initial storage	10%	As recommended
Field capacity	100 mm	100/270 typical for damp sand
Infiltration Co-efficient A & B	300 mm/day, 1.0	High infiltration capacity
Groundwater		
Initial Depth	50mm	As recommended
Daily recharge rate	50%	High percolation to water table
Daily baseflow rate	20%	Slower lateral draining
Deep seepage	0%	As recommended

The pollutant loads adopted were as per the Guidelines (Ref 4) with the pre-developed case modelled as a single agricultural catchment while the developed case was modelled as split node urban catchments. The pollutant loading is summarised in Table 4.3

Table 4.3 - Pollutant Loading

Pollutant	Pre-development agricultural land	Urban - roof	Urban yards	Urban roads

	Mean & Std Dev (Log10 mg/L)	Mean & Std Dev (Log10 mg/L)	Mean & Std Dev (Log10 mg/L)	Mean & Std Dev (Log10 mg/L)
Total Suspended Solids				
Base flow	1.000, 0.13	n/a	1.00, 0.34	1.00, 0.34
Storm flow	2.477, 0.31	1.30, 0.39	2.18, 0.39	2.43, 0.39
Total Phosphorus				
Base flow	-1.155, 0.13	n/a	-0.97, 0.31	-0.97, 0.31
Storm flow	-0.495, 0.30	-0.89, 0.31	-0.47, 0.31	-0.30, 0.31
Total Nitrogen				
Base flow	-0.155, 0.13	n/a	0.20, 0.20	0.20, 0.20
Storm flow	0.290, 0.26	0.26, 0.23	0.26, 0.23	0.26, 0.23

Note, All pollutants were stochastically generated with zero serial correction.

A schematic of the model is shown in Figure 4.1.

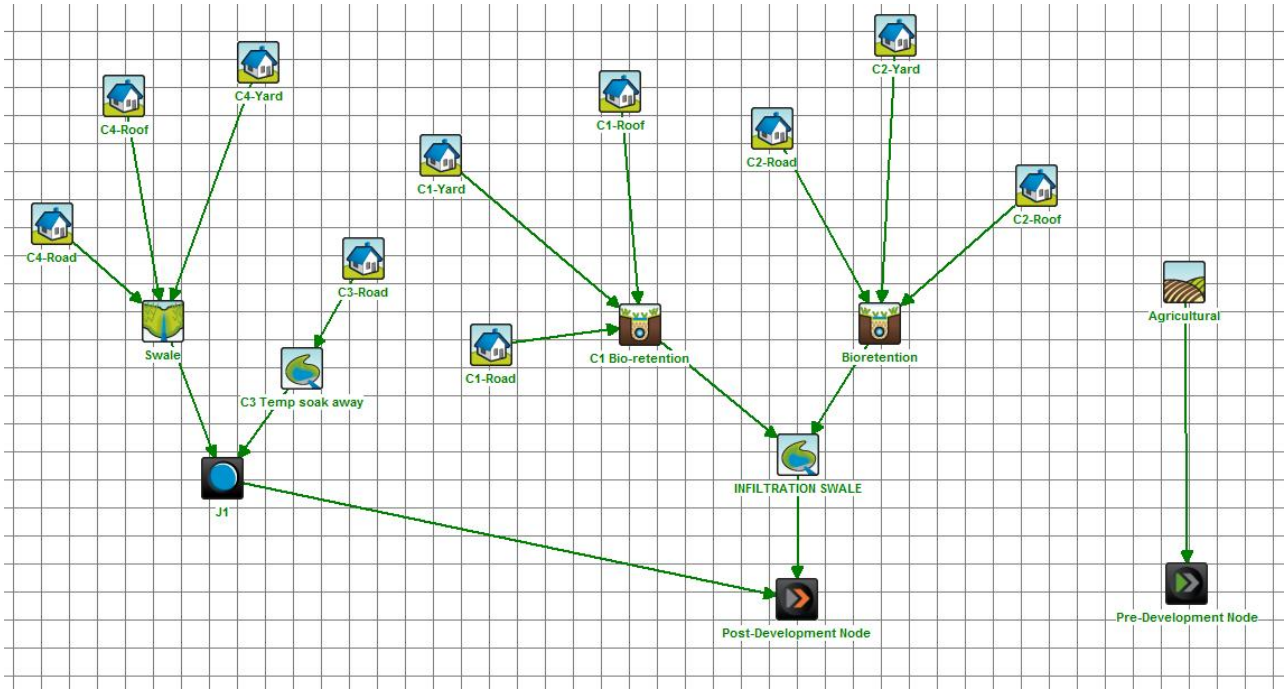


Figure 4.1 - MUSIC Model Schematic

5.2 Water Quality Treatment Measures

- **Bio-retention basins C1**. Treating catchment C1 (2.109 Ha)
  - Floor area 250 m² at RL 2.55 m;
  - min 0.4 m extended storage depth;
  - 0.4 m of filter media (sand, loam & compost mixture) of 200 mm/hr capacity;
  - Nutrient absorbing planting;
  - 0 mm/hr base infiltration (ie. impermeable);

- **Bio-retention basins C2.** Treating catchment C2 (0.797 Ha)
  - Floor area 40 m² at RL 2.55 m;
  - min 0.4 m extended storage depth;

- 0.4 m of filter media (sand, loam & compost mixture) of 200 mm/hr capacity;
- Nutrient absorbing planting;
- 0 mm/hr base infiltration (ie Impermeable);

- **Temporary infiltration "soak-away" basins.** Draining catchment C3 (0.122 Ha)
  Two shallow temporary basins of nom 10 m² floor area each at nominal 0.5 m deep. These will be replaced with road drainage as roads are extended in future stages.

- **Vegetated Swale drain.** Treating catchment C4 (0.208 Ha)
  Base 3 m wide by 10 m long, at 0.2% grade. Lined with filter media and vegetated.

- **Infiltration Swale.** Treating catchment C1 and C2. (2.906 Ha)
  Base 0.6 m wide, providing approximately 150 m of treatment length. Flat, base lined with filter media 0.6m deep, base and sides vegetated.

5.3 MUSIC Model Results

The modelling shows that these measures comfortably reduce the pollutants from the proposed development to below those from predevelopment conditions, as summarised in Table 4.4.

Table 4.4 - MUSIC Modelling Results

Pollutant	Predevelopment (kg/yr)	Post development without treatment measures (kg/yr)	Post development with treatment (kg/yr)
Total Suspended Solids	399	3030	70.1
Total Phosphorus	0.802	6.01	0.188
Total Nitrogen	6.51	34	1.48
Gross Pollutants	19.4	472	0

Note, MUSIC uses stochastic modelling (probability based) and its results will vary slightly between runs.

6 PROPOSED GROUNDWATER MANAGEMENT

It has been identified that infiltration across the site and surrounding areas plus subsequent groundwater seepage through the sand soils is the primary mechanism of inflows into Saltwater Lagoon. Thus a key requirement of the DCP (ref 1) is that the development does not adversely impact on the existing groundwater regime beyond its boundaries.

In this regard, urbanisation with its greater impervious areas (roofs, roads & paving) has the potential to reduce infiltration (and hence groundwater recharge), and to increase surface runoff. As discussed previously, under existing conditions there is anticipated to be little surface runoff, occurring only in times of significant or prolonged rainfall (2-year ARI or greater).

Subsequently, the proposed stormwater management includes measures to capture the increased surface runoff from the impervious areas and return it to the ground water.

The proposed urbanisation will result in approximately half the surface area becoming impervious and hence infiltration will be similarly reduced. The increased surface runoff from the impervious areas will be collected and drained by the proposed conventional pipe and pit drainage system. It

is not practical, in terms of construction and on-going maintenance, nor is it warranted to provide systems to infiltrate this runoff where it falls, across the site. Rather, it is proposed to infiltrate the runoff along the site's downstream boundary.

Such a system will reduce any impact to groundwater flows beyond the site and thus maintain the groundwater flow towards Saltwater Lagoon. While ground water flow to Saltwater Lagoon will be maintained, infiltration within the site will be reduced, which should lead to a slight reduction in the ground water table under the site. Given its now urban use this is considered advantageous. This strategy of infiltration along the downstream boundary was proposed in Douglas Partners Groundwater impact Assessment (Ref 2) and helps meet a DCP requirement for sufficient clearance of groundwater from residential developments.

6.1 Catchments C1 and C2

Combined Catchments C1 and C2 make up 90% of the site. These will have their impervious surface runoff directed to the two bio-retention basins, located along the boundary of the site closest to Saltwater Lagoon, but outside the 7A environmental zoning. These basins will contain 0.4m depth of soil filter media (sand, loam and compost mix) that is important for nutrient reduction. This soil will lie directly over an engineered geo-fabric, which is laid over the natural clean sands.

A long linear infiltration trench and swale is proposed that will connect the two basins along the eastern boundary of the development as per Douglas Partners recommendations (Ref 2) The gravel filled infiltration trench will include a slotted distribution pipe. Both will extend under the floor of both basins and will act to distribute any groundwater "mounding" at the bio-retention basins, distributing the groundwater recharge along the 190 m long linear element.

The floor of the trench will be set at RL 2.0m, a little above the existing average dry weather water table. The 0.6m wide by 0.5m deep trench of 190 m length offers approx 20 m^3 of storage and 300 m^2 of infiltration area. The extended detention volume and floor area of the bio-retention basins combines to increase storage to 165 m^3 and 600 m^2 of infiltration area. This storage volume is in excess of Douglas Partners recommendation of 40% flow from an average wet day. (40% by 30,000 m^2 by 11mm of rainfall = 130 m^3.).

Over the 600 m^2 of trench and basin floor area, an infiltration rate of 220 mm/day (9 mm/hour) is required for the average wet day (11mm of rainfall), well within the capacity of the sand soils which is typically 300 mm/hour.

To deal with larger rainfall events, an open swale is proposed over the infiltration trench. This will have a bed width of 5.0 m, bed level of RL 2.7m , side slopes of 1:4 and be typically between 0.6 and 0.8m deep. This swale will be grassed and as being dry most of the time it is anticipated that it will be mowable by tractor and slasher.

At a ponding water level of RL 3.2m, the swale combined with the bio-retention basins will provide 1,000 m^3 of storage (equivalent to approx 85mm of rainfall) and 2,300 m^2 of infiltration area. In heavy rainfall events that lead to overflow spilling along the swale, infiltration will initially be rapid, but if prolonged the infiltration rate will diminish as the ground water mounds up under and around the swale. It's precise modelling is beyond the scope of this assessment and beyond the data available. However, Douglas Partners assessment (Ref 2) provides sufficient for a rough estimation.

The permeability of the sand is given at typically $2.5x10^{-4}$ m/s and porosity of 0.2. A ground water mound under the swale at an 8% ground water gradient would provide an additional 1,150 m³ of storage above the normal water table. This about matches the sand's permeability. From dry conditions, the system could absorb about 2,150 m³ of runoff by a ponding level of RL 3.2 m. This equates to 180 mm of rainfall in a day or about 5-year ARI rainfall.

In events larger than this overflow will occur. This is to be provided for by an adjustable weir type structure at the south-western end of the swale, near basin C2. This will overflow into an existing shallow open drain that flows to Saltwater Lagoon. It is noted that under existing conditions surface flow already occurs along this drain in such events.

Further to these details and as recommended by Douglas Partners in their assessment (Ref 2):

- The overflow weir will be adjustable;
- Ground water monitoring bores and wells are to be installed along and adjacent the infiltration swale;
- During the installation of the infiltration trench, any impermeable layers of coffee rock or clays found are to be investigated and if necessary further excavations undertaken to ensure infiltration.

6.2 Catchment C3

Catchment C3, at just 3.7% of the site lies along the western boundary. Note it would be difficult to combine this catchment with C1 and drain to the east without significant filling. Rather, this small catchment of road only will drain to two small temporary infiltration or soak away basins. As such the impervious area runoff from the road will be infiltrated back to the groundwater in close proximity to where it otherwise would have.

The soak away basins will be temporary. As further stages progress, the roads will be extended and the basins no longer required and would be filled.

6.3 Catchment C4

Catchment C4 lies in the north-western corner, and makes up 6.3% of the site. It will drain to an existing open drain that flows west before returning south and east to Saltwater Lagoon. Infiltration will readily occur along the considerable length of this drain.

7 STORMWATER MASTER PLAN

The conceptual design of the stormwater and groundwater management presented above demonstrates how the DCP requirements can be met for stage 1. It is intended that a similar approach will be taken for the remaining stages.

7.1 General Description of Future Development

The balance of the total development site, (ie. the area of Lot 35, DP 1167775 excluding Stage 1) consists of approximately 34.5 Ha, and is marked for future residential development, similar in nature to that of Stage 1. A preliminary subdivision layout for the whole site is shown on drawing 13056-MP8.

Similarly to the proposed Stage 1 development, bulk filling is not proposed. Most areas will be serviced by conventional kerb and gutter, pipe and pit drainage, although it is anticipated that its reach will be limited to perhaps 200 m at most. Subsequently, a series of much flatter open drainage, treatment and infiltration corridors are proposed that will radiate out through the subdivision, providing a discharge locations for the conventional drainage. These are shown on drawing 13056-MP8. These will mostly lie along existing open drainage lines.

As with stage 1, the open drainage elements will contain a series of bio-retention basins / swales, infiltration trenches and open swale drainage for overflows. The design of this system has not been progressed to the level of that for Stage 1, and is preliminary only. Regardless, that prepared for Stage 1 can give confidence that viable and effective drainage solutions that meet the requirements of the DCP are achievable.

7.2 Stormwater Quality Management of Future Stages

In relation to the long term stormwater management for the site, experience suggests that approximately 1% of the catchment area needs to be set aside for WSUD treatment, if bio swales or bio-retention systems are used – or of the order of 3,450 m² for the balance of the site (including the deferred areas).

To demonstrate that sufficient treatment for the proposed future development of the site is feasible, the future development was divided into sub-catchments, for indicative stormwater quality modelling. It is noted that the sub-catchments are indicative only, and may be modified when the future stages of the development undergo detailed design.

A MUSIC model was created to represent the future development, based on the model used for stage 1. However, for the purposes of indicative modelling the lumped catchment modelling was used, as defined by the MUSIC modelling guidelines (reference 4). Each sub-catchment was conservatively assumed to be 55% impervious for the MUSIC modelling.

The MUSIC model used in assessing the proposed stormwater quality management for the future development of the site is shown in the figure below.

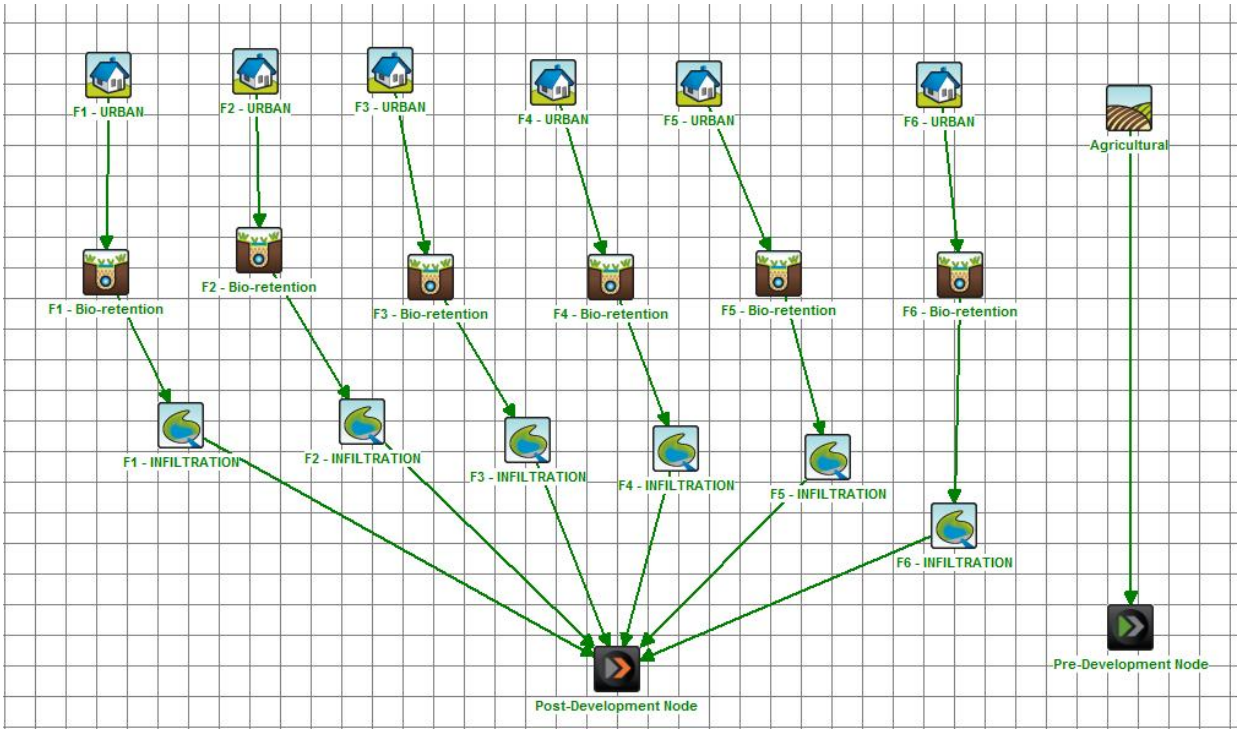


Figure 7.1 - MUSIC Model Schematic

The following table shows the basic parameters used for MUSIC modelling, and the assumed extents of each sub-catchment are shown on drawing 13056-MP8.

Table 7.1 - MUSIC Modelling Parameters

Catchment	Source Node Area (Ha)	Bio-retention Filter Area (m^2)	Bio-Retention Ponding Area (m^2)	Infiltration Filter Area (m^2)
F1	9.148	832	1601	1006
F2	7.915	2546	4623	871
F3	3.088	844	1531	340
F4	1.941	744	1413	213
F5	7.553	1433	2491	831
F6	3.649	773	1555	401
TOTAL	33.295	7172	13213	3662

The bio-retention basins were set to have an impermeable base (ie. an exfiltration rate of 0.0), and the infiltration galleries modelled with an exfiltration rate of 300 mm/hr.

The results of the stormwater quality modelling are presented in the table below.

Table 7.2 - MUSIC Modelling Parameters

Pollutant	Predevelopment (kg/yr)	Post development without treatment measures (kg/yr)	Post development with treatment (kg/yr)
Total Suspended Solids	3930	35,400	6.49
Total Phosphorus	8.36	72.8	405
Total Nitrogen	67.6	436	1.36
Gross Pollutants	202	5420	12.6

It should be noted that the MUSIC modelling did not include the treatment that would be available by buffer strips, which are areas of vegetated land that runoff from impervious areas must pass over before being captured by the pit and pipe system. Therefore in reality the stormwater is likely to receive more treatment than that which is presented above.

Furthermore, the MUSIC model demonstrated that the proposed stormwater quality improvement devices (SQIDs) would provide more than sufficient treatment for the post-construction stormwater runoff. As such it is to be expected that the SQIDs could be further optimised upon detailed design of the stormwater management system of the future stages.

7.3 Groundwater Management of Future Stages

The groundwater impact assessment (reference 2) suggested that long term groundwater recharge could be maintained if the system had sufficient storage volume to accommodate 40% of the flow from an average daily rainfall event. It suggested that the average daily rainfall was about 11mm.

Preliminary calculations were conducted to size infiltration areas for each sub-catchment, and are summarised in the following table.

Table 7.3 - Required Infiltration for Groundwater Recharge

Catchment	Area (Ha)	Design Rainfall (mm)	Required Infiltration Storage (m^3)	Infiltration Depth of Ponding (mm)	Required Infiltration Area (m^2)
F1	9.148	11	403	400	1006
F2	7.915	11	348	400	871
F3	3.088	11	136	400	340
F4	1.941	11	85	400	213
F5	7.553	11	332	400	831
F6	3.649	11	161	400	401
TOTAL	33.295		1465		3662

The sized infiltration areas have been incorporated into the stormwater quality management strategy detailed in the previous section, and drafted onto drawing 13056-MP8.

The infiltration areas shown above for each sub-catchment are completely achievable. As such the proposed Stormwater Management plan for the complete development of Lot 35 should be able to also ensure that impacts on groundwater are minimised.

7.4 Stormwater Management Plan for Future Stages

Upon conducting the preliminary investigations presented above for the future stages of the development of Lot 35, DP 1167775 a concept Stormwater Management plan has been developed. It incorporates the following:

- All roads being provided with a kerb and gutter and a piped drainage system. Because of the flat nature of the site, and minimal freeboards, it is recommended that some dynamic modelling be undertaken of the piped system to ensure minimum disruption during heavy rainfall events.
- The piped systems would discharge into a series of bioretention swales distributed around the site, which would then drain to infiltration areas to recharge the groundwater system.

The Douglas Report for Stage 1 provides an indication of the storage that should be provided for infiltration areas. It proposes that the storage volume be 40% of the flow from the average daily rainfall event. It estimates this to be 11mm

- The preliminary modelling suggests that there will be no surface runoff from the site for storms up to a 1 in 2 year event. The runoff from these storms will go to groundwater.
- When full, the swale would over flow into the existing main drainage lines eventually discharging in Saltwater Lagoon

7.5 Comparison to Solutions for Neighbouring Properties

As part of the design of a residential subdivision of Lot 52 DP 831284 and Lot 84 DP 792945 (off Belle O'Conner Street, South West Rocks), Land Dynamics Australia Pty Ltd produced a Stormwater Quality Report detailing a WSUD solution which was made available to de Groot & Benson.

The following table summarises the similarities and differences between the strategies proposed in this report and those proposed by Land Dynamics Australia in their Stormwater Quality Report for the neighbouring development.

Table 7.4 - Comparison of WSUD Solutions

ITEM	Land Dynamics Australia	de Groot & Benson
Stormwater Quality Software	MUSIC modelling used	MUSIC modelling used
Pollutants Reduced to less than Pre-development levels	Yes	Yes
Node Type Used for Development	Urban	Urban
Rainwater Tanks Used	No	No
Swales Used	Yes	Used as part of stormwater conveyance, but not modelled in MUSIC
Bio-Retention Basins / Swales Used	Yes. Exfiltration rate 50mm/hr	Yes. Exfiltration Rate 0.0mm/hr , as requested by the NSW Office of Water
Pits and Pipes Used	For Interallotment Drainage only	For interallotment drainage and sections of road drainage. Refer drawing 13056-MP8
Groundwater Recharge	Provided by exfiltration from bio-retention and swales. Infiltration storage area not defined in report.	Provided by dedicated Infiltration Areas sized to suit the requirements defined by Douglas Partners in their document 'Report on Groundwater Impact Assessment'

As can be seen from the table above, both designs by de Groot & Benson and Land Dynamics Australia use the same WSUD principles and treatment devices. In addition to this, upon the recommendation of the NSW Office of Water, de Groot and Benson have proposed that the bio-retention systems used as part of the stormwater treatment train have impermeable bases, and groundwater recharge by provided by dedicated infiltration areas, to the specification of the Groundwater Impact Assessment conducted by Douglas Partners.

In consideration of the findings of the preliminary examination of the proposed future stages of the development of Lot 35, DP 1167775, and the comparison of the suggested treatment train with other approved WSUD solutions for neighbouring developments, de Groot & Benson Pty Ltd are of the opinion that a satisfactory solution for stormwater and groundwater management is entirely feasible.

8 RESPONSE TO PLANNING CONTROLS

8.1 Compliance to Saltwater Creek & Lagoon Estuary Management Study and Plan

The Estuary Management plan developed 14 objectives. How the current proposal addresses these options is discussed in summarised below:

OBJECTIVE	DEVELOPMENT RESPONSE
(1) Reduce the urban stormwater pollutant loads entering Saltwater Creek and Lagoon;	The proposed development will use WSUD principles to reduce nutrient and pollutant runoff from the site in accordance with guidelines.
(2) Ensure that the water quality of Saltwater Creek and Lagoon is compatible with the recreational uses of the estuary;	The runoff from the development will meet water quality targets which are compatible to recreational use of the estuary.
(3) Ensure that the contamination of the former oil terminal site does not degrade the existing or future estuarine environment of Saltwater Creek and Lagoon;	Not Applicable to site
(4) Reduce the impact of on-site sewage treatment systems on the surface water quality of Saltwater Creek and Lagoon;	Not Applicable to site as it is sewered.
(5) Prevent the generation of acidic runoff resulting from activities carried out on potentially acid sulfate soils surrounding Saltwater Creek and Lagoon;	The development does not propose disturbance of acid sulfate soils
(6) Prevent any further loss or damage to the habitats around the lagoon that are valued by the local ecological communities, including the vegetation that provides an important buffer between the estuary and existing development, and enhance existing habitats through targeted restoration and rehabilitation;	Not Applicable to site
(7) Ensure fire and weeds are managed appropriately on private properties surrounding Saltwater Creek and Lagoon;	Relevant asset protection zones and fire trails will be provided as part of the development
(8) Ensure that water levels in Saltwater Creek and Lagoon do not compromise the functioning of existing assets around the estuary;	Not Applicable to site
(9) Ensure that any artificial manipulation of the Saltwater Creek entrance does not adversely affect the value or health of the estuarine environment of Saltwater Creek and Lagoon;	Not Applicable to site
(10) Ensure that water levels in the estuary do not unduly compromise the recreational opportunities offered by the Saltwater Creek / South West Rocks area;	The proposed development has no effect on this objective.
(11) Ensure that all entrance works are carried out by authorized persons or their representatives only;	Not Applicable to development

OBJECTIVE	DEVELOPMENT RESPONSE
(12) Allow for selective temporary access across creek entrance during particular circumstances when the creek is open;	Not Applicable to development
(13) Ensure that all future development does not place any additional stress on the existing natural environment of Saltwater Creek and Lagoon; and	Development proposes significant buffers to the natural environment.
(14) Ensure that all future development controls consider the environmental sensitivity of Saltwater Lagoon and Creek.	The development is in accordance with Saltwater Development Control plan.

8.2 Compliance with Kempsey Development Control Plan – Section D2 – Saltwater Precinct.

The DCP requires the preparation of an integrated Water Cycle Management Strategy (IWCMS) for the site. This report plus Reference 2 provide this integrated strategy.

In relation to the specific requirements of the DCP in Section 4.3 in relation to the IWCMS we comment as follows:

OBJECTIVE OF Section 4.3 DCP	DEVELOPMENT RESPONSE
4.3 Integrated Water Cycle Management Strategy	
Desired Outcomes	
DO1 – An Integrated Water Cycle Management Strategy, incorporating a Stormwater Management Strategy, for the relevant part of the Saltwater Precinct, is approved by Council prior to the issue of a development consent for any development within that part of Saltwater Precinct.	This report coupled with the Reference 2 is the An Integrated Water Cycle Management Strategy for Stage 1. It also make recommendations for future stages.
DO2 - The Integrated Water Cycle Management Strategy generally complies with the relevant requirements of:	
• Chapter B3 – Engineering;	Development will comply with B3. Compliance will be shown as part of the CC process
• Chapter B5 – Stormwater Management;	Development will comply with B5 . Compliance will be shown as part of the CC process
• Chapter B6 – Water Sensitive Urban Design;	Development will comply with B6 . Compliance will be shown as part of the CC process
• Council's Engineering Guidelines for Subdivision and Development; and	Development will comply with these. Compliance will be shown as part of the CC process
DO3 - The Integrated Water Cycle Management Strategy is generally compatible with:	
• Kempsey Shire Council Urban Stormwater Management Plan 2004;	Complies
• Saltwater Creek and Lagoon South West Rocks Estuary Management Study and Plan WBM 2006; and	Complies – refer Section 8.1
• Saltwater Lagoon and Catchment Stormwater	This document was used as a

OBJECTIVE OF Section 4.3 DCP	DEVELOPMENT RESPONSE
Management Strategy 2007.	reference document for the DCP. Compliance with the DCP will result in compliance with this strategy,
DO4 - The Integrated Water Cycle Management Strategy is based on modelling of projected rises in ground water levels and makes appropriate recommendations in relation to clearances required between development/earthworks and the ground water table.	Modelling done by Douglas Partners (Ref 2)
DO5 - The Integrated Water Cycle Management Strategy achieves the following objectives:	
• To ensure that the volume of stormwater flow is restricted to pre-development levels by specifying maximum site coverage requirements coupled with Water Sensitive Urban Design measures including retention and detention systems (OSD) and harvesting onsite.	WSUD measures incorporated in design. No specific requirements for restricting site coverage..
• To ensure that the water reuse system is integrated with Council's recycled water supply scheme.	Recycled water system proposed.
• To ensure there is a net reduction of pollutants entering the estuary or Saltwater Lake from both existing and future development for all rain events up to and including the 1 in 2 year ARI to achieve a net positive environmental outcome through development of an appropriate strategy.	WSUD measures proposed for pollutant reduction
• To ensure there are no changes to the natural groundwater regime that could adversely affect Saltwater Lagoon and Creek and associated wetland by either: o Varying the volume of flow such that there are irreversible changes to the natural environment which is reliant on groundwater and/or groundwater-surface water interaction;	Groundwater recharge proposed to meet this requirement. (reference 2)
o by reducing the area available for infiltration and recharging; or	Infiltration recharge areas proposed
o by increasing the pollutant load above natural levels.	pollutant reduction measures proposed
• To ensure that there remains after development a balance between the surface and groundwater flows that mimic the natural condition through operation, implementation, review and maintenance of a suitable detailed Water Management System.	This strategy aims to meet this objective.
• To ensure that the stormwater drainage system does not adversely impact flood protection measures.	The drainage system does not interfere with flood protection.
• To ensure that Integrated Water Cycle Management Infrastructure is provided in line with the staging of development within Saltwater Precinct.	Each Stage will be required to provide compatible IWCM infrastructure appropriate to its size in accordance with the principles set out in this report and reference 2.
• To ensure that all future development does not place any additional stress on the existing natural environment of Saltwater Creek and Lagoon.	The Master Planning for the future stages makes more than sufficient allowance for protection of the natural environment by adoption of the principles of this report.

OBJECTIVE OF Section 4.3 DCP	DEVELOPMENT RESPONSE
DO6 - All water treatment systems are wholly located within the residential zoned land being outside the land zoned E2 – Environmental Conservation.	All treatment systems are in the R2 land.
DO7 - Development incorporates best practice urban water management practices and techniques for controlling stormwater quality and quantity (above and below ground), water conservation and reuse and ecosystem health.	Best Practice design will be used as part of the Construction certificate process.
DO8 - The design of the Stormwater Drainage System minimises the need to fill the site, as it is relatively flat.	No filling proposed in Stage 1. Some filling required in future stages for flood protection purposes.
Development Requirements	
a) Detailed surface and ground water modelling is to be undertaken to identify the opportunities and constraints in relation to drainage, flood protection, high water tables and protection of downstream waterways.	Detailed modelling undertaken. The CC will further refine and detail this modelling.
b) Prior to any development being undertaken within the relevant part of the Saltwater Precinct, an Integrated Water Cycle Management (ICWM) Strategy that addresses the following is to be approved by Council:	
(i) Water Sensitive Urban Design (WSUD) Strategy providing the broad concept of how the WSUD requirements contained in this chapter will be achieved;	WSUD modelling undertaken and detailed in this report.
(ii) Provision of guidelines for managing: site drainage, flooding, high water tables, water quality and quantity and protection of Saltwater Lake and Creek;	Detailed guidelines will be prepared as part of the CC. General guidelines form part of this report.
(iii) Minimisation of grading and filling;	Grading and filling is minimised.
(iv) Measures to be incorporated to reduce sediment and litter being washed into receiving waters during site regrading works;	Sediment control measures are proposed.
(v) Provision of feasible integrated solutions for the management of water supply, wastewater, stormwater and groundwater throughout the Saltwater Precinct;	Integrated solutions for water supply, sewerage, stormwater and groundwater are detailed in this report and the supporting documentation
(vi) Have regard for the need to integrate with Kempsey Shire Council's Recycled Water Supply scheme without impeding and or reducing the schemes function in any way;	Recycled Water reticulation pipework is proposed
(vii) Incorporate Demand management solutions in the following order of preference:	Residential dwellings will need to comply with BASIX.
• Connection of all proposed development in the Saltwater Precinct to Council's Recycled Water Supply Scheme as a first priority;	Recycled Water reticulation pipework is proposed. Connection to the system will be carried out when supply is available under Council's Section 26 contributions
• If a situation arises where access to Council's Recycled Water Main Scheme is not physically possible then tank use on individual lots is desirable, roof runoff from all such dwellings will be collected and stored in rainwater tanks for domestic re-use including toilet flushing, laundry cold water and outdoor uses in accordance with	Rainwater Tanks excluded according to Council's comments

OBJECTIVE OF Section 4.3 DCP	DEVELOPMENT RESPONSE
BASIX requirements;	
• Communal rainwater tanks may be investigated as an option for collection and storage of runoff for use in landscape and open space irrigation in medium density areas where the Kempsey Recycled Water Supply Scheme cannot adequately service these areas;	Not applicable
• Overflow from the rainwater tanks and runoff from the remainder of the development is to be treated by means of constructed wetlands. These wetlands may be augmented by the inclusion of infiltration systems, porous pavements, grassed filter strips, vegetated swales and Bio-retention systems into the treatment train. Flows from the residential precinct will be restricted to pre-development flow volumes using suitable means of detention; and	bio retention swales proposed in lieu of wetlands
• The use of WELS Scheme related water-efficient devices (including taps, showerheads, toilets, dishwashers and washing machines) to further reduce demand across the development.	This is a BASIX requirement.

9 REFERENCES

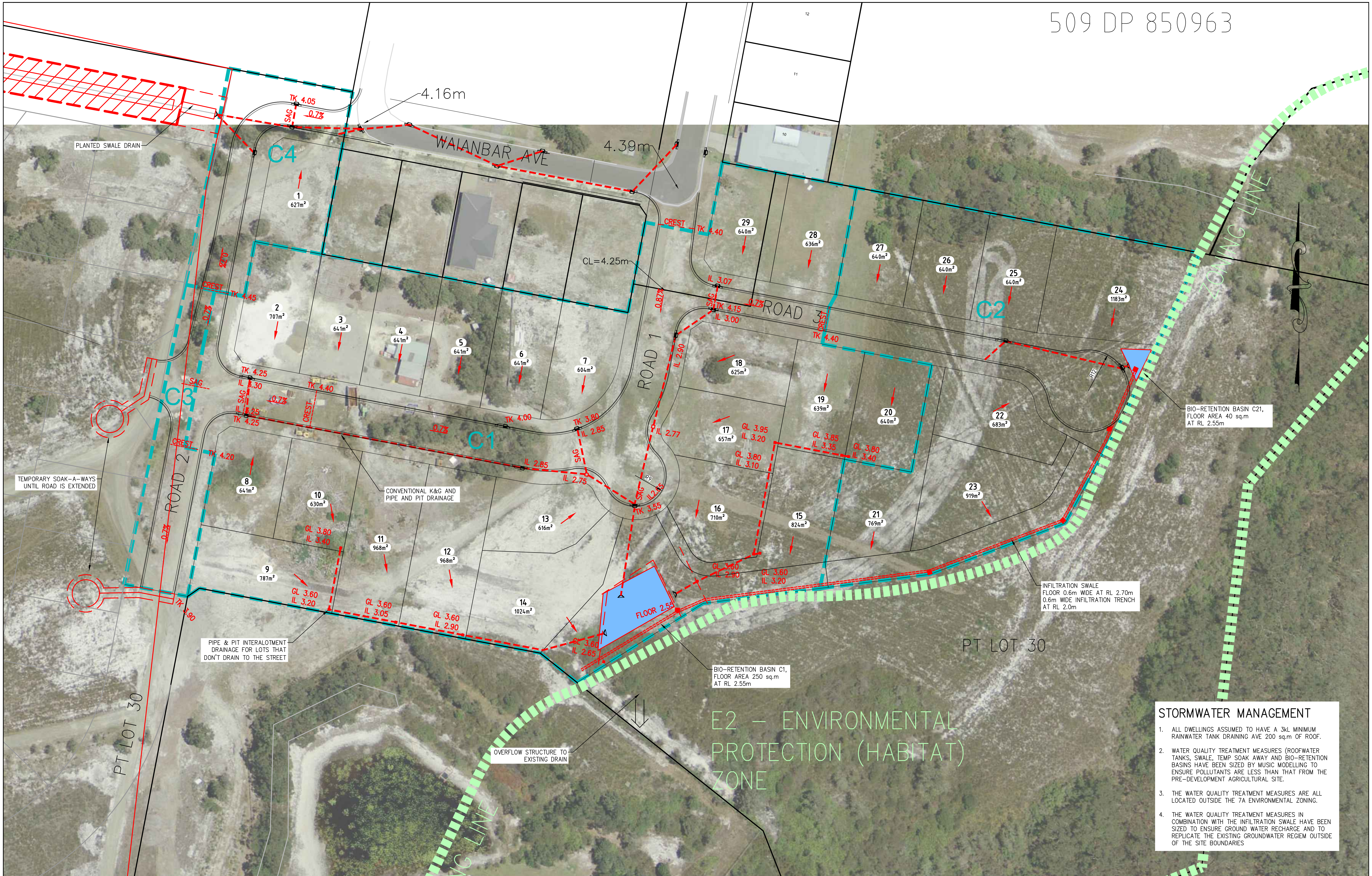
1. "Kempsey Development Control Plan 2013 – Section D2 – Saltwater Precinct", Kempsey Shire Council, 2013

2. "Groundwater Impact Assessment, Proposed Stage 1 - Saltwater Development South West Rocks", Douglas Partners, November 2013

3. "Report on Hydrogeological Assessment, Proposed Residential Subdivision, Off Phillips Drive, South West Rocks", Douglas Partners, October 2007

4. "MUSIC Modelling Guidelines", Version 1.0-2010, water by design and South East Queensland Healthy Waterways Partnership, 2010

DRAWINGS



STORMWATER MANAGEMENT

1. ALL DWELLINGS ASSUMED TO HAVE A 3kL MINIMUM RAINWATER TANK DRAINING AVE 200 sq.m OF ROOF.
2. WATER QUALITY TREATMENT MEASURES (ROOFWATER TANKS, SWALE, TEMP SOAK AWAY AND BIO-RETENTION BASINS HAVE BEEN SIZED BY MUSIC MODELLING TO ENSURE POLLUTANTS ARE LESS THAN THAT FROM THE PRE-DEVELOPMENT AGRICULTURAL SITE.
3. THE WATER QUALITY TREATMENT MEASURES ARE ALL LOCATED OUTSIDE THE 7A ENVIRONMENTAL ZONING.
4. THE WATER QUALITY TREATMENT MEASURES IN COMBINATION WITH THE INFILTRATION SWALE HAVE BEEN SIZED TO ENSURE GROUND WATER RECHARGE AND TO REPLICATE THE EXISTING GROUNDWATER REGIEM OUTSIDE OF THE SITE BOUNDARIES

10 0 10 20 30 40 50
SCALE OF METRES 1:1000

REV.	DATE	REVISION	DR.BY	AP.BY
DA4	20/02/14	Minor Amendments throughout	APR	RDG

de Groot & Benson
Consulting Engineers & Planners
A.C.N. 052 300 571
236 Harbour Drive,
Coffs Harbour NSW 2450
Phone (02) 6652 1700
Fax (02) 6652 7418
Email: email@dgb.com.au

Scale: 1:1000 @ A3		Cad File No.: 13056_Civil - APRIL 2015.dwg	
Surveyed: MR		Datum: AHD	
Drawn: APR	Designed: APR	Approved: RDG	
Checked: RDG	Date: 2013	No. of dwgs: ---	

Project: SALTWATER DEVELOPMENT SOUTH WEST ROCKS, NSW

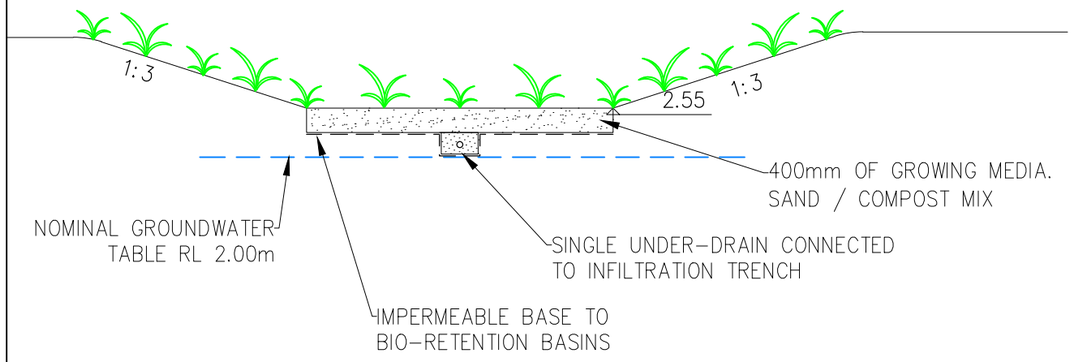
Client: LEX TALL

Title: STORMWATER MANAGEMENT PLAN

Project No. 13056

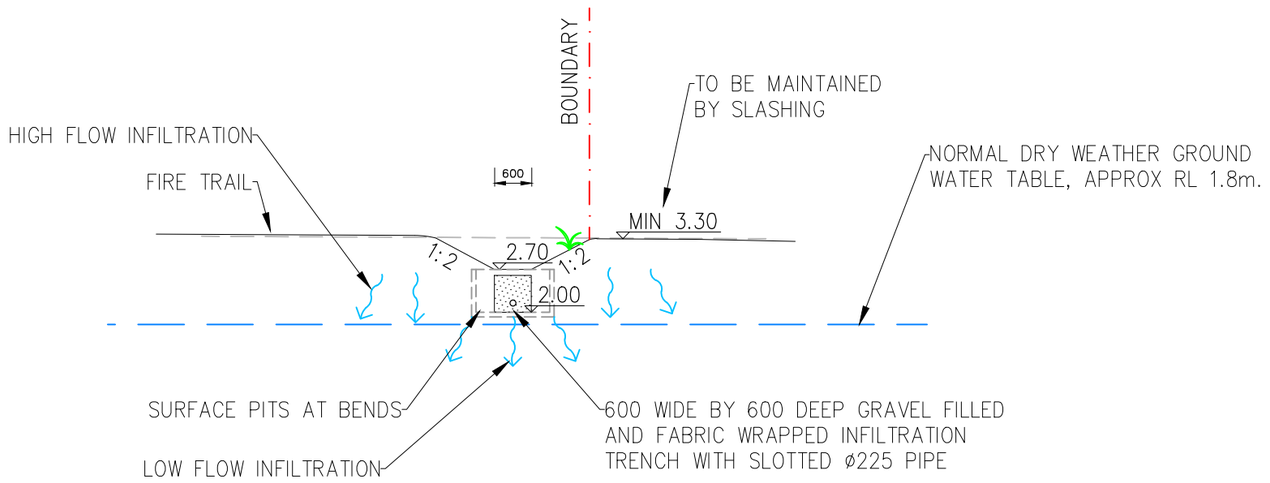
Drawing No. DA-16 CONCEPT - 7

Amendment No. DA4



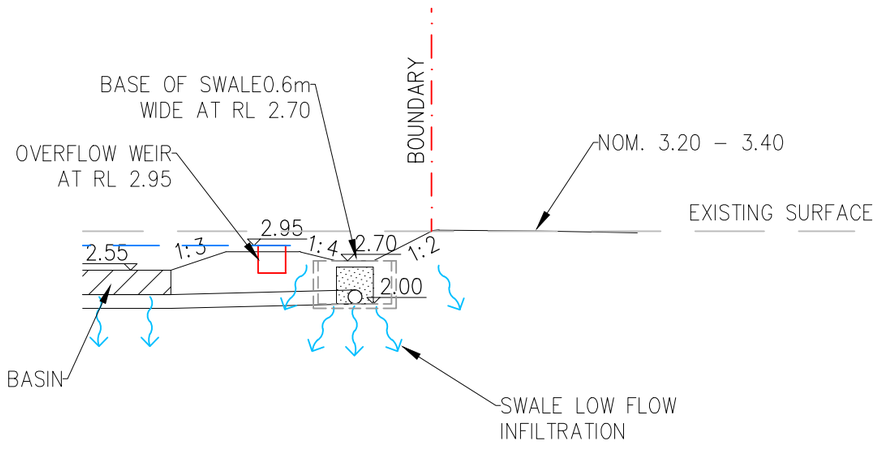
BIORETENTION BASIN DETAIL

SCALE 1:100



INFILTRATION SWALE DETAIL

SCALE 1:100



BIORETENTION AND INFILTRATION SECTION

SCALE 1:100

10 0 10 20 30 40 50

SCALE OF METRES 1:1000

REV.	DATE	REVISION	DR.BY	AP.BY
DA4	20/02/14	Minor Amendments throughout	APR	RDG

de Groot & Benson

Consulting Engineers & Planners

A.C.N. 052 300 571
236 Harbour Drive,
Coffs Harbour NSW 2450

Phone (02) 6652 1700
Fax (02) 6652 7418
Email: email@dgb.com.au

Scale: 1:1000 @ A3	Cad File No.: 13056_Civil - APRIL 2015.dwg		
Surveyed: MR	Datum: AHD		
Drawn: APR	Designed: APR	Approved: RDG	
Checked: RDG	Date: 2013	No. of dwgs: ---	

Project: SALTWATER DEVELOPMENT
SOUTH WEST ROCKS, NSW

Client: LEX TALL

Title: STORMWATER DETAILS

Project No. 13056

Drawing No. DA-17
CONCEPT - 7

Amendment No. DA4

STORMWATER MANAGEMENT

The Stormwater Management will comprise:

1. Conventional road Kerb & Gutter, pipe and pits. Due to flat topography such drainage will be limited to approximately 200m of pipe run maximum.
2. Piped interalotment drainage where lots do not fall to kerbs.
3. The piped systems will discharge into a network of open infiltration bio-retention swales. Bioretention filter media and planting will be located at pipe outlets as per concept design for Stage 1.
4. Swales will be laid at very flat grades with a base level above the normal dry weather ground water table.
5. Swales will include a low flow infiltration trench to assist in distributing infiltration and reducing standing water, allowing the swale to be mowable in dry weather.
6. High flow infiltration will be direct from the swale.
7. Water quality treatment will be sized to reduce pollutants from the pre-development agriculture case.
8. For future stages, the area required for bio-retention is about 2.0% of the catchment areas. These bio-retention areas will then drain to infiltration galleries which will recharge groundwater.

GROUNDWATER MANAGEMENT

The Groundwater Management will comprise:

1. Groundwater Water infiltration areas are to be provided.
2. The system is to have sufficient storage volume for 40% of the average daily rainfall (excluding non-rain days).
3. Analysis shows that the average daily rainfall is about 11mm per day.
4. On the assumption that the developable area outside of Stage 1 is approximately 34.5 ha, then a storage volume of approximately 1,520 cubic metres is required.
5. With an average depth of 400 mm – the total surface area required is about 3,800 square metres or 1.1% of the catchment area.

REV.	DATE	REVISION	DR.BY	AP.BY
P3	05/06/15	WSUD AMENDMENTS	TJP	RDG
P2	28/10/14	MINOR AMENDMENTS	APR	RDG

de Groot & Benson
Consulting Engineers & Planners
A.C.N. 052 300 571
236 Harbour Drive,
Coffs Harbour NSW 2450
Phone (02) 6652 1700
Fax (02) 6652 7418
Email: email@dgb.com.au

Scale: AS SHOWN	Cad File No.: 13056_Civil - APRIL 2015.dwg		
Surveyed: MR	Datum: AHD		
Drawn: APR	Designed: APR	Approved: RDG	
Checked: RDG	Date: 2013	No. of dwgs: ---	

Project: SALTWATER DEVELOPMENT SOUTH WEST ROCKS, NSW

Client: LEX TALL

Title: CONCEPT STORMWATER AND GROUNDWATER PLAN

Project No. 13056

Drawing No. MP8

Amendment No. P2

Ref: 13056

19 June 2015

Geoff Smyth & Associates
PO Box 1925
COFFS HARBOUR, NSW 2450

de Groot & Benson Pty Ltd

Consulting Engineers & Planners

Dear Geoff

Saltwater Precinct – Water Supply Capacity

In relation to the development application, you have requested additional details about possible timing of the upgrading works for the water supply to the precinct. The long term concept was detailed in our Engineering issues Report - the relevant extract has been copied into Annexure A. The concept was provided to us by Council. Essentially, the area requires augmenting with a new trunk main from the existing reservoir south of the site. Council have not carried out any specific analysis as to when these mains will be required.

In the DA we proposed initially connecting the site to the existing supply in Waianbar Ave. To determine the possible spare capacity on the existing system, we have ordered from Council a "Water Performance Test'". This will enable us to estimate the spare capacity in the system. Until such results are available, it will be difficult to be definitive about timing.

We note that the DA development proposes 29 residential allotments. These lots, when fully developed will draw approximately 4.3L/s at peak instantaneous times (typically in early evening). The existing Waianbar Ave has a potential for around 30 dwellings. Thus the combined for Waianbar Ave and Stage 1 would be around 8.6L/s.

Waianbar Ave is fed off the existing trunk main in Phillip Drive. This main delivers water to the residential areas to the east which is boosted by the Cardwell St booster pumping Station. Given this we would expect that the minimum pressure in this main would most likely be of the order of 40m to 50m pressure at the Waianbar St intersection.

Based on this, our preliminary assessment suggests the following:

- We would expect that the additional demands imposed by the development would reduce existing pressure in the Waianbar area by 1m to 2m.
- At the extremities of Stage 1, the pressure at these lots would be around 3m to 5m lower than at the intersection of Waianbar Ave and Phillip Drive. This suggests that the pressure at the extremities of the development (around proposed Lot 9) would be above 30m.
- The minimum residual pressure generally design for is 12m
- This suggests that there could be of the order of 18m of "available pressure" that could pressure mains beyond Stage 1.

Robert de Groot
Gregory Benson
Graham Knight
Anthony Greenland
John Anderson

236 Harbour Drive, Coffs Harbour 2450

PO Box 1908, Coffs Harbour 2450

Phone: (02) 6652 1700

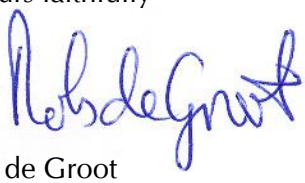
Email: email@dgb.com.au
A.C.N. 052 300 571
A.B.N. 50 772 141 249

- On these assumptions, we calculate that the peak flow that could be drawn from this main and still give acceptable pressures upto 500m into the development site is 16.3L/s at Phillip Drive and 12 L/s into the estate.
- The 12 L/s equates to around 80 dwellings or an additional 50 beyond Stage 1.

Our preliminary assessment suggests that approximately 50 additional dwellings could be supplied from the existing Waianbar Ave reticulation system before augmentation is required. This details can be better assessed when the results of the flow test are known

Should you have any further queries, please contact Rob de Groot on 02 6652 1700, or mobile 04 1883 1700 or by email at rob@dgb.com.au.

Yours faithfully



R J de Groot

ANNEXURE A: Extract from:

Saltwater Residential Development

South West Rocks

Engineering Issues Statement and Infrastructure Strategy Revision 2

5.2 Water Supply

Council have indicated that there is adequate capacity in the water supply system to cater for the development, given the time span that full development might take to occur.

Council have developed a long term strategy to supply the whole Saltwater development. The plan is showmen on Figure 5.1. Essentially the long term plan to supply the Saltwater area is with a 250mm watermain connected from the south from the Gregory Street Reservoir. The plan shows three watermain within the site – notated as Trunkmains D, E and F. The following sizes are indicated:

Trunkmain	Required Diameter	Equivalent size to be funded by developer. Balance of cost to be funded by Council
D	250 mm	150mm
E	250 mm	150mm
F	200 mm	150mm

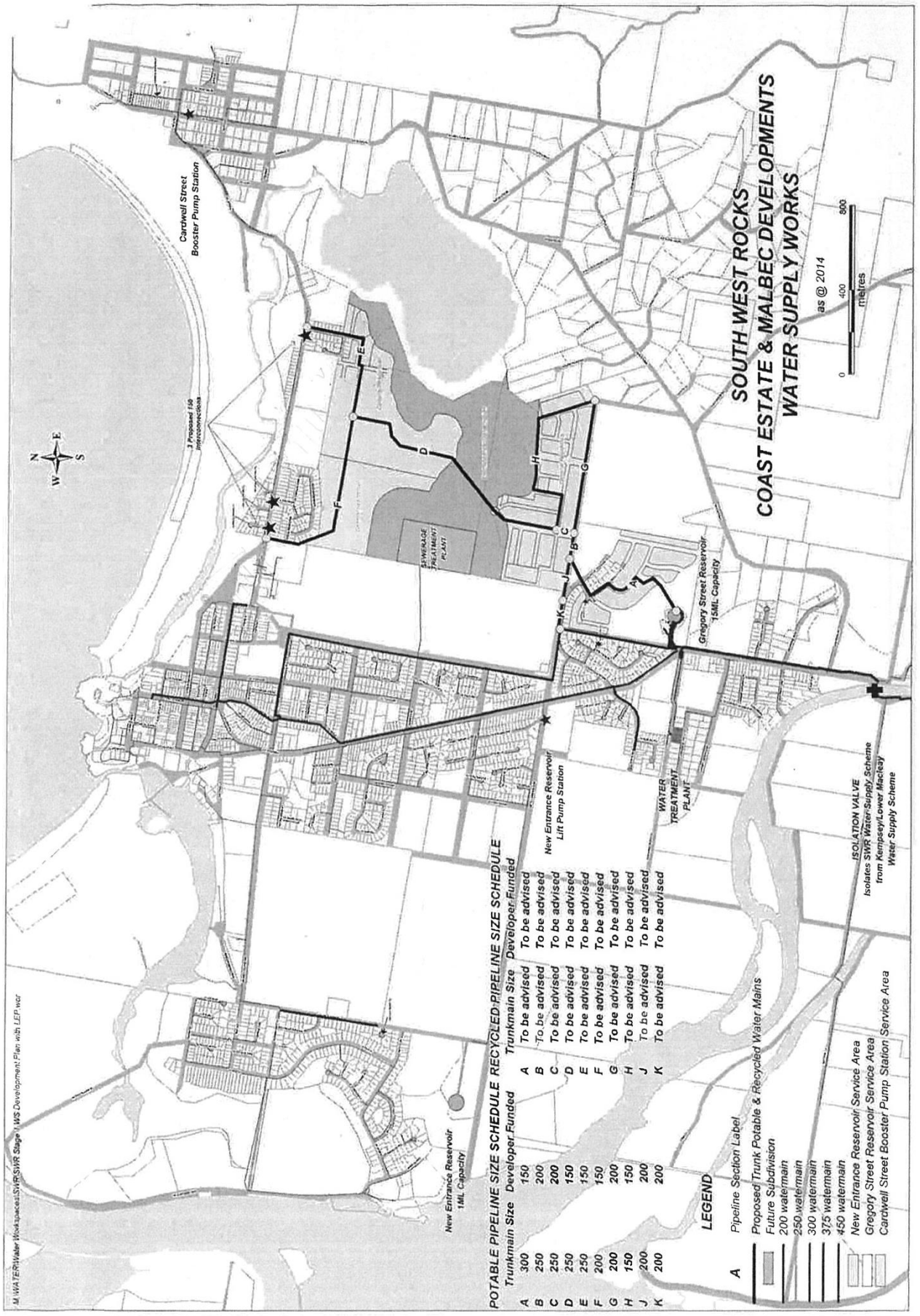
Concept plans for water supply are shown on Drawing 13056-DA13.

Generally the internal mains are proposed as 100mm. Larger mains will be provided on a cost sharing arrangement with Council in accordance with the approved strategy.

Discussions have been held with Council as to the timing of the connection from the south. Our understanding is that there is capacity in the existing reticulation in Philip Drive and Waianbar Ave to supply Stage 1. However, the adequacy of the supply beyond this will require modelling to determine appropriate staging options as it is impacted on by the levels of surrounding development (eg Malbec to the south and other possible developments along Phillip Drive).

Our understanding is that Council will be bringing recycled water to the development when it builds the water supply connection from the south. In the interim, the recycled water mains will be cross connected with the potable water mains.

Figure 5.1 – Water Supply Works



Saltwater Residential Development

South West Rocks

Traffic Impact Assessment and Traffic Study

Revision 2

June 2015

de Groot & Benson Pty Ltd

Saltwater Residential Development

South West Rocks

Traffic Impact Assessment and Traffic Study

Revision 2

June 2015

de Groot & Benson Pty Ltd

Ph 02 6652 1700
Email: email@dgb.com.au

236 Harbour Drive
PO Box 1908
Coffs Harbour NSW 2450

DOCUMENT CONTROL STATUS

Issue	Rev.	Issued To	Qty	Date	Reviewed	Approved
Revision 0		Geoff Smyth-	1	Nov 2014	RDG	RDG
Revision 1		Geoff Smyth-	1	28 Nov 2014	RDG	RDG
Revision 2		Geoff Smyth-	1	9 June 2015	RDG	RDG

Printed:	19 June, 2015 11:56 AM
Last Saved:	19 June 2015 11:56 AM
File Name:	S:\13\13056 Saltwater - Waianbar Ave South West Rocks\WP\13056 Stage 1- Traffic Management Plan-09 June 2015.docx
Project Manager:	Rob de Groot
Name of Organisation:	de Groot & Benson Pty Ltd
Name of Project:	Saltwater Development
Name of Document:	Traffic Management Plan – Revision 1
Job Number:	13056

TABLE OF CONTENTS

DOCUMENT CONTROL STATUS **1**

TABLE OF CONTENTS **2**

1 INTRODUCTION **4**

1.1 Existing Site 4

2 PROPOSED DEVELOPMENT **4**

2.1 STAGING 4

2.2 SITE CONCEPT PLAN 4

2.3 ACCESS 4

3 DCP REQUIREMENTS **5**

3.1 Traffic Impact Assessment 5

3.2 Traffic Study 5

3.3 Council Design Standards 5

4 SALTWATER TRAFFIC GENERATION **6**

4.1 Traffic Generation from the Precinct 6

4.1.1 Existing Traffic 6

4.1.2 Traffic Generation from the Precinct 7

4.1.3 Traffic Distribution – Full Development 8

4.1.4 Traffic Distribution – Stage 1 Development 8

4.2 Intersection Capacities 13

4.2.1 Full Development 13

4.2.2 Stage 1 – Phillip Drive and Waianbar Ave 19

4.3 The Link Road 19

4.3.1 The DCP 19

4.3.2 Traffic Impacts of Link Road on Development 20

4.3.3 Other issues 21

4.4 Findings 22

5 TRAFFIC STUDY **22**

5.1 TRAFFIC ISSUES RELATING TO THE DEVELOPMENT 22

5.2 Traffic Management 23

5.2.1 High Level Strategy 23

5.2.2 Road Hierarchy 23

5.2.3 Road Construction and Design Widths 23

5.2.4 Pedestrian and Cycleway Services 24

5.2.5 Garbage Services 24

5.2.6 Bus Routes 24

6 OVERALL CONCEPT PLAN 24
6.1 Concept Plan 24
6.2 Traffic Management 25
7 COMPLIANCE WITH KEMPSEY DCP SECTION D2 – SALTWATER PRECINCT 25
8 REFERENCES 27
9 DRAWINGS 28
Appendix A – Council Supplied Traffic Information 29
Appendix B – Traffic Distribution 45

1 INTRODUCTION

de Groot & Benson has been engaged by South West Developments Pty Ltd to prepare a Traffic Management Plan for Stage 1 of the proposed development of a site at Lot 35 DP 1167775, Waianbar Avenue, South West Rocks, NSW. The study site, known as "Saltwater", is located in the local government area of Kempsey Shire Council in NSW and approximately 2km east of the town centre.

Within this report, the term "Saltwater" relates to two areas as follows:

- Saltwater development – Lot 35 DP 1167775
- Saltwater Precinct – the area covered by the Saltwater DCP. It includes the subject site, additional land between the site and Phillip Dive and the development areas off Belle O'Conner Street to the south of Lot 35.

1.1 Existing Site

Lot 35 is approximately 66 ha in area. Stage 1 is located in the north eastern corner of the site. The site is essentially cleared. It is proposed to ultimately develop the entire residential zoned areas of the site as a residential subdivision.

The site is bounded by Waianbar Avenue to the north, reserve land to the east, future developable land with Lot 35 to the west and an existing large residential lot (Lot 34 DP 1167775) to the south.

The site is completely undeveloped as there are currently only a few shed like structures occupying the site.

2 PROPOSED DEVELOPMENT

The proposed development would contain around 29 low density lots, roads, associated infrastructure and residual public reserve.

The proposed development is shown on Drawing 13056-DA10.

2.1 STAGING

The proposed development application is for a 29 lot staged subdivision of the land into conventional residential allotments.

2.2 SITE CONCEPT PLAN

Stage 1 fits in with an overall concept developed for the site. The overall concept is detailed further in Section 6.

2.3 ACCESS

Initial access to the site is off Waianbar Avenue and Phillip Drive. According to the overall concept plan, in later years additional accesses will be constructed to Phillip Drive. This intersection will be upgraded to an unsignalised channelized right turn intersection.

3 DCP REQUIREMENTS

3.1 Traffic Impact Assessment

The Saltwater DCP requires the preparation of a Traffic Impact Assessment as required by Section 4.2 – Traffic Management Plan of the Kempsey DCP 2013 – Section D2 – Saltwater Precinct. The scope of the assessment is to include:

i. The scope shall be projected traffic for the Saltwater Precinct as a whole;
ii. Traffic impacts of existing neighbouring and future developments including impacts on existing down and upstream road infrastructure;
iii. Road design parameters for the primary link road, secondary road and remaining internal roads;
iv. The effect of noise, safety and visual amenity;
v. Appropriate location of proposed roads;
vi. Appropriate location of intersections (including number and type);
vii. Impact on Council's existing road network;

These issues are addressed in the various sections of this report

3.2 Traffic Study

In addition, the DCP requires a Traffic Study. The Traffic Study is to comply with the following requirements:

i. The recommendations of any approved Traffic Impact Assessment;
ii. The remaining development requirements within this section;
iii. The internal road layout is to provide for an even distribution for the additional traffic;
iv. All streets within residential areas are to have a low traffic volume in order to provide a reasonable standard of residential amenity;
v. Road reserve widths are to accommodate WSUD measures;
vi. Good connectivity between the established and new areas is to be promoted for pedestrians, cyclists and motorists and is essential in order to provide for the efficient movement (in both directions) to those destinations of significance within the broader residential community of South West Rocks;
vii. Provision is to be made for bus shelters within the main primary distributor road;
viii. All roundabouts must be designed to cater for bus movement;
ix. Primary linkages engineered to promote greater vehicular usage, with secondary access points engineered to promote a comparatively reduced usage is encouraged; and
x. Be compatible with the South West Rocks Pedestrian Access and Mobility Plan MBK 2003.

This report addresses both the Impact Assessment requirements and the Study requirements.

The DCP makes mention of a possible link road between the northern and southern precincts. An assessment of this linkage is discussed in this report.

3.3 Council Design Standards

Council's requirements are also set out in other sections of the DCP.

- Chapter B1 – Subdivision;
- Chapter B2 – Parking, Access and Traffic Management;
- Council's Engineering Guidelines for Subdivision and Development

Council has set out the required road standards for the development in its Development Design Specification. The Key criteria are summarised below:

Table 3.1 Design Standards

Road Design Criteria	Road Classification			
	Access Place	Local Street	Collector Road	Arterial
Traffic Volume	200 vpd	2,000vpd	6,000 vpd	10,000 vpd
Reserve width (min)	15m	16m	19m	22m
Carriageway Width	7m	9m	11m	15m
Traffic Catchment	20	100	300	-
Design Speed	50kph (max)	50kph(max)	60kph(max)	80kph
Minimum Distance Between Intersection	30m	60m	80m	80m

The design traffic volumes, can be converted to an equivalent number of residential lots as follows by use of criteria set out in the report:
Traffic generation from a

- dwelling: average – 9 vehicles per day; peak of 0.85 vehicles per hour
- medium density – 6.5vehicles per day; peak of 0.65 vehicles per hour

Thus each class of road can be ascribed a number of lots that it is able to service as follows:

- Access Place 22 dwellings
- Local Street 220 dwellings
- Collector Road 670 dwellings
- Arterial Road 1,100 dwellings

Waianbar Avenue has a carriageway width of 9.0m from back of kerb to back of kerb. This means that this road is considered a "local street" with a nominal capacity of 2,000 vpd.

4 SALTWATER TRAFFIC GENERATION

4.1 Traffic Generation from the Precinct

4.1.1 Existing Traffic

References (1), (2) and (3) provided details of the existing Traffic on Phillip Drive and Belle O'Conner Street. It is summarised in Table 4.1.

In addition, Kempsey Shire Council has undertaken traffic counts at various places around the township, including Phillip Drive and Bell O'Conner Street in February 2015. These are contained in Appendix A.

Table 4.1 Local Traffic Volumes

Existing Traffic			
		PHILLIP DRIVE	**BELLE O'CONNER ST (Eastern End)**
AADT	vehicles per day	2003: 2,450 veh/day on weekends 1,615 on weekdays veh/day (Ref 1) 2012: 690 and 750 2015: 2,700 veh/day on weekends 1950 on weekdays veh/day (App A)	2003:70 and 130 2015: 2,700 veh/day on weekends and 1950 on weekdays veh/day (App A)
AM Peak	vehicles/hour	2003: 63 2015: 294 at midday on Sunday 193 at midday weekday	2003: 8 2015: 124 at 11:00am on Saturday
PM Peak	vehicles/hour	2003: 75 2015: 294 at midday on Sunday 193 at midday weekday	2003: 13 2015: 120 at 5:00pm on Friday

At other key locations around the township, existing traffic volumes are contained in Appendix A. The traffic counts are summarised n Appendix B and include estimates for 2015 traffic and 2025 traffic using 3% annual growth rates. Some comments are:

- Existing traffic at the intersection of Phillip Drive , McIntyre Street and Landsborough Street is approximately 3500 vpd east of the roundabout, 1700 vpd in McIntyre Street and 1900 vpd in Landsborough Street.
- Existing traffic in Gregory Street, mid way between Belle O'Conner Street and Gordon Young Drive is around 6700 vpd.
- Existing traffic in Arrakoon Road is around 1,300 vpd

4.1.2 Traffic Generation from the Precinct

Precinct Traffic

Based on the development for the Saltwater Precinct, traffic volumes can be determined. The likely development level for the various sites in the Saltwater precinct are shown in table 4.2 and on Figure 4.1 for average daily traffic and table 4.3 and Figure 4.2 for peak hourly traffic.

The Tables shows that the northern precinct and the southern precinct generate similar volumes of traffic when the respective areas are fully developed.

Stage 1 Development Traffic

Stage 1 with 29 lots is estimated to generate 261 vehicles per day and 25 vehicles per hour during the peak hour.

4.1.3 Traffic Distribution – Full Development

Given that the location of schools, shopping facilities and sporting facilities in the South West Rocks region is generally to the west of the precinct. Two cases were considered, either with or without a link road and the following assessment of the likely traffic destinations are proposed:

Case A) - With a Link Road present:

a. Southern Sector:
    i. 75% of traffic would use Belle O'Conner Street
    ii. 25% would use the link road (of which 80% would head westwards on Phillip Drive)

b. Northern Sector:
    i. 80% of traffic would use Phillip Drive (of which 80% would head westwards)
    ii. 20% would use the link road and Belle O'Conner Street.

Case B) - With NO Link Road present:

a. Southern Sector:
    i. 100% of traffic would use Belle O'Conner Street

b. Northern Sector:
    i. 100% of traffic would use Phillip Drive (of which 80% would head westwards).

The traffic distribution for each precinct and on the major road linkages for Case (A) and Case (B) are shown diagrammatically on Figures 4.3 and 4.4

The traffic distribution for each precinct and on the major road linkages for Case (A) and Case (B) are shown diagrammatically on Figures 4.3 and 4.4.

Comparison of the two figures (Figures 4.3 and 4.4) shows the following:

- The average daily traffic that would use the link Road if constructed is 2097 vehicles per day.
- The average traffic on Belle O'Conner Street will be slightly higher with no Link Road constructed compared to if it is by approximately 5%.
- The average traffic on Phillip Drive will be lower (by 5%) if no link road is constructed compared to if the link road is constructed.

4.1.4 Traffic Distribution – Stage 1 Development

Given that there is no link road in Stage 1, all traffic will be using Waianbar Avenue. In this case, the traffic distribution is assumed to be:

- 100% of traffic would use Phillip Drive (of which 80% would head westwards).

Table 4.2 AADT Traffic volumes by Development (veh/day)

SALTWATER PRECINCT - TRAFFIC GENERATION				
DEVELOPMENT	**Low Density**	**Medium Density**	**Total**	**AADT**
	No of Lots	*No of units*	*No*	*veh/day*
Northern Precinct				
SALTWATER (inc Deferred Area)	**338**	**0**	**338**	**3042**
Existing Waianbar Ave	**28**	**0**	**28**	**252**
SW RUT	37	26	63	502
POLOVA T	37	26	63	502
McNIVEN	34	8	42	358
Sub Total				*4656*
Southern Precinct				
MALBEC PA	238	62	300	2545
MAJESTICA	36	9	45	382
SEASCAPE GROVE	163	42	205	1740
Sub Total				*4667*
TOTAL	**911**	**173**	**1084**	**9323**

Figure 4.1 AADT Traffic volumes by Development (veh/day)

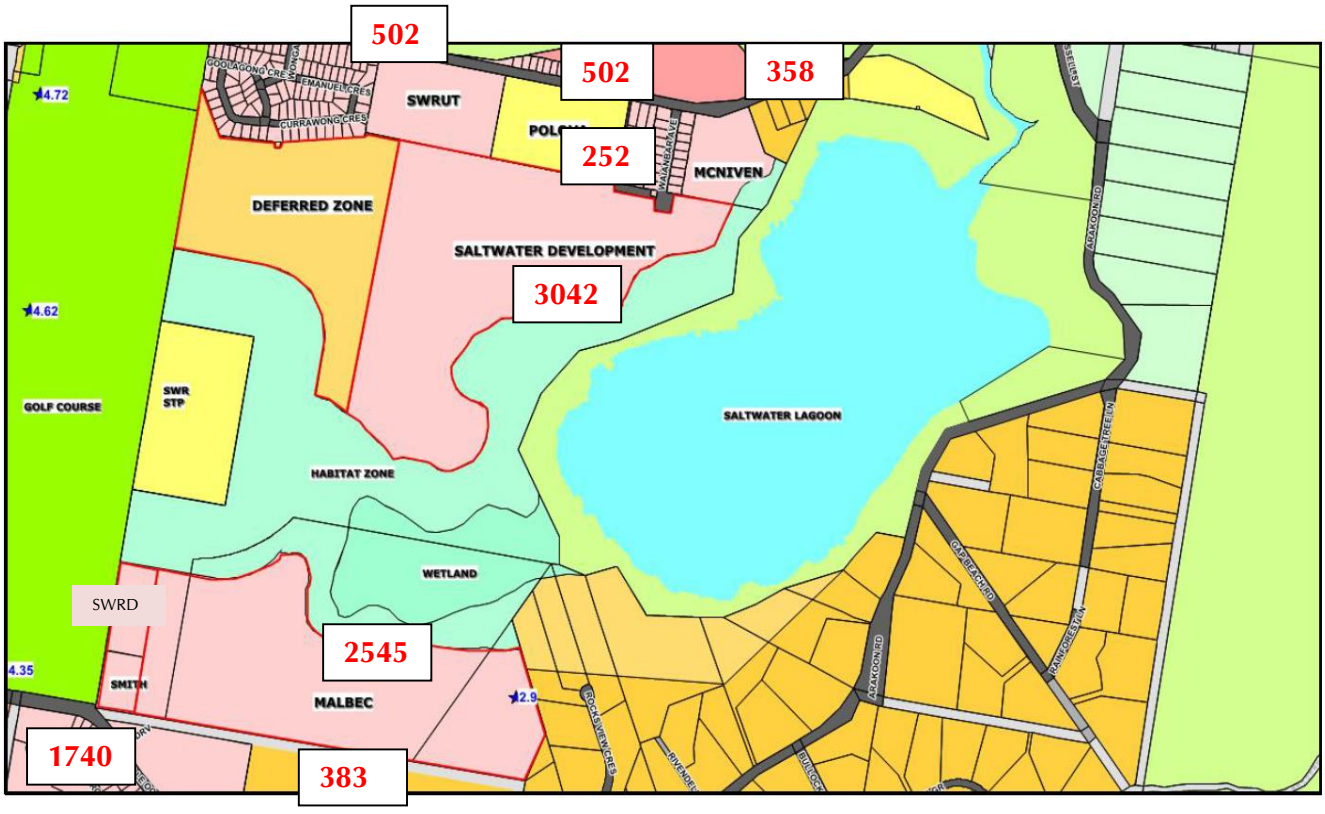


Table 4.3 Peak Hour Traffic volumes by Development (veh/hour)

SALTWATER PRECINCT - TRAFFIC GENERATION – PEAK HOUR				
DEVELOPMENT	**Low Density**	**Medium Density**	**Total**	**Peak Hour Trips**
	No of Lots	*No of units*	*No*	*veh/hour*
Northern Precinct				
SALTWATER (inc Deferred Area)	**338**	**0**	**338**	**287**
Existing Waianbar Ave	**28**	**0**	**28**	**24**
POLOVA T	37	26	63	48
SW RUT	37	26	63	48
McNIVEN	34	8	42	34
Sub Total				*441*
Southern Precinct				
MAJESTICA	36	9	45	36
SEASCAPE GROVE	163	42	205	166
MALBEC PA	238	62	300	243
Sub Total				*445*
TOTAL	**911**	**173**	**1084**	**886**

Figure 4.2 Peak Hour Traffic volumes by Development (veh/hour)

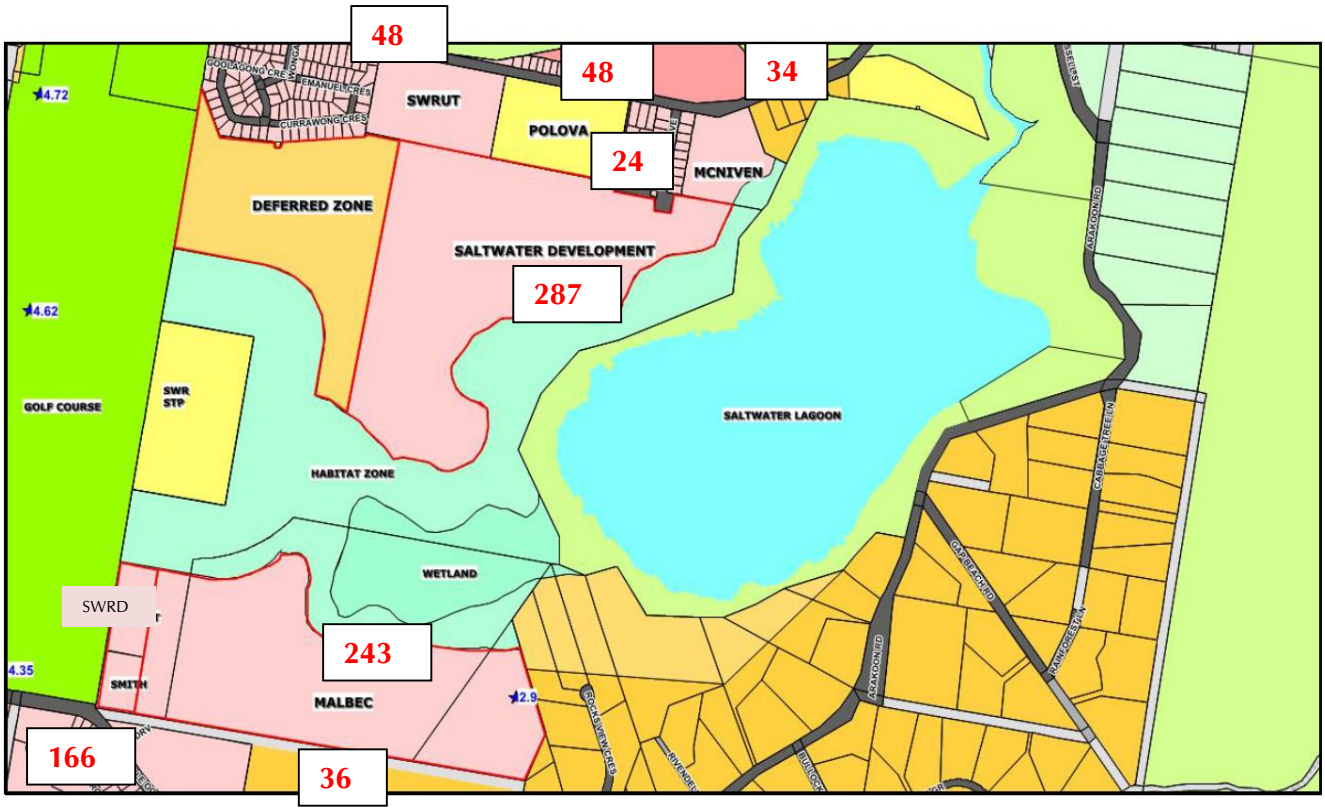


Figure 4.3 – Case A - Saltwater Precinct with Link Road– AADT Traffic Assignments from development precincts

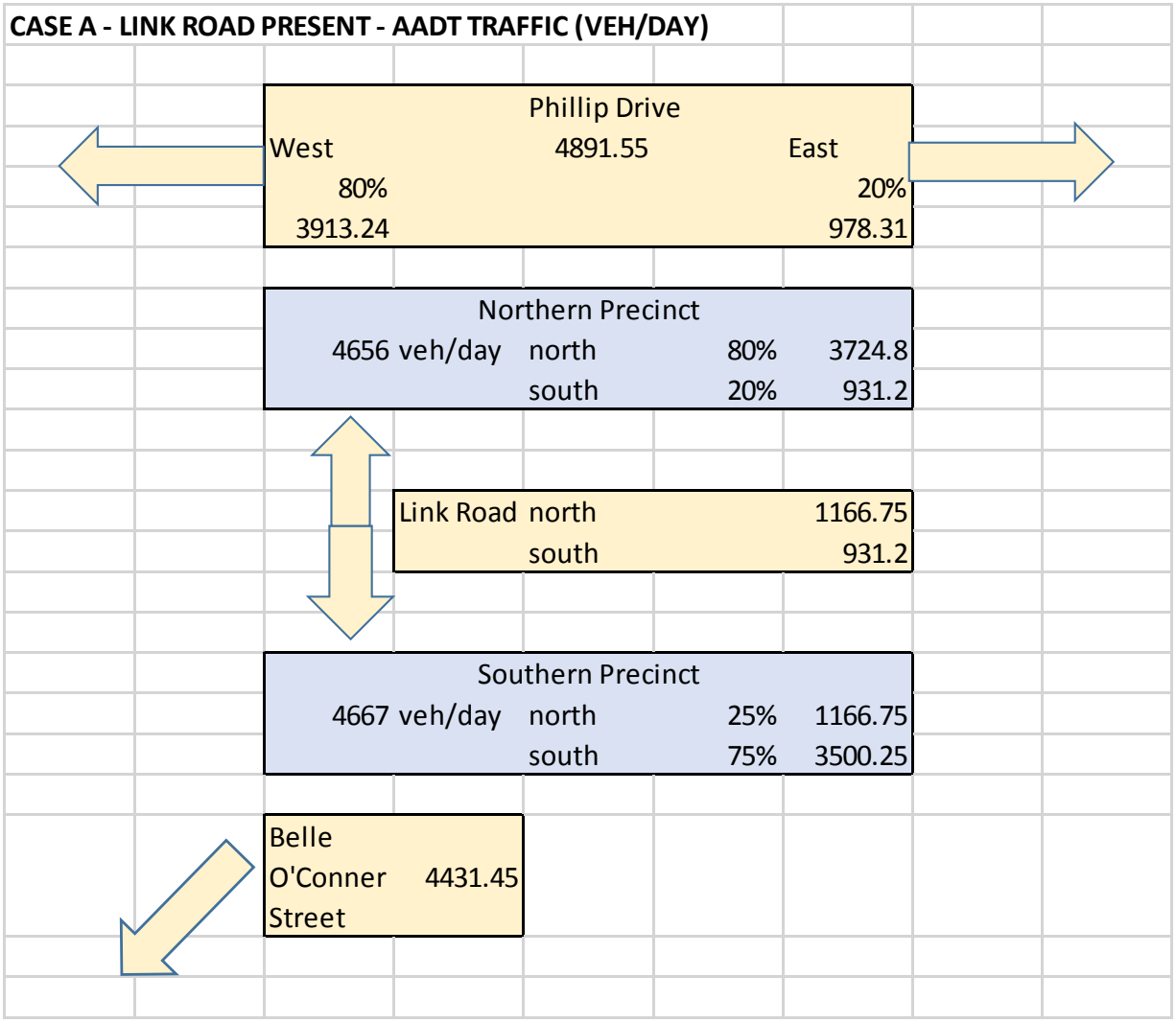
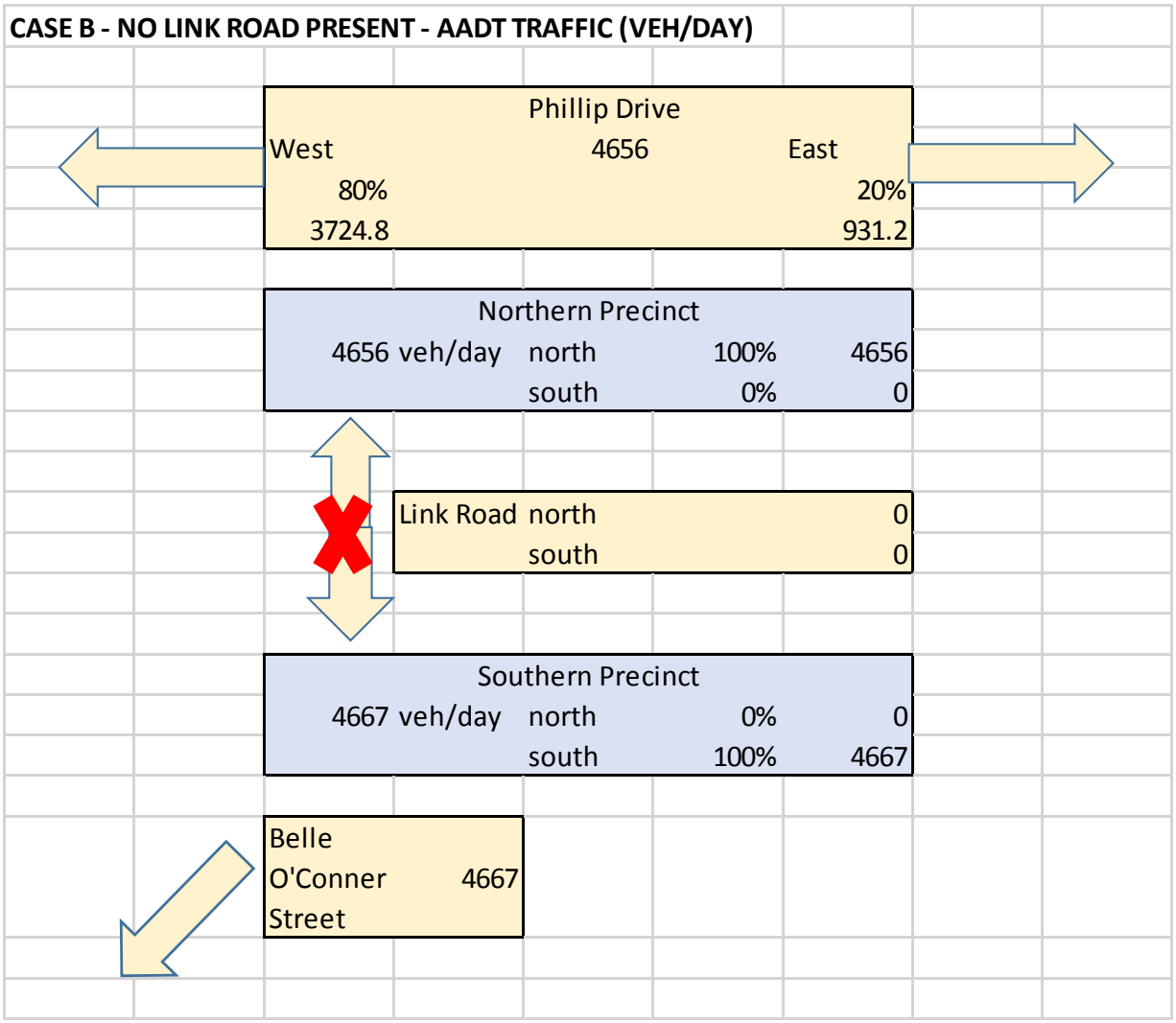


Figure 4.4 – Case B - Saltwater Precinct with NO Link Road– AADT Traffic Assignments from development precincts



4.2 Intersection Capacities

4.2.1 Full Development

The key interaction points of this development with Phillip Drive have been examined.

- An eastern connection to Phillip Drive. Under this development proposal, the eastern connection is proposed to be Waianbar Ave
- A western connection to Phillip Drive. The master plan for the site proposes additional connections to Phillip Drive.

In addition, there are traffic impacts on intersections external to the site (refer Section 4.2.2).

4.2.1.1 Phillip Drive and Saltwater Precinct

An unsignalised channelized right turn intersections has been proposed for the various intersections with Phillip Drive. In terms of traffic on Phillip Drive, Case A represents a slightly worse case.

Further, we have examined the worst case scenario being that all traffic predicted uses only 1 intersection with Phillip Drive. The intersection was modelled for a 10 year design horizon assuming a 3% annual traffic growth.

Initial traffic volumes are shown in Figure 4.5

The results are shown in Table 4.5.

The results show that a single intersection of the Saltwater precinct with Phillip Drive will perform satisfactorily for all traffic movements for the design traffic horizon modelled (up to the year 2024). All turn movements had Level of Service A.

This result is conservative as:

- It assumes full development of both the northern and southern precincts.
- It assumes that 100% of the traffic uses a single intersection. As noted in Section 4.4, two intersections will eventually be required with Phillip Drive.

4.2.1.2 Other intersections external to the site

Other possible intersections external to the site, impacted by traffic from the development include:

Belle O'Conner Street / Gregory Street
Belle O'Conner Street and Gregory Street. As this report does not recommend any connection to Belle O'Conner Street, the development will have no additional traffic impact on this intersection and so it was not considered further.

Phillip Drive / McIntyre Street Landsborough Street
Phillip Drive / McIntyre Street Landsborough Street. This intersection is a three way "T" Intersection controlled by a roundabout. The proposed development will increase traffic at the roundabout by an estimated 3,725 vehicles per day (3,910 veh/day if a link road is constructed) when the whole Saltwater Precinct is developed.

Section 4.1.1 determined the existing traffic volumes at the intersection of Phillip Drive , McIntyre Street and Landsborough Street is approximately 3500 vpd east of the roundabout, 1700 vpd in McIntyre Street and 1900 vpd in Landsborough Street

The intersection has been modelled using the SIDRA software for a 10 year design horizon assuming a 3% annual traffic growth.

Initial traffic volumes are shown in Figure 4.6

The results are shown in Table 4.5

The results show that the intersection of Phillip Drive / McIntyre Street / Landsborough Street will perform satisfactorily for all traffic movements for the design traffic horizon modelled (up to the year 2024). All turn movements had Level of Service A.

This result is conservative as:

- It assumes full development now with 10 years of traffic growth.

Table 4.4 – SIDRA ANALYSIS

MOVEMENT SUMMARY

Site: Phillip Dr / Saltwater- pm 2015

Three-way intersection with 2-lane major road (Stop control)

Stop (Two-Way)
Design Life Analysis (Practical Capacity): Results for 10 years

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Saltwater Precinct											
1	L2	251	0.0	0.344	3.0	LOS A	1.7	12.0	0.45	0.94	10.5
3	R2	62	0.0	0.344	3.0	LOS A	1.7	12.0	0.45	0.94	13.2
Approach		313	0.0	0.344	3.0	LOS A	1.7	12.0	0.45	0.94	11.2
East: Phillip Street											
4	L2	68	0.0	0.138	6.4	LOS A	0.0	0.0	0.00	0.23	39.3
5	T1	219	0.0	0.138	0.0	LOS A	0.0	0.0	0.00	0.23	39.8
Approach		287	0.0	0.138	1.5	NA	0.0	0.0	0.00	0.23	39.7
West: Phillip Street											
11	T1	205	0.0	0.097	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
12	R2	283	0.0	0.206	1.1	LOS A	1.0	7.0	0.41	0.28	10.0
Approach		489	0.0	0.206	0.7	NA	1.0	7.0	0.24	0.17	14.9
All Vehicles		1089	0.0	0.344	1.6	NA	1.7	12.0	0.24	0.41	16.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
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.

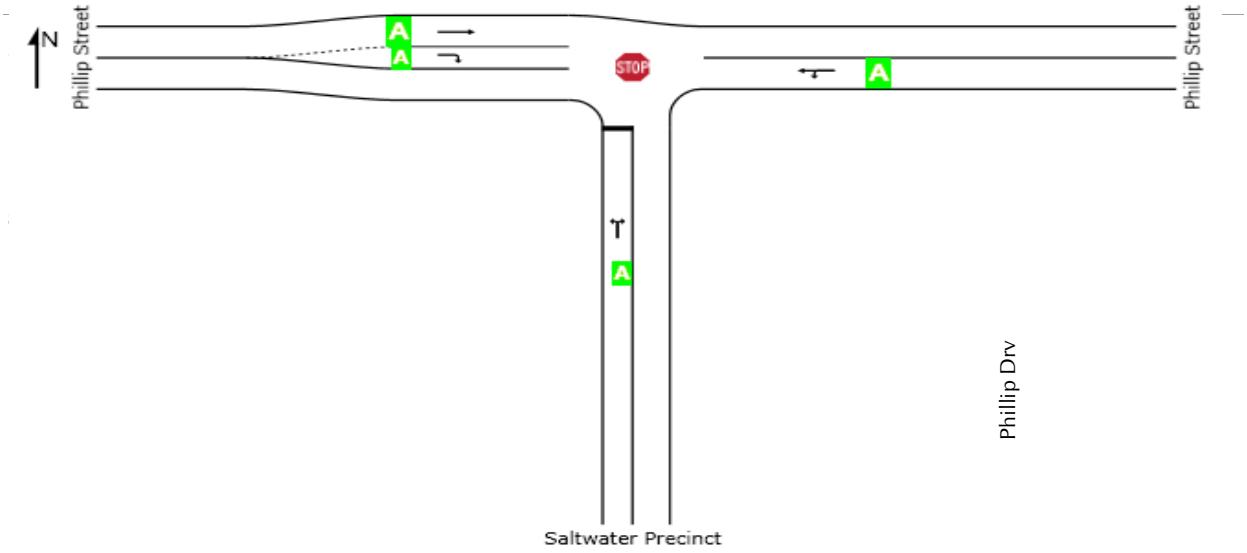


Figure 4.5 - Initial traffic volumes – Phillip Drive / Development

INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

Site: Phillip Dr / Saltwater- pm 2015

Three-way intersection with 2-lane major road (Stop control)

Stop (Two-Way)

Volume Display Method: Separate

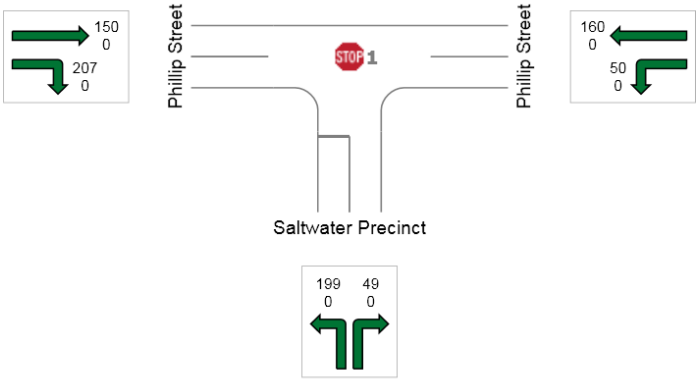
Volumes are shown for Movement Class(es): Light Vehicles and Heavy Vehicles

Total Intersection Volumes (veh)

All Movement Classes: 815

Light Vehicles (LV): 815

Heavy Vehicles (HV): 0



Project: S:\13\13056 Saltwater - Waianbar Ave South West Rocks\Traffic\13056 Phillip Street.sip6
8000364, 6016421, DE GROOT AND BENSON PTY LTD, PLUS / 1PC

Figure 4.6 - Initial traffic volumes – Phillip Drive / McIntrye St

INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

Site: Phillip Dr/McIntyre St - 2015

- Phillip Drive / McIntyre Street Landsborough Street. Roundabout

Volume Display Method: Total and %

Volumes are shown for Movement Class(es): All Classes and Heavy Vehicles

Total Intersection Volumes (veh)

All Movement Classes: 730

Light Vehicles (LV): 694

Heavy Vehicles (HV): 37

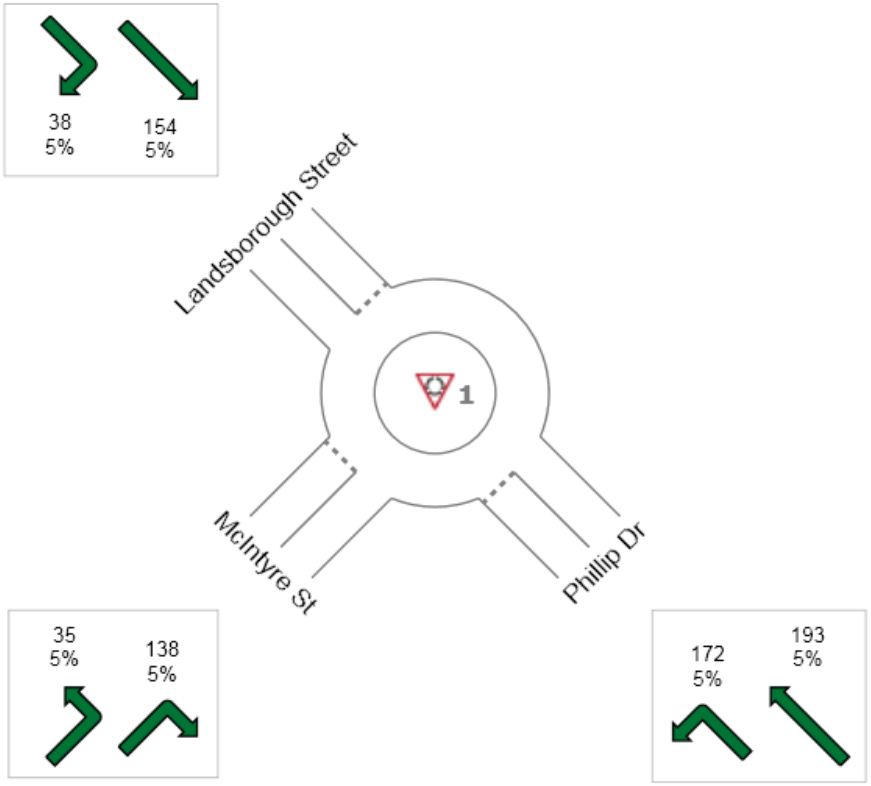


Table 4.5 Movement Summary

LEVEL OF SERVICE

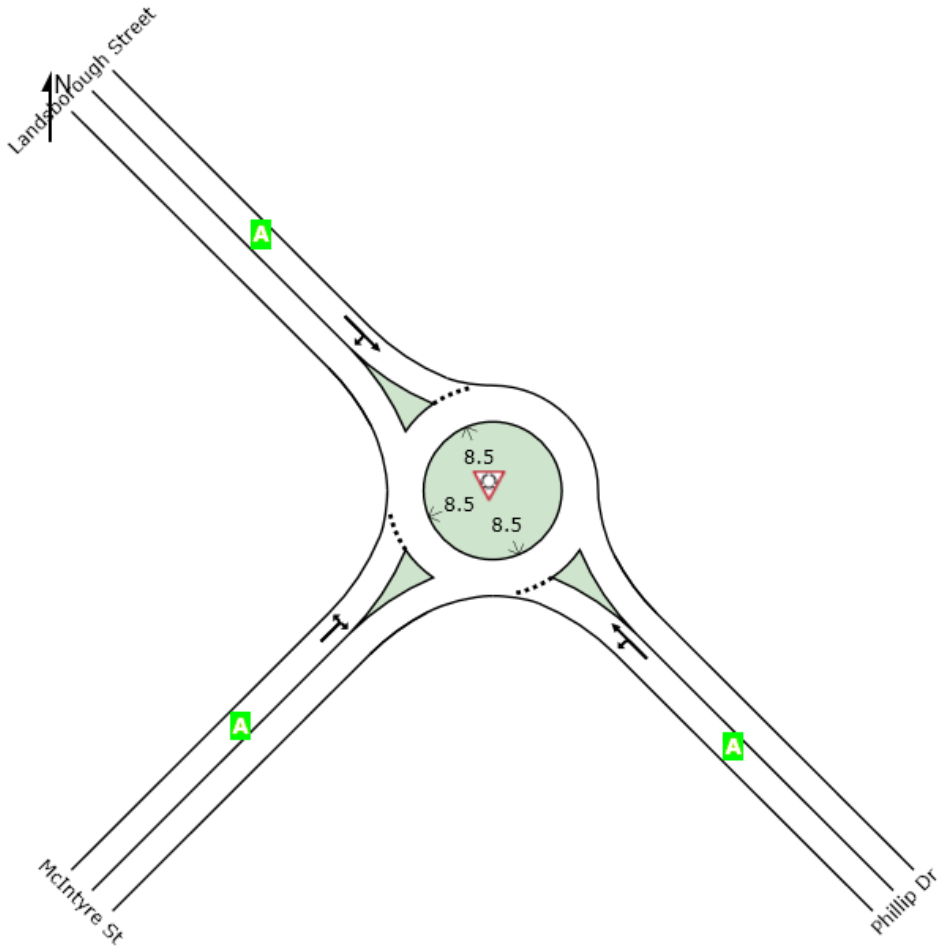
Site: Phillip Dr/McIntyre St - 2015

- Phillip Drive / McIntyre Street Landsborough Street. Roundabout

Design Life Analysis (Practical Capacity): Results for 10 years

All Movement Classes

	Southeast	Northwest	Southwest	Intersection
LOS	A	A	A	A



Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

MOVEMENT SUMMARY

Site: Phillip Dr/McIntyre St - 2015

- Phillip Drive / McIntyre Street Landsborough Street. Roundabout

Design Life Analysis (Practical Capacity): Results for 10 years

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
SouthEast: Phillip Dr											
4	L2	217	5.0	0.334	5.0	LOS A	2.3	17.0	0.23	0.49	53.1
5	T1	244	5.0	0.334	5.1	LOS A	2.3	17.0	0.23	0.49	54.1
Approach		461	5.0	0.334	5.1	LOS A	2.3	17.0	0.23	0.49	53.7
NorthWest: Landsborough Street											
11	T1	195	5.0	0.225	5.9	LOS A	1.3	9.7	0.42	0.57	52.9
12	R2	48	5.0	0.225	9.1	LOS A	1.3	9.7	0.42	0.57	52.5
Approach		243	5.0	0.225	6.6	LOS A	1.3	9.7	0.42	0.57	52.9
SouthWest: McIntyre St											
1	L2	44	5.0	0.216	6.3	LOS A	1.2	8.7	0.46	0.67	50.8
3	R2	174	5.0	0.216	9.6	LOS A	1.2	8.7	0.46	0.67	51.3
Approach		219	5.0	0.216	8.9	LOS A	1.2	8.7	0.46	0.67	51.2
All Vehicles		922	5.0	0.334	6.4	LOS A	2.3	17.0	0.33	0.56	52.9

Level of Service (LOS) Method: Delay (RTA NSW).
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.

Project: S:\13\13056 Saltwater - Waianbar Ave South West Rocks\Traffic\13056 Phillip Street.sip6
8000364, 6016421, DE GROOT AND BENSON PTY LTD, PLUS / 1PC

4.2.2 Stage 1 – Phillip Drive and Waianbar Ave

The analysis undertaken in Section 4.2.1.1 shows that unsignalised channelized right turn intersection from Phillip Drive taking 100% of the traffic generated from the development site will perform satisfactorily.

Accordingly, at Stage 1, when traffic volumes are significantly, such an intersection will also perform satisfactorily. As such no specific modelling was undertaken.

4.3 The Link Road

4.3.1 The DCP

The DCP is written on the basis that the link road (ie - a connection from Belle O'Conner Street to Phillip Drive) is the preferred strategy.

Notwithstanding this, the proposed development does not require the construction of a link road. The development can provide adequate traffic access to the South West Rocks area without the need for the link road with the proposed two, possibly three connections to Phillip Drive.

4.3.2 Traffic Impacts of Link Road on Development

Section 4.1.3 assessed traffic using the link road based on an assumed traffic usage. In determining the traffic volumes, Section 4.1.3 assumed:

- With the link road present
    - 25% of traffic from the southern areas would use the Link road to head north
    - 20% of the northern sector would travel south to Belle O'Conner Street.

Impact on Phillip Drive

Given this assumption, the impacts on Phillip Drive are similar with only 5% difference in estimated traffic. However, within the Saltwater development there will be another 1,167 average daily traffic movements resulting from traffic originating from the southern precincts and further south in Belle O'Conner Street. This obviously has associated safety and noise issues for the Saltwater development residents.

Further, we have looked at the sensitivity of the traffic distribution assumption and the results are shown in table 3.6

Table 4.5 – Sensitivity Analysis:

Traffic Originating from the southern precinct travelling northwards	Extra traffic from Link Road through the development	Total northern and southern precinct traffic impact on Phillip Drive
Base Case:		
25% of traffic from south using Link Road	1,167 vpd	4,891 vpd
Sensitivity Analysis:		
40% of traffic from south using link road	1,866 vpd (extra 60 % traffic)	5,591 vpd (extra 14% traffic)
50% of traffic from south using the Link Road	2,333 vpd (extra 100% traffic)	5,591 vpd (extra 24% traffic)
60% of traffic from south using the Link Road	2,800 vpd (extra 140% traffic)	6,525 vpd (extra 33% traffic)

The Table shows that the traffic on the internal Saltwater development roads is very sensitive – an extra 15% of traffic from the southern precinct can result in an additional 60% traffic on the local roads.

Impact on Gregory Street

The link road, if not provided would require traffic from Belle O'Conner area to make more use of Gregory Street. Similarly, traffic from the development site, would also add additional traffic to Gregory Street when accessing the Coles Supermarket area or even leaving the township.

Section 4.1.1 suggested that the existing traffic in the section of Gregory Street between Belle OConner Street and Gordon Young Drive is around 6,700 vpd. Appendix B predicts a figure of around 8,900 vpd without any of the Saltwater precinct traffic in year 2025.

We have assessed the increase in traffic due to both the proposed development and that of the southern precinct which will combined add around 9,323 vpd (Table 4.2) to the South West Rocks traffic regime.

Specifically for Gregory, we estimate that traffic will increase as follows:

- With no Link Road present – 13,400 vpd
- With Link Road present – 13,300 vpd

As such, there is minimal traffic difference in the section of Gregory Street analysed with or without the Link Road present.

4.3.3 Other issues

Positives

- The Link Road does provide some benefit to the Saltwater development in that it provides a more direct route for traffic heading towards the Gregory Street shops or to leave the South West Rocks township.

- In addition, the link road provides a third possible route for traffic wanting to travel from the south western areas of the township and the north eastern areas in addition to the Philip Drive route and the Arakoon Road routes.

- The provision of the access road provides more flexibility on planning bus routes to service the South West Rocks area

Negatives

- The Developers have undertaken local community consultation, and they have advised that the community representatives who have offered opinions, are concerned that a link road could result in even higher traffic levels, particularly on the busy school holiday periods. Their overwhelming feedback was opposed to the construction of the link road.

- The Link Road will result in more traffic noise impacting on the Saltwater development residents.

- The construction of the Link Road through the environmental zoned land poses risks to ecological communities in this area. It also bisects a possible corridor for fauna travelling from the Saltwater lagoon to the golf course area. It is noted that the Mid North Coast Regional Strategy (Ref 3) has as one of its aims:

  > *Protect high value environments, including significant coastal lakes, estuaries, aquifers, threatened species, vegetation communities and habitat corridors by ensuring that new urban development avoids these important areas and their catchments"* (page 11).

- Further, the Strategy has as one of its Environment and Natural Resources Outcomes:

  > *The Strategy supports the maintenance and enhancement of the Region's biodiversity. Urban development will be directed away from areas of known or likely conservation importance, including corridors which allow wildlife to connect with or migrate to other habitat areas and climatic zones. (Page 30)*

- One of the perceived benefits of the link road is for connection of the Belle O'Conner area to the north eastern recreational areas of South West Rocks. However, our understanding is that the development proposals for the sites around Belle O'Conner Street, propose a connection to Arakoon Road. This connection is an obvious replacement for the need for the Link Road.

The Saltwater development's vision is for a low traffic / family friendly environment and as such the extra traffic generated by a link road travelling on the internal roads does not fit in with the development's aims. In addition, it is our opinion that the positives of the link road do not outweigh the negatives and as such, the link road is not recommended for this development.

Rather than a link road, the developers would propose a cycleway / pedestrian linkage between the northern and southern precincts should be provided. This link could follow existing tracks to minimise any father disturbance of the environment in the area.

4.4 Findings

Traffic volumes for the Saltwater Precinct and the Saltwater development have been estimated including the Cases of "with" and "without" the link road joining the northern and southern section of the overall precinct. The analysis showed that the traffic impacts externally to the precinct will be similar for both Cases. In addition, the traffic volumes in Gregory Street will also be similar with and without the link road.

The capacities of major intersections affected by increased traffic from the development was examined (including allowing for future traffic growth). The analysis showed that they all performed satisfactorily – even if all the Saltwater development site had only one access to Phillip Drive.

When the major road traffic distributions are compared to the traffic standards summarised in Table 4.1 and Figures 4.3 and 4.4, it is concluded that the highest class of road required in the development site is a Collector Class Road (up to 6,000 veh/day).

The existing traffic volumes in Waianbar Ave is approximately 252 vehicles per day. As noted in Section 3.1.1, Waianbar Ave has a nominal capacity of 2,000 vehicles per day. This gives the roadway spare capacity of up to 1,750 vehicles per day or about 194 extra residential lots.

Given the above, we would recommend that the timing for an additional connection to Phillip Drive be based on traffic volumes and that conservatively a new connection should be provided when no more than 150 additional lots have been created in the development site.

This report finds that

- That two accesses from the development site were required to Phillip Drive. This report proposed that the second intersection would be required when at least 150 lots within the development site were constructed.
- The intersection from the development site with Phillip Drive will perform satisfactorily into the near future.
- The intersections external to the site impacted by extra traffic from the development also perform satisfactorily.
- The link road is not recommended

5 TRAFFIC STUDY

5.1 TRAFFIC ISSUES RELATING TO THE DEVELOPMENT

Access to the site is from Waianbar Avenue. The intersection with Phillip Drive will be upgraded to an unsignalised channelized right turn intersection.

This road has been designed as the main access to the Saltwater development area. As noted in Section 4.4, up to 150 development lots could be provided before a second access to Phillip Drive is required.

The section of road within Stage 1 will be built to Collector road standard. This road will be capable of use by public transport.

The remaining roads in Stage 1 are considered Local Access Streets

Footpaths will be provided to all roadways in accordance with Council standards.

5.2 Traffic Management

A concept traffic management plan for the whole site is shown on Drawing 13056-MP7.

5.2.1 High Level Strategy

The high level strategy for the site includes:

- At least two accesses to Phillip Drive
- Internal collector class road loop, suitable for bus transport
- Local streets serving the majority of the developable lots.

Drawing 13056-MP7 shows:

- The existing access to the site from Waianbar Ave
- Three possible accesses to Phillip Drive, two through land immediately to the north of the site, and one in the north western corner through part of the golf course land.
- A smaller access to Currawong Crescent.

This drawing complies with the findings in Section 4.4. Which of the future accesses are proceeded with, will be determined with the Development Applications for future stages and beyond and depends on;

- Status of the deferred land
- Land availability issues with all the access routes.

5.2.2 Road Hierarchy

The development falls within the Saltwater Development Control Plan area. This DCP sets out the proposed hierarchy for roads within the development and the DCP area.

Based on the DCP, a road hierarchy to fit in with the proposed development has been prepared. Drawing 13056-MP7 shows this the details.

5.2.3 Road Construction and Design Widths

The road widths proposed inside the development vary and are shown on Drawing 13056-MP7 and are summarised below:

a) Waianbar Ave – This is initially the main access roadway for the Development Site. For Stage 1, the road is proposed to have a Carriageway width of 8.5m
b) Internal Collector Roads (coloured yellow on Drawing 13056-MP7) – 11m carriageway in a 19m wide road reserve.

c) Local Streets (coloured green, on Drawing 13056-MP7) – 9m and 16mwide road reserve
d) Access Street (coloured blue on Drawing 13056-MP7) - 7m carriageway in a 15m wide road reserve.
e) Dual Lane roads (also coloured yellow on Drawing 13056-MP7). These roads are proposed to have 4.5m one way carriageway separated by a 10m bioswale required for water quality and groundwater recharge purposes.

All road gradings comply with Council's design standards.

5.2.4 Pedestrian and Cycleway Services

There are currently no existing pedestrian links along Waianbar Ave. However the development will have in place the following:

- All roads will have a minimum of a 1.2m wide footpath.
- Pedestrian and cycleway linkages in the environmental zones

In the long term a cycleway linkage between the northern and southern precincts of the Saltwater DCP area is recommended.

5.2.5 Garbage Services

The proposed road widths and road alignments conform to Council's technical guidelines for the subdivision, as such all roadways are suitable for access by Garbage contractors.

5.2.6 Bus Routes

The Collector Class roads are capable of being used as bus routes as required. No bus stops are proposed in Stage 1 as Phillip Drive is within 400m.

In future stages, bus stops will be provided in consultation with the relevant bus companies and will be nominated in future DA's. The typical rule of thumb is that, it there is a bus service provided, there should be no more than 400m walk from the furthest residence. Drawings 13056-MP7 shows possible bus stop locations.

6 OVERALL CONCEPT PLAN

6.1 Concept Plan

An overall concept plan for the site has been developed. The purpose of this Section is to examine how Stage 1 fits in with the possible eventual development of the site to ensure that servicing and access occurs in a logical and sustainable manner.

The concept plan is shown in Drawing 13056-MP1. The plan shows a development concept for three areas:

- Stage 1 – the subject of this DA
- Future Lots – the balance of the residential zoned land on the site.
- Deferred Area – the section of the site that is currently not zoned residential but has potential as residential land subject to consideration of the required odour buffers from the South West Rocks Sewage Treatment Plan.

The Plan includes the following features:

- A grid pattern residential footprint
- A ring road system which would be constructed to collector road class standard. This road would be suitable as a bus route. The road system initially connects to Waianbar Avenue and thence to Phillip Drive. Three other possible connections to the north are highlighted.
- Perimeter roads to the environmental areas to the east and south
- Stormwater management infrastructure
- Water supply
- Sewerage
- Electrical and communication facilities.

6.2 Traffic Management

A concept Traffic management plan is detailed in the Traffic Management Plan.

7 COMPLIANCE WITH KEMPSEY DCP SECTION D2 – SALTWATER PRECINCT

Section D2 of the Kempsey Development Control Plan sets out specific requirements for the Saltwater precinct. In relation to Infrastructure Servicing (Section 4.2 of the DCP) we comment specifically on each requirement:

OBJECTIVE	DEVELOPMENT RESPONSE
4.2 Traffic Management Plan	
Desired Outcomes	
DO1 – A Traffic Study for the Saltwater Precinct is approved prior to the issue of a development consent for any development within Saltwater Precinct.	Traffic Study has been prepared
DO2 - A Traffic Study provides for a road network throughout the Saltwater Precinct that will generally comply with the relevant requirements of: • *Chapter B1 – Subdivision;* • *Chapter B2 – Parking, Access and Traffic Management;* • *Council's Engineering Guidelines for Subdivision and Development; and* • *The following Development Requirements.*	Complying road network is proposed
DO3 - The Traffic Study shows how the transport network will be constructed in stages commensurate with staging of subdivision and development in Saltwater Precinct, where relevant.	Staging proposed
DO4 - Adequate vehicular, pedestrian and cycleway connections are provided throughout the Saltwater Precinct.	adequate connections provided
Development Requirements	
*a) A detailed **Traffic Impact Assessment** is to be undertaken to inform the Traffic Study. The Traffic Impact Assessment is to address, but not be limited to:*	Traffic impact Assessment undertaken
(i) The scope shall be projected traffic for the Saltwater Precinct as a whole;	noted
(ii) Traffic impacts of existing neighbouring and future developments including impacts on existing down and upstream road infrastructure;	noted
(iii) Road design parameters for the primary link road, secondary road and remaining internal roads;	noted
(iv) The effect of noise, safety and visual amenity;	no specific noise study has been provided
(v) Appropriate location of proposed roads;	noted

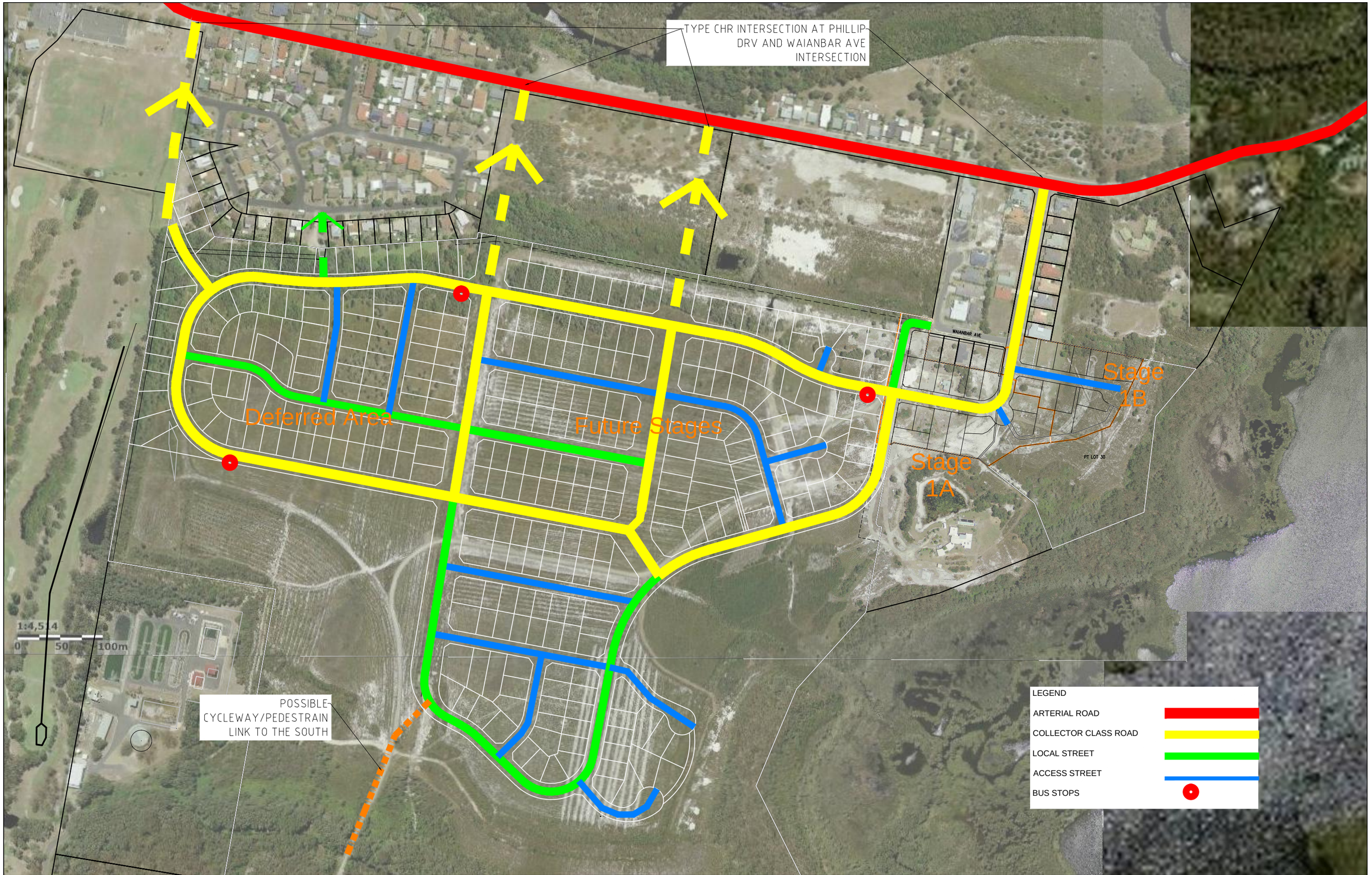
OBJECTIVE	DEVELOPMENT RESPONSE
(vi) Appropriate location of intersections (including number and type);	noted
(vii) Impact on Council's existing road network;	noted
*b) The **Traffic Study** is to comply with the following requirements:*	noted
(i) The recommendations of any approved Traffic Impact Assessment;	noted
(ii) The remaining development requirements within this section;	noted
(iii) The internal road layout is to provide for an even distribution for the additional traffic;	even road patter proposed with minimal cul-de-sacs
(iv) All streets within residential areas are to have a low traffic volume in order to provide a reasonable standard of residential amenity;	this is a primary aim of the road network proposed.
(v) Road reserve widths are to accommodate WSUD measures;	Road reserve widths varied to accommodate WSUD
(vi) Good connectivity between the established and new areas is to be promoted for pedestrians, cyclists and motorists and is essential in order to provide for the efficient movement (in both directions) to those destinations of significance within the broader residential community of South West Rocks;	Good Connectivity is proposed. There are minimal cul-de-sacs.
(vii) Provision is to be made for bus shelters within the main primary distributor road;	Bus Shelters will be provided. None are proposed in Stage 1.
(viii) All roundabouts must be designed to cater for bus movement;	nil proposed
(ix) Primary linkages engineered to promote greater vehicular usage, with secondary access points engineered to promote a comparatively reduced usage is encouraged; and	All linkages proposed are in accord with Traffic Impact Assessment and Council guidelines.
(x) Be compatible with the South West Rocks Pedestrian Access and Mobility Plan MBK 2003.	noted
*c) Transport **connection points to Phillip Drive and Bell O'Connor Street** are to provide connections for pedestrians, cycle-ways and vehicles.*	Noted
(i) These points should be limited so as to control access to Philip Drive and Belle O'Connor Street;	
*(ii) A **Traffic Impact Assessment** is to be submitted which provides adequate justification for the number of connection points to Phillip Drive and Belle O'Connor Street;*	Justification provided
(iii) Where possible:	
• *A primary link road through the site is to connect to Phillip Drive at a point to the north of the western half of the Saltwater Precinct, through adjoining properties to the north; and*	Possible linkages are noted.
• *Any road connecting to the eastern frontage of Saltwater Precinct to Phillip Drive is to be secondary to the main linkage road through the site.*	
(iv) Details demonstrating compliance with the relevant provisions of Council's Engineering Guidelines for Subdivision and Development, are to be provided with respect to management measures and works required in order to maintain or improve traffic efficiency at these points; and	noted
(v) The main intersection with Philip Drive must provide for a priority controlled intersection and be designed so as to accommodate the predominance of traffic through the site.	a channelized right turn intersection proposed

OBJECTIVE	DEVELOPMENT RESPONSE
*d) A **primary road linkage route** is to be provided from the north to the south of the Saltwater Precinct. The primary road linkage route is to be connected to Phillip Drive to the north and Belle O'Connor Street to the south.*	The primary north South linkage is not proposed.
*(i) A detailed environmental and traffic engineering assessment is to be undertaken as part of the **Traffic Impact Assessment** with respect to this linkage to ascertain the number and location of intersections required to Phillip Drive and Belle O'Connor Street including any temporary access point in order to ensure that no adverse impacts arise.*	Two intersections proposed to Phillip Drive
*(ii) Detailed **environmental assessment** is to be provided to justify any route traversing the drainage channel (ie that area zoned E2 – Environmental Conservation).*	Not Applicable
*(iii) Details of fauna friendly road construction measures with respect to the road through the Zone E2 - Environmental Conservation land are to be included in the **Traffic Study**. In this regard, fauna fencing, under crossings and overhead corridor facilities are recommended.*	Not Applicable
*e) A **predominant ring road** is to be provided around residential zoned land to:*	Ring Road link predominantly provided
*f) A **Traffic Study** for the Saltwater Precinct, including a concept road layout, is to be submitted to Council and approved prior to the issue of a development consent for any development. The Traffic Management Plan is to demonstrate compliance with all of the above development requirements.*	Refer Drawing 13056-MP7

8 REFERENCES

1. Saltwater Developments Area – Phillip Drive & Belle O'Connor Street – South West Rocks – Local Environment Study" by Connell Wagner Pty Ltd, February 2018
2. "Seascape Grove, Belle O'Connor Street, South West Rocks, Stage 1 - Traffic Impact Assessment" August 2006 by Environmental Resources Management Australia Pty Ltd
3. "Mid North Coast Regional Strategy – 2006-2031", March 2009; NSW Department of Planning

9 DRAWINGS



REV.	DATE	REVISION	DR.BY	AP.BY
DA5	19/06/15	LAYOUT AMMENDMENTS	APR	RDG
P2	28/10/14	MINOR AMENDMENTS	APR	RDG

de Groot & Benson
Consulting Engineers & Planners

A.C.N. 052 300 571
236 Harbour Drive,
Coffs Harbour NSW 2450

Phone (02) 6652 1700
Fax (02) 6652 7418
Email: email@dgb.com.au

Scale: AS SHOWN	Cad File No.: 13056_Civil - APRIL 2015.dwg		
Surveyed: MR	Datum: AHD		
Drawn: APR	Designed: APR	Approved: RDG	
Checked: RDG	Date: 2013	No. of dwgs: ---	

Project: SALTWATER DEVELOPMENT SOUTH WEST ROCKS, NSW

Client: LEX TALL

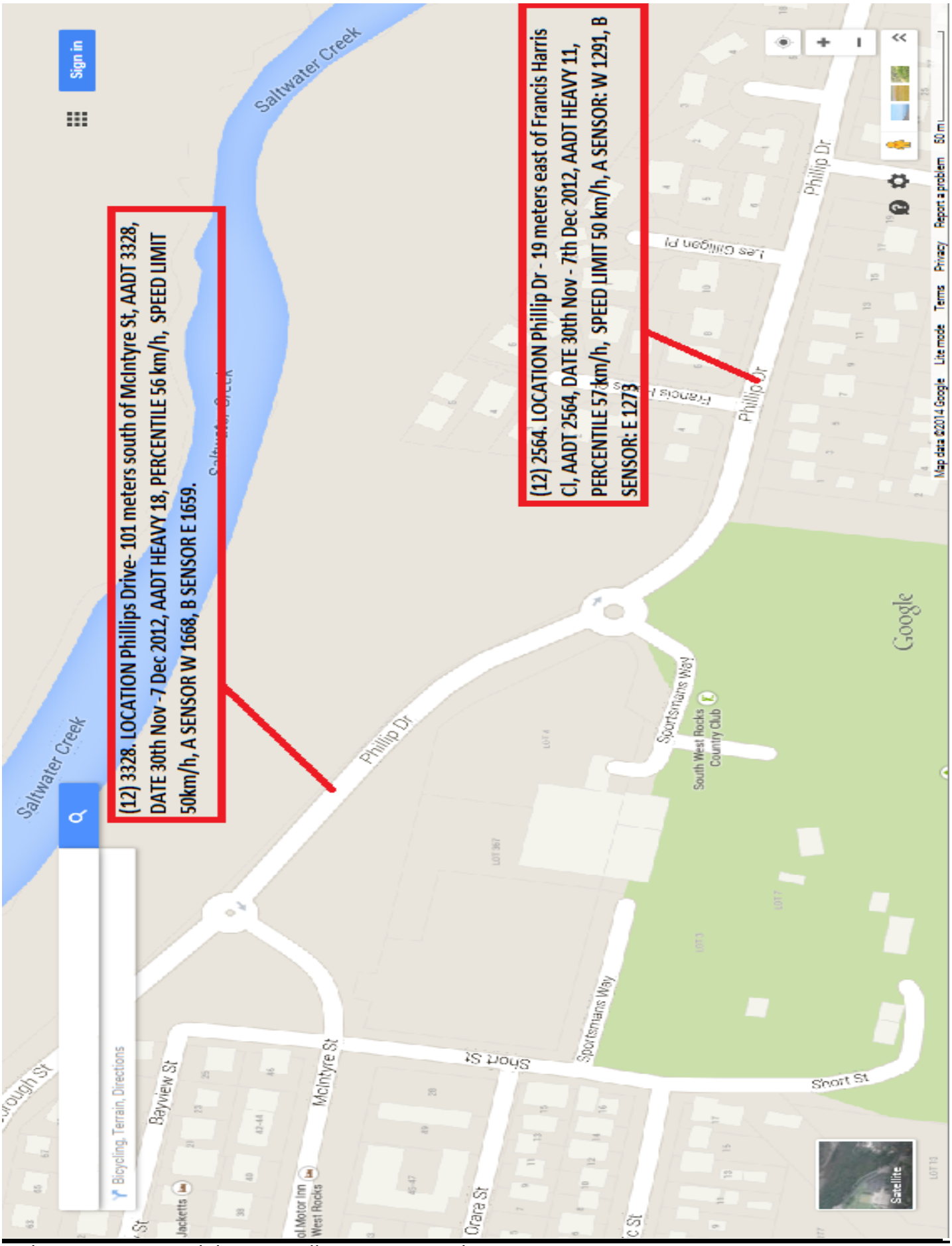
Title: CONCEPT TRAFFIC STRATEGY

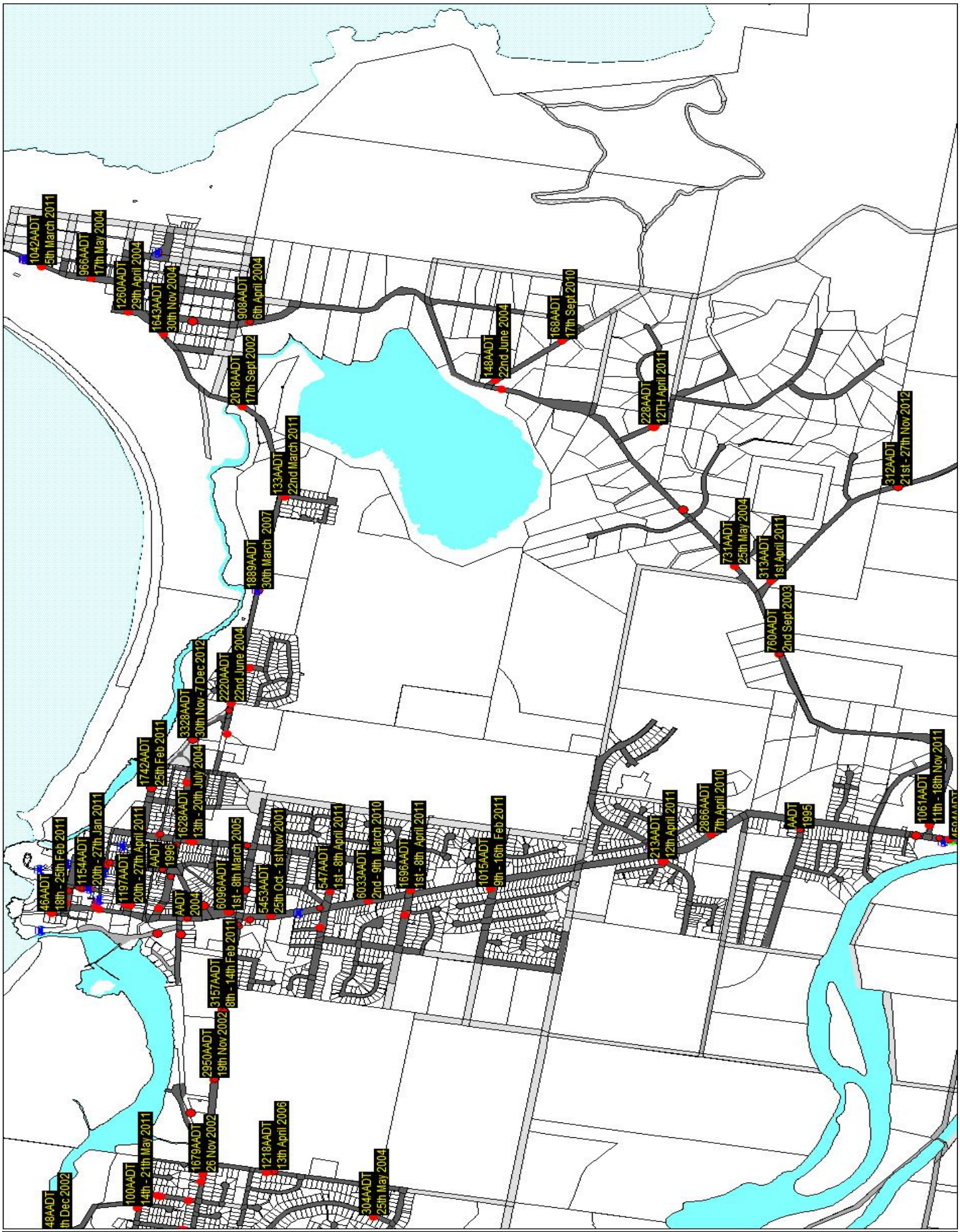
Project No.: 13056

Drawing No.: MP7

Amendment No.: DA5

Appendix A – Council Supplied Traffic Information


(12) 3328. LOCATION Phillips Drive- 101 meters south of McIntyre St, AADT 3328, DATE 30th Nov -7 Dec 2012, AADT HEAVY 18, PERCENTILE 56 km/h, SPEED LIMIT 50km/h, A SENSOR W 1668, B SENSOR E 1659.
(12) 2564. LOCATION Phillip Dr - 19 meters east of Francis Harris Cl, AADT 2564, DATE 30th Nov - 7th Dec 2012, AADT HEAVY 11, PERCENTILE 57 km/h, SPEED LIMIT 50 km/h, A SENSOR: W 1291, B SENSOR: E 1273
Saltwater Creek
Phillip Dr
Sportsmans Way
Short St
McIntyre St
Bayview St
Orara St
South West Rocks Country Club
Google


1042AADT 6th March 2011
966AADT 17th May 2004
1260AADT 29th April 2004
1643AADT 30th Nov 2004
908AADT 6th April 2004
2018AADT 17th Sept 2002
148AADT 22nd June 2004
168AADT 17th Sept 2010
228AADT 12TH April 2011
312AADT 21st - 27th Nov 2012
133AADT 22nd March 2011
731AADT 25th May 2004
313AADT 1st April 2011
1889AADT 30th March 2007
760AADT 2nd Sept 2003
2220AADT 22nd June 2004
3328AADT 30th Nov - 7 Dec 2012
1742AADT 25th Feb 2011
1628AADT 13th - 20th July 2004
1061AADT 11th - 18th Nov 2011
2866AADT 7th April 2010
213AADT 12th April 2011
1015AADT 9th - 16th Feb 2011
1696AADT 1st - 8th April 2011
6033AADT 2nd - 9th March 2010
547AADT 1st - 8th April 2011
5453AADT 25th Oct - 1st Nov 2001
6096AADT 1st - 8th March 2005
3157AADT 8th - 14th Feb 2011
2950AADT 19th Nov 2002
1679AADT 26 Nov 2002
1218AADT 13th April 2006
304AADT 25th May 2004
100AADT 14th - 21th May 2011
48AADT th Dec 2002
46AADT 18th - 25th Feb 2011
1154AADT 20th - 27th Jan 2011
1197AADT 20th - 27th April 2011

ID	Coordinate_X	Coordinate_Y	LOCATION	Road_Segment_No	AADT_Overall	YEAR	AADT_Heavy	Percentile_85	Speed_Limit	RTC_FILE_NO	ROAD_NO	A_Sensor
1260(04)	153.069	-30.8865	PILLIP DR. 60 METERS NORTH OF RUSSELL ST.	41410007	1260	29th April 2004	2	54 km/h	60 km/h		4141	
133(11)	153.06	-30.892	WAIANBAR AVE - 20 METERS SOUTH OF PHILLIP DR.	41770001	133	22nd March 2011	2	31 km/h	50 km/h		4177	
1495(11)	153.04	-30.8864	Landsborough St - 50 meters East of Gregory St	40910001	1495	20th - 27th April 2011	4	35 km/h	50 km/h		4091	
1643(04)	153.068	-30.8877	PHILLIP DR. 130 METERS WEST OF RUSSELL ST.	41410006	1643	30th Nov 2004	3	65 km/h	60 km/h		4141	
2018(02)	153.064	-30.8905	PHILLIP DR. 130 METERS SOUTH OF YOUNG ST.	41410005	2018	17th Sept 2002	10	73 km/h	60 km/h		2018	
2220(04)	153.05	-30.8901	PHILLIP DR - 85 METERS EAST OF SECOND ROUNDABOUT	41410002	2220	22nd June 2004	132	49 km/h	50 km/h		4141	
2630(04)	153.043	-30.887	LANDSBOROUGH ST. 30 METERS EAST OF MITCHELL ST.	40910004	2630	13th April 2004	1	55 km/h	50 km/h		4091	
2905(10)	153.043	-30.9069	Gregory St - Outside BI-LO Shopping Center	01980040	2905	7th April 2010	97	52km/h			MR198	
413(07)	153.048	-30.89	S.W.R. Country Club Car Park		413	3rd - 10th August 2007	0	16 km/h	10 km/h			
424(11)	153.051	-30.8907	Wongal Ave - 40 Meters South of Phillip Dr	41710001	424	26th Feb 2011	2	39 km/h	50 km/h		4171	
5093(08)	153.042	-30.8868	LANDSBOROUGH ST - 10 METRES EAST OF MEMORIAL AVE.	40910002	5093	1st - 8th Jan 2008	41	43 km/h	50 km/h		4091	
5453(01)	153.039	-30.8915	GREGORY ST - 130 METERS SOUTH OF GORDON YOUNG DRIVE.	01980045	5453	25th Oct - 1st Nov 2001	13	60 km/h	50 km/h		4073	
6033(10)	153.04	-30.8949	Gregory St - In front of Nursing Home	01980044	6033	2nd - 9th March 2010	187	52 km/h	50 km/h		4073	
6096(05)	153.039	-30.89	GREGORY ST - 30 METERS NORTH OF GORDON YOUN DR.		6096	1st - 8th March 2005	18	53 km/h	50 km/h		4073	
6261(02)	153.042	-30.9055	GREGORY ST. 50 METERS SOUTH OF BELLE O'CONNOR ST. WEST SIDE.		6261	22nd Oct 2002	9	46 km/h	50 km/h		4073	
834(11)	153.04	-30.8866	Landsborough St - 50 meters east of Gregory St. West Bound	40910001	834	25th Feb - 4th March 2011	6	40 km/h	50 km/h		4091	
4138 (04)	153.039	-30.8886	GREGORY ST. 40 METERS SOUTH OF FIG TREE LN.	01980046		2004					4073	
4352(95)	153.039	-30.8932	GREGORY ST. 30 METERS NORTH OF ARTHUR ST.(S.W.R.)	01980045		1995				114	4073	
6084 (05)	153.039	-30.8907	GREGORY ST. 30 METERS SOUTH OF GORDON YOUNG DRIVE			2005					4073	
6096 (05)	153.039	-30.8901	GREGORY ST. 30 METERS NORTH OF GORDON YOUNG DRIVE			2005					4073	
927 (04)	153.069	-30.8907	RUSSELL ST. 70 METERS SOUTH OF YOUNG ST.	00040007		2004					4151	
(12) 777	153.069	-30.8887	Arakoon Rd - 201 metres south of Phillips Dr Intersection	00040008	777	21st - 27th Nov 2012	12	67 km/h	50 km/h		0004	
(12) 2413	153.043	-30.8869	Landsborough St - 38 meters west of Mitchell St	40910003	2413	30th Nov - 7th Dec 2012	15	52 km/h	50 km/h		4091	
(12) 1769	153.045	-30.8873	Landsborough St - 56 meters east of Trail St	40910005	1769	30 Nov -7 Dec 2012	14	56 km/h	50 km/h		4091	
(12) 3328	153.048	-30.8887	Phillips Drive- 101 meters south of McIntyre St	41410001	3328	30th Nov -7 Dec 2012	18	56 km/h	50 km/h		4141	
(12) 2564	153.051	-30.8903	Phillip Dr - 19 meters east of Francis Harris Cl	41410003	2564	30th Nov - 7th Dec 2012	11	57 km/h	50 km/h		4141	
(15) 1117	153.042	-30.9048	Bell O Connor St - 35.65 metres west of Peter Marks CCT	40100001	1117	7th - 14th Feb 2015	6	40 km/h	50 km/h		4010	E 561
(15) 1729	153.055	-30.891	Phillip Dr - 322 east of Michael Osling Pl	41410004	1729	18th - 25th Feb 2015	18	65 km/h	60 km/h		4141	W 957

MetroCount Traffic Executive
Weekly Vehicle Counts

Philip Dr WeeklyVehicle134 -- English (ENA)

Datasets:
Site: **[Philip Dr] PHILLIP DR - 322.50 m EAST OF MICHAEL OSLING PL. 41410004. <60>**
Attribute: 153.04242167 -30.90478311
Direction: 6 - West bound A>B, East bound B>A. **Lane:** 0
Survey Duration: 13:05 Friday, 6 February 2015 => 12:21 Monday, 16 February 2015,
File: H:\Documents\MetroCount\MTE 4.06\Data\2015\Philip Dr 0 2015-02-16 1221.EC0 (Plus)

Profile:
Filter time: **0:00 Saturday, 7 February 2015 => 0:00 Saturday, 14 February 2015 (7)**
Filter: Cls(1 2 3 4 5 6 7 8 9 10 11 12) Dir(NESW) Sp(10,160) GapX(>0) Span(0 - 100)
Speed range: 10 - 160 km/h.
Direction: North, East, South, West (bound), P = East
Scheme: Vehicle classification (ARX)
Units: Metric (metre, kilometre, m/s, km/h, kg, tonne)
In profile: Vehicles = 8316 / 9497 (87.56%)

Weekly Vehicle Counts

Philip Dr WeeklyVehicle134
Site: Philip Dr.0.1WE
Description: **PHILLIP DR - 322.50 m EAST OF MICHAEL OSLING PL. 41410004. <60>**
Filter time: **0:00 Saturday, 7 February 2015 => 0:00 Saturday, 14 February 2015**
Scheme: Vehicle classification (ARX)
Filter: Cls(1 2 3 4 5 6 7 8 9 10 11 12) Dir(NESW) Sp(10,160) GapX(>0) Span(0 - 100)

	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Averages	
	07 Feb	08 Feb	09 Feb	10 Feb	11 Feb	12 Feb	13 Feb	1 - 5	1 - 7
Hour									
0000-0100	6	1	0	0	0	0	0	0.0	1.0
0100-0200	2	1	0	0	0	0	0	0.0	0.4
0200-0300	1	0	0	1	0	0	0	0.2	0.3
0300-0400	0	0	1	2	0	0	0	0.6	0.4
0400-0500	4	2	2	5	0	0	0	1.4	1.9
0500-0600	9	7	15	14	0	0	0	5.8	6.4
0600-0700	34	24	46	30	3	0	0	15.8	19.6
0700-0800	82	83	92	83	0	0	0	35.0	48.6
0800-0900	113	139	144	161	4	0	0	61.8	80.1
0900-1000	185	181	174	144	1	1	0	64.0	98.0
1000-1100	196	286	**179**	185	**4**	**2**	0	**74.0**	121.7
1100-1200	**239**	**294**	169	**186**	0	0	**0**	71.0	**126.9**
1200-1300	**242**	292	**172**	175	0	0	0	69.4	**125.9**
1300-1400	215	272	168	**193**	0	0	0	**72.2**	121.1
1400-1500	208	**292**	157	20	0	0	0	35.4	96.7
1500-1600	211	226	148	0	0	0	0	29.6	83.6
1600-1700	221	191	151	3	0	0	0	30.8	80.9
1700-1800	145	158	133	0	0	0	0	26.6	62.3
1800-1900	125	117	96	1	0	0	0	19.4	48.4
1900-2000	80	85	68	0	0	0	0	13.6	33.3
2000-2100	52	43	37	0	0	0	0	7.4	18.9
2100-2200	25	11	9	0	0	0	0	1.8	6.4
2200-2300	10	6	8	0	0	0	0	1.6	3.4
2300-2400	11	0	2	0	**0**	**0**	**0**	0.4	1.9
Totals									
0700-1900	2182	2531	1783	1151	9	3	0	589.2	1094.1
0600-2200	2373	2694	1943	1181	12	3	0	627.8	1172.3

0600-0000	2394	2700	1953	1181	12	3	0	629.8	1177.6
0000-0000	2416	2711	1971	1203	12	3	0	637.8	1188.0
AM Peak	1100	1100	1000	1100	1000	1000	1100		
	239	294	179	186	4	2	0		
PM Peak	1200	1400	1200	1300	2300	2300	2300		
	242	292	172	193	0	0	0		

*** - No data.**

MetroCount Traffic Executive
Weekly Vehicle Counts

Philip Dr WeeklyVehicle138 -- English (ENA)

Datasets:

Site: **[Philip Dr] PHILLIP DR - 322.50 m EAST OF MICHAEL OSLING PL. 41410004. <60>**
Attribute: 153.04242167 -30.90478311
Direction: 6 - West bound A>B, East bound B>A. **Lane:** 0
Survey Duration: 13:05 Friday, 6 February 2015 => 12:21 Monday, 16 February 2015,
File: H:\Documents\MetroCount\MTE 4.06\Data\2015\Philip Dr 0 2015-02-16 1221.EC0 (Plus)

Profile:

Filter time: **0:00 Saturday, 7 February 2015 => 0:00 Saturday, 14 February 2015 (7)**
Filter: Cls(1 2 3 4 5 6 7 8 9 10 11 12) Dir(W) Sp(10,160) GapX(>0) Span(0 - 100)
Speed range: 10 - 160 km/h.
Direction: West (bound), P = East
Scheme: Vehicle classification (ARX)
Units: Metric (metre, kilometre, m/s, km/h, kg, tonne)
In profile: Vehicles = 4303 / 9497 (45.31%)

Weekly Vehicle Counts

Philip Dr WeeklyVehicle138
Site: Philip Dr.0.1WE
Description: **PHILLIP DR - 322.50 m EAST OF MICHAEL OSLING PL. 41410004. <60>**
Filter time: **0:00 Saturday, 7 February 2015 => 0:00 Saturday, 14 February 2015**
Scheme: Vehicle classification (ARX)
Filter: Cls(1 2 3 4 5 6 7 8 9 10 11 12) Dir(W) Sp(10,160) GapX(>0) Span(0 - 100)

	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Averages	
	07 Feb	08 Feb	09 Feb	10 Feb	11 Feb	12 Feb	13 Feb	1 - 5	1 - 7
Hour									
0000-0100	3	0	0	0	0	0	0	0.0	0.4
0100-0200	1	0	0	0	0	0	0	0.0	0.1
0200-0300	1	0	0	1	0	0	0	0.2	0.3
0300-0400	0	0	1	1	0	0	0	0.4	0.3
0400-0500	1	0	1	2	0	0	0	0.6	0.6
0500-0600	5	4	12	12	0	0	0	4.8	4.7
0600-0700	24	11	30	16	3	0	0	9.8	12.0
0700-0800	44	55	51	43	0	0	0	18.8	27.6
0800-0900	68	56	84	96	**4**	0	0	36.8	44.0
0900-1000	97	80	79	73	1	0	0	30.6	47.1
1000-1100	101	129	91	88	3	**1**	0	36.6	59.0
1100-1200	**110**	**137**	**98**	**98**	0	0	**0**	**39.2**	**63.3**
1200-1300	121	155	86	88	0	0	0	34.8	64.3
1300-1400	108	154	**87**	**114**	0	0	0	**40.2**	**66.1**
1400-1500	96	**160**	85	19	0	0	0	20.8	51.4
1500-1600	120	125	70	0	0	0	0	14.0	45.0
1600-1700	**121**	107	73	2	0	0	0	15.0	43.3
1700-1800	73	92	54	0	0	0	0	10.8	31.3
1800-1900	56	61	46	1	0	0	0	9.4	23.4
1900-2000	34	41	31	0	0	0	0	6.2	15.1
2000-2100	31	20	21	0	0	0	0	4.2	10.3
2100-2200	14	2	1	0	0	0	0	0.2	2.4
2200-2300	4	3	4	0	0	0	0	0.8	1.6
2300-2400	6	0	1	0	**0**	**0**	**0**	0.2	1.0
Totals									
0700-1900	1115	1311	904	622	8	1	0	307.0	565.9

0600-2200	1218	1385	987	638	11	1	0	327.4	605.7
0600-0000	1228	1388	992	638	11	1	0	328.4	608.3
0000-0000	1239	1392	1006	654	11	1	0	334.4	614.7
AM Peak	1100	1100	1100	1100	0800	1000	1100		
	110	137	98	98	4	1	0		
PM Peak	1600	1400	1300	1300	2300	2300	2300		
	121	160	87	114	0	0	0		

*** - No data.**

MetroCount Traffic Executive
Weekly Vehicle Counts

Philip Dr WeeklyVehicle137 -- English (ENA)

Datasets:

Site: **[Philip Dr] PHILLIP DR - 322.50 m EAST OF MICHAEL OSLING PL. 41410004. <60>**
Attribute: 153.04242167 -30.90478311
Direction: 6 - West bound A>B, East bound B>A. **Lane:** 0
Survey Duration: 13:05 Friday, 6 February 2015 => 12:21 Monday, 16 February 2015,
File: H:\Documents\MetroCount\MTE 4.06\Data\2015\Philip Dr 0 2015-02-16 1221.EC0 (Plus)

Profile:

Filter time: **0:00 Saturday, 7 February 2015 => 0:00 Saturday, 14 February 2015 (7)**
Filter: Cls(1 2 3 4 5 6 7 8 9 10 11 12) Dir(E) Sp(10,160) GapX(>0) Span(0 - 100)
Speed range: 10 - 160 km/h.
Direction: East (bound), P = East
Scheme: Vehicle classification (ARX)
Units: Metric (metre, kilometre, m/s, km/h, kg, tonne)
In profile: Vehicles = 4013 / 9497 (42.26%)

Weekly Vehicle Counts

Philip Dr WeeklyVehicle137
Site: Philip Dr.0.1WE
Description: **PHILLIP DR - 322.50 m EAST OF MICHAEL OSLING PL. 41410004. <60>**
Filter time: **0:00 Saturday, 7 February 2015 => 0:00 Saturday, 14 February 2015**
Scheme: Vehicle classification (ARX)
Filter: Cls(1 2 3 4 5 6 7 8 9 10 11 12) Dir(E) Sp(10,160) GapX(>0) Span(0 - 100)

	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Averages	
	07 Feb	08 Feb	09 Feb	10 Feb	11 Feb	12 Feb	13 Feb	1 - 5	1 - 7
Hour									
0000-0100	3	1	0	0	0	0	0	0.0	0.6
0100-0200	1	1	0	0	0	0	0	0.0	0.3
0200-0300	0	0	0	0	0	0	0	0.0	0.0
0300-0400	0	0	0	1	0	0	0	0.2	0.1
0400-0500	3	2	1	3	0	0	0	0.8	1.3
0500-0600	4	3	3	2	0	0	0	1.0	1.7
0600-0700	10	13	16	14	0	0	0	6.0	7.6
0700-0800	38	28	41	40	0	0	0	16.2	21.0
0800-0900	45	83	60	65	0	0	0	25.0	36.1
0900-1000	88	101	**95**	71	0	1	0	33.4	50.9
1000-1100	95	157	88	**97**	**1**	**1**	0	**37.4**	62.7
1100-1200	**129**	**157**	71	88	0	0	**0**	31.8	**63.6**
1200-1300	**121**	**137**	**86**	**87**	0	0	0	**34.6**	**61.6**
1300-1400	107	118	81	79	0	0	0	32.0	55.0
1400-1500	112	132	72	1	0	0	0	14.6	45.3
1500-1600	91	101	78	0	0	0	0	15.6	38.6
1600-1700	100	84	78	1	0	0	0	15.8	37.6
1700-1800	72	66	79	0	0	0	0	15.8	31.0
1800-1900	69	56	50	0	0	0	0	10.0	25.0
1900-2000	46	44	37	0	0	0	0	7.4	18.1
2000-2100	21	23	16	0	0	0	0	3.2	8.6
2100-2200	11	9	8	0	0	0	0	1.6	4.0
2200-2300	6	3	4	0	0	0	0	0.8	1.9
2300-2400	5	0	1	0	**0**	**0**	**0**	0.2	0.9
Totals									
0700-1900	1067	1220	879	529	1	2	0	282.2	528.3

0600-2200	1155	1309	956	543	1	2	0	300.4	566.6
0600-0000	1166	1312	961	543	1	2	0	301.4	569.3
0000-0000	1177	1319	965	549	1	2	0	303.4	573.3
AM Peak	1100	1100	0900	1000	1000	1000	1100		
	129	157	95	97	1	1	0		
PM Peak	1200	1200	1200	1200	2300	2300	2300		
	121	137	86	87	0	0	0		

*** - No data.**

MetroCount Traffic Executive
Weekly Vehicle Counts

Belle O Connor St WeeklyVehicle128 -- English (ENA)

Datasets:

Site: **[Belle O Connor St] BELLE O CONNOR ST - 35.65 m WEST OF PETER MARK CCT <50>**
Attribute: 153.04242167 -30.90478311
Direction: 8 - East bound A>B, West bound B>A. **Lane:** 0
Survey Duration: 12:12 Friday, 6 February 2015 => 11:54 Monday, 16 February 2015,
File: H:\Documents\MetroCount\MTE 4.06\Data\2015\Belle O Connor St 0 2015-02-16 1155.EC0 (Plus)

Profile:

Filter time: **0:00 Saturday, 7 February 2015 => 0:00 Saturday, 14 February 2015 (7)**
Filter: Cls(1 2 3 4 5 6 7 8 9 10 11 12) Dir(NESW) Sp(10,160) GapX(>0) Span(0 - 100)
Speed range: 10 - 160 km/h.
Direction: North, East, South, West (bound), P = East
Scheme: Vehicle classification (ARX)
Units: Metric (metre, kilometre, m/s, km/h, kg, tonne)
In profile: Vehicles = 7822 / 10948 (71.45%)

Weekly Vehicle Counts

Belle O Connor St WeeklyVehicle128
Site: Belle O Connor St.0.1EW
Description: **BELLE O CONNOR ST - 35.65 m WEST OF PETER MARK CCT <50>**
Filter time: **0:00 Saturday, 7 February 2015 => 0:00 Saturday, 14 February 2015**
Scheme: Vehicle classification (ARX)
Filter: Cls(1 2 3 4 5 6 7 8 9 10 11 12) Dir(NESW) Sp(10,160) GapX(>0) Span(0 - 100)

	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Averages	
	07 Feb	08 Feb	09 Feb	10 Feb	11 Feb	12 Feb	13 Feb	1 - 5	1 - 7
Hour									
0000-0100	3	8	1	4	3	0	2	2.0	3.0
0100-0200	0	0	0	0	0	0	0	0.0	0.0
0200-0300	0	0	1	0	0	2	1	0.8	0.6
0300-0400	4	0	0	0	0	0	2	0.4	0.9
0400-0500	2	0	4	2	2	4	4	3.2	2.6
0500-0600	4	9	12	26	15	18	20	18.2	14.9
0600-0700	19	20	44	32	30	32	34	34.4	30.1
0700-0800	57	34	71	57	74	58	63	64.6	59.1
0800-0900	100	47	**92**	**95**	94	73	**93**	**89.4**	84.9
0900-1000	108	57	69	92	**95**	86	86	85.6	84.7
1000-1100	**124**	92	64	91	87	43	75	72.0	82.3
1100-1200	103	**106**	89	58	90	**87**	79	80.6	**87.4**
1200-1300	**100**	72	81	79	82	87	86	83.0	83.9
1300-1400	72	62	80	68	73	53	91	73.0	71.3
1400-1500	70	58	73	80	69	81	65	73.6	70.9
1500-1600	60	**97**	93	85	**112**	102	106	99.6	93.6
1600-1700	71	79	**119**	**99**	103	**104**	**120**	**109.0**	**99.3**
1700-1800	59	71	87	81	106	100	106	96.0	87.1
1800-1900	42	62	57	70	76	50	87	68.0	63.4
1900-2000	45	34	44	37	34	50	38	40.6	40.3
2000-2100	25	19	23	17	33	31	22	25.2	24.3
2100-2200	30	12	18	16	21	17	30	20.4	20.6
2200-2300	11	9	6	2	6	11	11	7.2	8.0
2300-2400	10	4	1	1	1	7	7	3.4	4.4
Totals									

0700-1900	966	837	975	955	1061	924	1057	994.4	967.9
0600-2200	1085	922	1104	1057	1179	1054	1181	1115.0	1083.1
0600-0000	1106	935	1111	1060	1186	1072	1199	1125.6	1095.6
0000-0000	1119	952	1129	1092	1206	1096	1228	1150.2	1117.4
AM Peak	1000	1100	0800	0800	0900	1100	0800		
	124	106	92	95	95	87	93		
PM Peak	1200	1500	1600	1600	1500	1600	1600		
	100	97	119	99	112	104	120		

*** - No data.**

MetroCount Traffic Executive
Weekly Vehicle Counts

Belle O Connor St WeeklyVehicle130 -- English (ENA)

Datasets:

Site: **[Belle O Connor St] BELLE O CONNOR ST - 35.65 m WEST OF PETER MARK CCT <50>**
Attribute: 153.04242167 -30.90478311
Direction: 8 - East bound A>B, West bound B>A. **Lane:** 0
Survey Duration: 12:12 Friday, 6 February 2015 => 11:54 Monday, 16 February 2015,
File: H:\Documents\MetroCount\MTE 4.06\Data\2015\Belle O Connor St 0 2015-02-16 1155.EC0 (Plus)

Profile:

Filter time: **0:00 Saturday, 7 February 2015 => 0:00 Saturday, 14 February 2015 (7)**
Filter: Cls(1 2 3 4 5 6 7 8 9 10 11 12) Dir(NSW) Sp(10,160) GapX(>0) Span(0 - 100)
Speed range: 10 - 160 km/h.
Direction: North, South, West (bound), P = East
Scheme: Vehicle classification (ARX)
Units: Metric (metre, kilometre, m/s, km/h, kg, tonne)
In profile: Vehicles = 3894 / 10948 (35.57%)

Weekly Vehicle Counts

Belle O Connor St WeeklyVehicle130
Site: Belle O Connor St.0.1EW
Description: **BELLE O CONNOR ST - 35.65 m WEST OF PETER MARK CCT <50>**
Filter time: **0:00 Saturday, 7 February 2015 => 0:00 Saturday, 14 February 2015**
Scheme: Vehicle classification (ARX)
Filter: Cls(1 2 3 4 5 6 7 8 9 10 11 12) Dir(NSW) Sp(10,160) GapX(>0) Span(0 - 100)

	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Averages	
	07 Feb	08 Feb	09 Feb	10 Feb	11 Feb	12 Feb	13 Feb	1 - 5	1 - 7
Hour									
0000-0100	2	3	0	1	1	0	1	0.6	1.1
0100-0200	0	0	0	0	0	0	0	0.0	0.0
0200-0300	0	0	1	0	0	1	1	0.6	0.4
0300-0400	2	0	0	0	0	0	1	0.2	0.4
0400-0500	1	0	3	0	1	2	3	1.8	1.4
0500-0600	4	7	11	21	12	16	18	15.6	12.7
0600-0700	14	14	30	22	22	22	22	23.6	20.9
0700-0800	34	25	47	39	47	41	44	43.6	39.6
0800-0900	56	30	**54**	**63**	**60**	**49**	**60**	**57.2**	**53.1**
0900-1000	57	30	39	48	49	48	44	45.6	45.0
1000-1100	**64**	**53**	28	45	44	23	39	35.8	42.3
1100-1200	55	50	50	29	42	44	38	40.6	44.0
1200-1300	**52**	33	34	34	37	39	35	35.8	37.7
1300-1400	35	26	35	31	42	29	54	38.2	36.0
1400-1500	29	27	42	**44**	42	41	37	41.2	37.4
1500-1600	25	**44**	39	39	**48**	46	43	43.0	40.6
1600-1700	31	39	**55**	38	44	40	**59**	**47.2**	**43.7**
1700-1800	23	29	34	35	42	**49**	34	38.8	35.1
1800-1900	20	27	32	24	31	21	40	29.6	27.9
1900-2000	18	16	9	13	11	12	17	12.4	13.7
2000-2100	12	6	10	12	12	8	9	10.2	9.9
2100-2200	13	5	6	3	9	6	13	7.4	7.9
2200-2300	6	3	4	1	2	7	5	3.8	4.0
2300-2400	3	1	0	0	1	3	2	1.2	1.4
Totals									

0700-1900	481	413	489	469	528	470	527	496.6	482.4
0600-2200	538	454	544	519	582	518	588	550.2	534.7
0600-0000	547	458	548	520	585	528	595	555.2	540.1
0000-0000	556	468	563	542	599	547	619	574.0	556.3
AM Peak	1000	1000	0800	0800	0800	0800	0800		
	64	53	54	63	60	49	60		
PM Peak	1200	1500	1600	1400	1500	1700	1600		
	52	44	55	44	48	49	59		

*** - No data.**

MetroCount Traffic Executive
Weekly Vehicle Counts

Belle O Connor St WeeklyVehicle132 -- English (ENA)

Datasets:

Site: **[Belle O Connor St] BELLE O CONNOR ST - 35.65 m WEST OF PETER MARK CCT <50>**
Attribute: 153.04242167 -30.90478311
Direction: 8 - East bound A>B, West bound B>A. **Lane:** 0
Survey Duration: 12:12 Friday, 6 February 2015 => 11:54 Monday, 16 February 2015,
File: H:\Documents\MetroCount\MTE 4.06\Data\2015\Belle O Connor St 0 2015-02-16 1155.EC0 (Plus)

Profile:

Filter time: **0:00 Saturday, 7 February 2015 => 0:00 Saturday, 14 February 2015 (7)**
Filter: Cls(1 2 3 4 5 6 7 8 9 10 11 12) Dir(E) Sp(10,160) GapX(>0) Span(0 - 100)
Speed range: 10 - 160 km/h.
Direction: East (bound), P = East
Scheme: Vehicle classification (ARX)
Units: Metric (metre, kilometre, m/s, km/h, kg, tonne)
In profile: Vehicles = 3928 / 10948 (35.88%)

Weekly Vehicle Counts

Belle O Connor St WeeklyVehicle132
Site: Belle O Connor St.0.1EW
Description: **BELLE O CONNOR ST - 35.65 m WEST OF PETER MARK CCT <50>**
Filter time: **0:00 Saturday, 7 February 2015 => 0:00 Saturday, 14 February 2015**
Scheme: Vehicle classification (ARX)
Filter: Cls(1 2 3 4 5 6 7 8 9 10 11 12) Dir(E) Sp(10,160) GapX(>0) Span(0 - 100)

	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Averages	
	07 Feb	08 Feb	09 Feb	10 Feb	11 Feb	12 Feb	13 Feb	1 - 5	1 - 7
Hour									
0000-0100	1	5	1	3	2	0	1	1.4	1.9
0100-0200	0	0	0	0	0	0	0	0.0	0.0
0200-0300	0	0	0	0	0	1	0	0.2	0.1
0300-0400	2	0	0	0	0	0	1	0.2	0.4
0400-0500	1	0	1	2	1	2	1	1.4	1.1
0500-0600	0	2	1	5	3	2	2	2.6	2.1
0600-0700	5	6	14	10	8	10	12	10.8	9.3
0700-0800	23	9	24	18	27	17	19	21.0	19.6
0800-0900	44	17	38	32	34	24	33	32.2	31.7
0900-1000	51	27	30	44	46	38	**42**	40.0	39.7
1000-1100	**60**	39	36	**46**	43	20	36	36.2	40.0
1100-1200	48	**56**	**39**	29	**48**	**43**	41	**40.0**	**43.4**
1200-1300	**48**	39	47	45	45	48	51	47.2	46.1
1300-1400	37	36	45	37	31	24	37	34.8	35.3
1400-1500	41	31	31	36	27	40	28	32.4	33.4
1500-1600	35	**53**	54	46	64	56	63	56.6	53.0
1600-1700	40	40	**64**	**61**	59	**64**	61	**61.8**	**55.6**
1700-1800	36	42	53	46	**64**	51	**72**	57.2	52.0
1800-1900	22	35	25	46	45	29	47	38.4	35.6
1900-2000	27	18	35	24	23	38	21	28.2	26.6
2000-2100	13	13	13	5	21	23	13	15.0	14.4
2100-2200	17	7	12	13	12	11	17	13.0	12.7
2200-2300	5	6	2	1	4	4	6	3.4	4.0
2300-2400	7	3	1	1	0	4	5	2.2	3.0
Totals									

0700-1900	485	424	486	486	533	454	530	497.8	485.4
0600-2200	547	468	560	538	597	536	593	564.8	548.4
0600-0000	559	477	563	540	601	544	604	570.4	555.4
0000-0000	563	484	566	550	607	549	609	576.2	561.1
AM Peak	1000	1100	1100	1000	1100	1100	0900		
	60	56	39	46	48	43	42		
PM Peak	1200	1500	1600	1600	1700	1600	1700		
	48	53	64	61	64	64	72		

*** - No data.**

Appendix B – Traffic Distribution

Figure B- 1- Historical AADT Traffic Counts

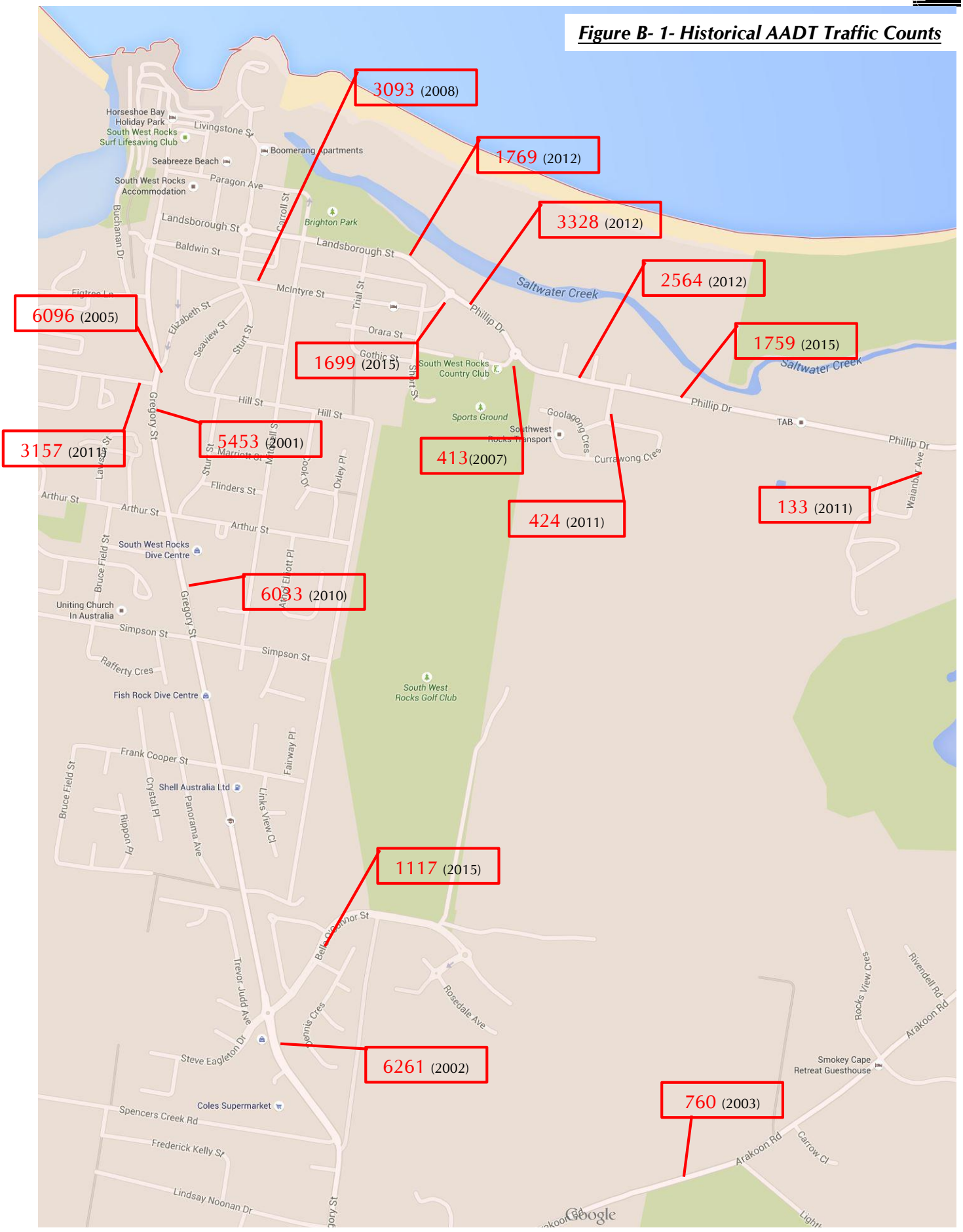


Figure B- 2- Estimated 2015 AADT Traffic Counts

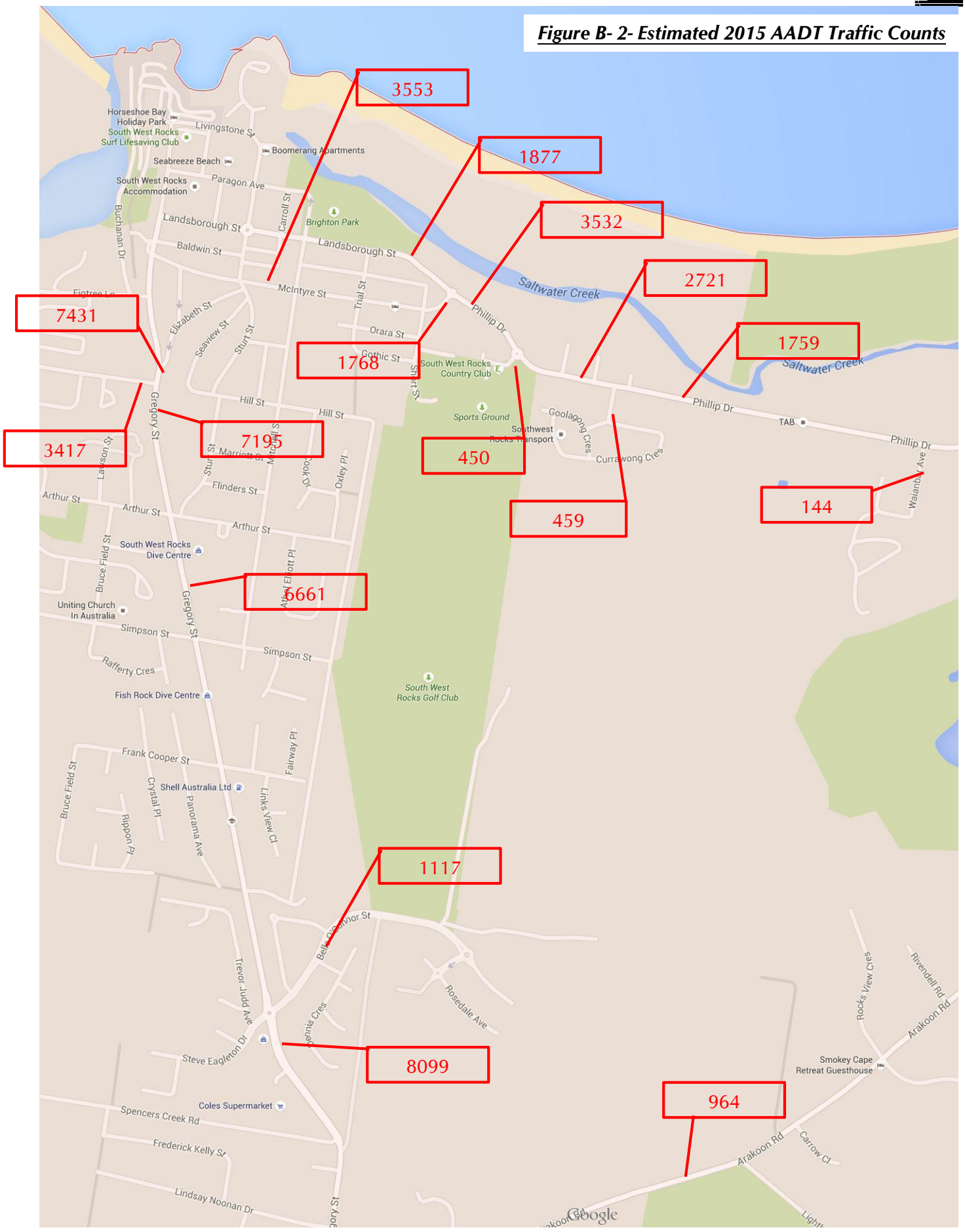
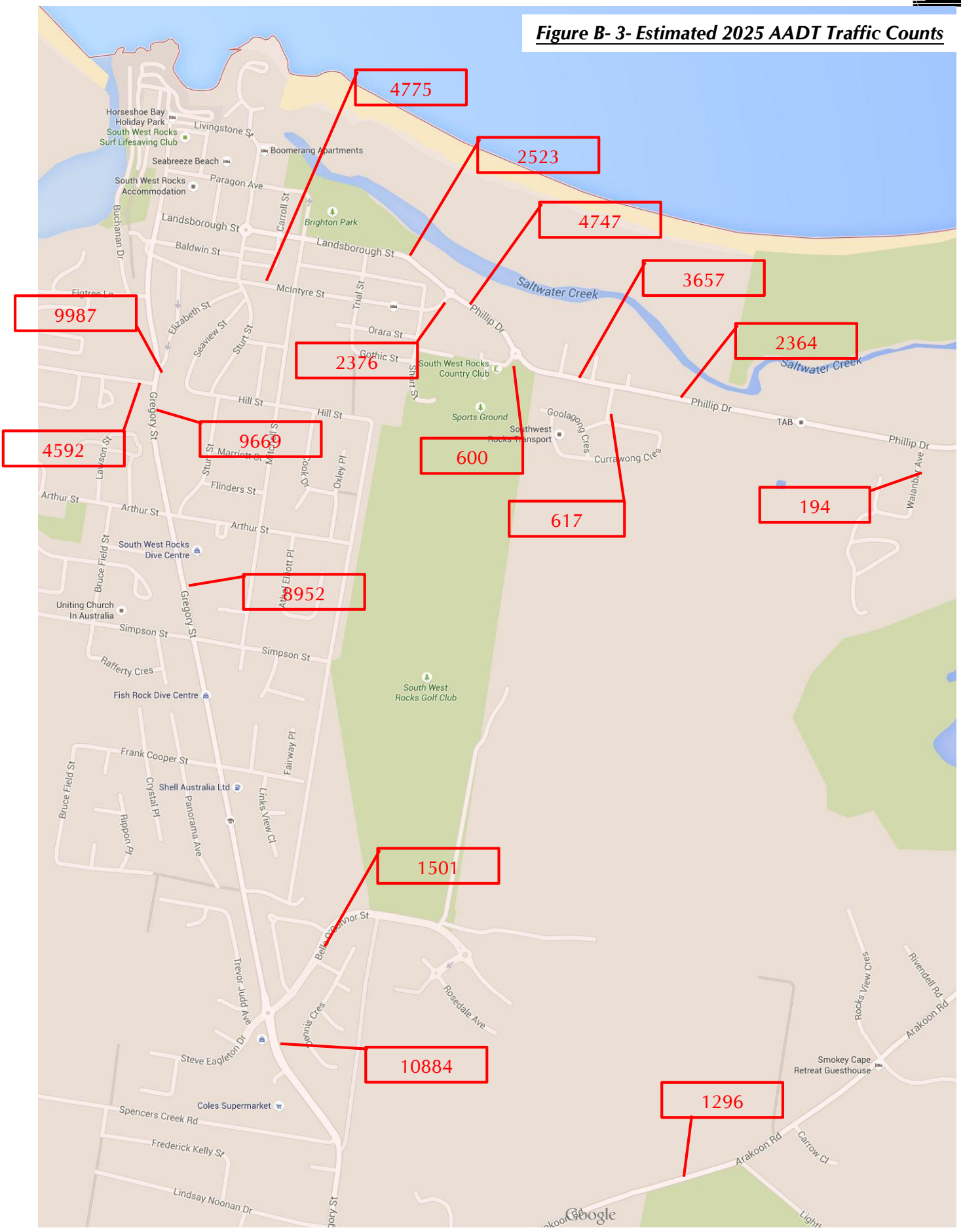


Figure B- 3- Estimated 2025 AADT Traffic Counts



ANNEXURE C

Aboriginal Heritage
Dual Diligence Assessment
by Myall Coast Archaeological Services

Myall Coast Archaeological Services

"Tall Pines" Phone: 49971011 Mobile: 0403071922

Tea Gardens. 2324 Email: archaeology@myallcoast.net.au ACN: 002 992 430

Aboriginal Heritage
Due Diligence Assessment

Lot 35 DP 1167775 Waianbar Avenue, South West Rocks, NSW

Report to
Geoff Smyth & Associates
Coffs Harbour, NSW
Thursday 18th June, 2015

By Len Roberts B.A. (Arch/Hist); Grad. Dip. Comp; Dip. Sp. Ed..
("Tall Pines", Tea Gardens. 2324 Ph: 49 971011)

Myall Coast Archaeological Services

Aboriginal Heritage Assessment

Table of Contents

1. **Introduction** **page 2**
2. **The Due Diligence Process** **page 4**
3. **Due Diligence Assessment** **page 6**
4. **Recommendations** **page 8**
5. **Certification** **page 8**
6. **Appendix** **page 9**

1. Introduction

1.1 Background

This report has been prepared at the request of Geoff Smyth and Associates, Coffs Harbour, NSW, to assess the possible impact a proposed residential Development may have on Aboriginal Cultural Heritage at Lot 35 DP 1167775, Waianbar Avenue, South West Rocks, NSW in order to demonstrate due diligence by :

1. Identifying whether or not Aboriginal objects are, or are likely to be, present in an area;
2. Determining whether or not their activities are likely to harm Aboriginal objects (if present); and
3. Determining whether an Aboriginal heritage Impact Permit (AHIP) application is required.

The requirement for this report was also at the request of OEH, who in their advice to council on 6/2/2015 stated:

> 11. An Aboriginal cultural heritage assessment of the project area should be conducted to inform the decision making process. This assessment should include consultation with the local Aboriginal community and a thorough archaeological survey of the subject lands. Consultation with the local Aboriginal community should be conducted in such a manner as to ensure that any known cultural values relevant to the project are identified.

This request appears to be at odds with a previous assessment over the study area which concluded in part that **"Further survey or sub-surface investigation is highly unlikely to be effective and is not recommended."**

Council engaged Connell Wagner to undertake a Local Environmental Study (LES) to facilitate the rezoning of various Lots including the study area, for residential purposes in 2004 ahead of a Local Environmental Plan (LEP) preparation which was subsequently adopted. The purpose of an LES is to inform an LEP of various constraints affecting the land. According to Kempsey Shire Councils website (LEPs) are prepared by Councils to guide planning decisions in their Local Government Areas and establish the requirements for the use and development of land. Through zoning and development controls they allow Councils to supervise the ways in which land is used.

The LEP formalises the constraints to the land. Once an LEP is gazetted, it dictates how the land can be used. If there are particular constraints to the land the LEP reflects those constraints. In this instance the LEP does not indicate any Aboriginal Heritage constraints. Therefore further assessment at the subdivision stage for Aboriginal Heritage is not warranted nor required.

An Aboriginal Heritage assessment was conducted over the land in 2004 by consultant archaeologist Jacqueline Collins. That assessment was undertaken professionally and with full consultation with the Aboriginal Community. The report concluded that "**the study area is not known to contain any surviving sites or places of cultural/social significance to the Aboriginal community."**

The views of the Aboriginal community and a competent archaeologist should be followed. Once the LEP was gazetted no further assessment for lawful landuse under that LEP is required. as the LEP, s informed by the 2004 report, identified and protected any Aboriginal Heritage values. **The decision making process has already been informed.**

Since the 2004 study, legislation for Aboriginal Heritage has been amended and has preserved the legislative status of Aboriginal Heritage assessments. Any person has a a legislated strict liability not to harm an Aboriginal Object or place.

1.3 Legislative Context

The *National Parks and Wildlife Act 1974*, administered by the Office of Environment and Heritage (OEH), is the primary legislation for the protection of some aspects of Aboriginal cultural heritage in NSW. Section 86 of that Act deals with harming and desecrating Aboriginal Objects.

'Aboriginal object means any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains.'

Under section 86 of the NPW Act, it is an offence to 'harm' an Aboriginal object. 'Harm' means any act or omission that:

- destroys, deface, damages or desecrates the object
- moves the object from the land on which it had been situated, or
- causes or permits the object to be harmed.

The NPW Act provides several defences to prosecution for an offence. Where a person either knows or does not know they are harming an Aboriginal object, a person has a defence under section 87 where:

- The harm or desecration concerned was authorised by an Aboriginal heritage impact permit, and the conditions to which that Aboriginal heritage impact permit was subject were not contravened.
- Due diligence was undertaken and it was reasonably determined that no Aboriginal object would be harmed.
- Was work on land that has been disturbed for maintenance of existing roads, fire and other trails and tracks, maintenance of existing utilities and other similar services
- Land is disturbed if it has been the subject of human activity that has changed the land's surface, being changes that remain clear and observable.

Harm does not include something that is trivial or negligible.

2. The Due Diligence Process

Due diligence amounts to taking reasonable and practicable steps to protect Aboriginal objects. OEH has developed a generic code that provides one process for satisfying the due diligence requirements under the National Parks and Wildlife Act 1974 (as amended). It is not mandatory to follow this code. An individual or corporation can take other measures, provided that such measures are objectively reasonable and practicable and meet the ordinary meaning of exercising due diligence.

The purpose of due diligence is to identify whether Aboriginal objects are present in an area, and to determine whether a proposed activity will have impacts on Aboriginal objects. Therefore it is essential to identify and understand all the expected impacts of the proposed activity. There are two categories of activity used for assessing impacts:

- Activities involving no additional surface disturbance
- Activities causing additional surface disturbance.

For activities causing additional surface disturbance, it is necessary to determine whether an activity is proposed for:

a) A developed area or a previously disturbed area, or

b) An undisturbed area.

For activities in previously developed or disturbed areas, it is then necessary to determine whether the new activity will create significant additional surface disturbance. If it will, then the process for undisturbed areas will apply. Otherwise no further assessment is required and the project can proceed with caution.

Disturbed land has been defined in the OEH due diligence process as Land that has been previously subjected to any activity that has resulted in clear and observable changes to the land's surface.

OEH will not approve or certify a person's compliance with their due diligence requirements carried out under this or any other code. It is the responsibility of the individual or proponent to ensure that they have undertaken due diligence.

According to the OEH Due diligence Code of practice at 7.7 it states that:

"You can follow your own due diligence process and manage your own risk. Due diligence amounts to taking reasonable and practicable steps to protect Aboriginal objects. This generic code provides one process for satisfying the due diligence requirements of the NPW Act.

It is not mandatory to follow this code. An individual or corporation can take other measures, provided that such measures are objectively reasonable and practicable and meet the ordinary meaning of exercising due diligence."

The Collins assessment constitutes due diligence in that it **reasonably determined that no Aboriginal object would be harmed.**

Nonetheless, this report is an updated assessment in line with current legislation. This Due Diligence Assessment follows the OEH generic due diligence code and aligns the Collins assessment with that code.

2.1 Assessment Personnel

The research, visual assessment and report were undertaken by Len Roberts, (BA [Arch.], Grad. Dip. Comp., Dip Sp. Ed.,) who also holds a certificate in Archaeological fieldwork, from Tel Aviv University, Israel. Len has worked on archaeological projects in Australia and overseas. Len is a member and was Deputy Chairperson of Karuah Local Aboriginal Land Council. He was a part time member of the Local Government Appeals Tribunal before it became the Land and Environment Court. He has been an expert witness before the Land and Environment court on Aboriginal heritage matters. Len has also taught at Beifang University, Yinchuan, China.

3.0 The Assessment

3.1 Description of Land and Activity

Lot 35 DP 1167775, Waianbar Avenue, South West Rocks, NSW. The property has a total area of 65.53ha and Stage I comprises 29 residential lots at the eastern side of the property. Figure 1 is a plan showing the subdivision layout.

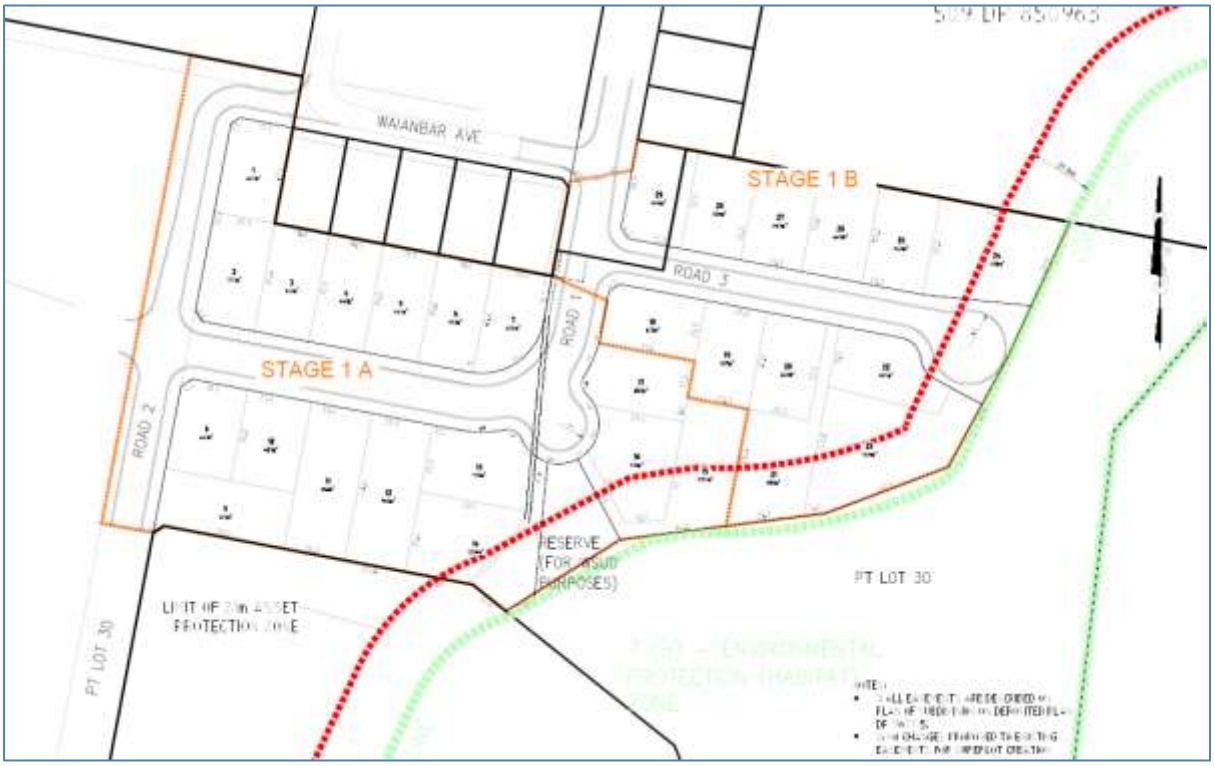


Figure 1 Subdivision Layout

3.2 Is the Land defined as "Disturbed Land" or an exempt or complying development?

Yes. The Land has been previously subjected to an activity that has resulted in clear and observable changes to the land's surface. The 2004 report observed that:

Kempsey LALC and Dunghutti Elders representatives advised that the natural and spiritual qualities of this site and its surrounds have already been compromised to such an extent that the proposed development would have little further adverse effect on its contemporary cultural values. Figtree Aboriginal community field representative Greg Blair also supported this conclusion.

Dunghutti Elders CAC Sites Officer David Hoskins advised that a Bora/ceremonial ground is known to have once been situated somewhere near the north-eastern corner of the study area, although its exact location is uncertain. Inspection of the possible Bora ground location revealed high level disturbance caused by an abandoned horticultural enterprise and it was concluded that this site, if ever present within the study area, has been destroyed.

3.3 Is the activity exempt?

No

3.4 Will the activity involve harm that is trivial or negligible?
No

3.5 Is the activity in an Aboriginal Place or are you already aware of Aboriginal objects on the land?
No

3.6 Is the activity a low impact activity for which there is a defence in the regulation?
No

3.7 Will the activity disturb the ground surface?
Yes, but as recognised in the 2004 report, such disturbance, "*would have little further adverse effect…"*

3.8 Does the Aboriginal Heritage Information Management System suggest potential?
No see appendix A

3.9 Is there archaeological potential because the proposal is:

- **within 200m of waters;**
  No
- **located within a sand dune;**
  No, but The densely vegetated hind dune adjacent to Phillip Drive on the north-east corner is considered to have a higher level of archaeological potential than any other part of the study area, and provides no survey exposure off a narrow fire break behind existing houses. Further survey or sub-surface investigation is highly unlikely to be effective and is not recommended.
- **located on a ridge top, ridge line, or headland;**
  No
- **located within 200m below or above a cliff face;**
  No
- **within 20m of or in a cave, rock shelter, or a cave mouth;**
  No

3.10 Can harm be avoided to the object or disturbance of the landscape feature?
N/A

3.11 Is Desktop assessment and visual inspection required?
No a previous report "*Local Environmental Study Phillip Drive, South West Rocks NSW Mid-North Coast Aboriginal Heritage Assessment, August 2004. Prepared on behalf of Connell Wagner. (2004)",* was undertaken (included in this report as Appendix B). That report did not find any Aboriginal objects and found that: "**No archaeological sites have been recorded in the study area, nor is there a high expectation that significant undetected sites will occur."**

3.12 Are Further investigations and impact assessment required?
No

4.0 Recommendations

After applying the due diligence process and given that any Aboriginal heritage constraints have been identified and protected in the Local Environmental Plan covering the area; it is reasonably concluded that there is no constraint to development provided that:

1. Under the NPW Act 1974, it is the responsibility of all persons to ensure that harm does not occur to an Aboriginal object. If human skeletal remains are found during the activity, work must stop immediately, the area secured to prevent unauthorised access and the NSW Police and OEH contacted. The NPW Act requires that, if a person finds an Aboriginal object on land and the object is not already recorded on AHIMS, they are legally bound under s.89A of the NPW Act to notify OEH as soon as possible of the object's location. This requirement applies to all people and to all situations.

2. A Cultural Education Program should be developed by the proponent for the induction of personnel involved in the construction activities in the project area. The proponent has a duty of care to ensure each worker is aware of individual responsibilities under the Act. The Local Aboriginal Land Council may be able to assist in delivery of such induction.

3. That the concerns and recommendations of the Aboriginal community as expressed in the Collins report 2004 at 11.3 should be further considered if not already implemented within the LEP, which part required;

   The Kempsey LALC and Dunghutti Elders CAC have advised that they have no fundamental objections to future development of the study area providing: the existing Needlebark /stringybark woodland fringing Saltwater Lagoon is retained in its current condition (given that the Lagoon margin may contain undisturbed occupation sites);

5.0 Certification

This report was prepared in accordance with the brief given by Geoff Smyth and Associates to assess the impact of the proposed development on Aboriginal heritage and was undertaken to demonstrate due diligence.

Whilst every care has been taken in compiling this report to determine the impact the proposal may have on Aboriginal Heritage and to demonstrate a due diligence process, neither MCAS nor the Local Aboriginal community can warrant or guarantee that due diligence has been met. It is the responsibility of the individual or proponent to ensure that they have undertaken due diligence.

Signed

(Archaeologist)
29/5/2015

6.0 Appendix

A. AHIMS Search results
B. Collins' 2004 Assessment

APPENDIX A

AHIMS Web Services (AWS)
Search Result

Purchase Order/Reference : SWR1

Client Service ID : 178139

Myall Coast Archaeological Services

Date: 19 June 2015

Tall Pines
Tea Gardens New South Wales 2324
Attention: Sue Roberts

Email: archaeology@myallcoast.net.au

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lot : 35, DP:DP1167775 with a Buffer of 50 meters, conducted by Sue Roberts on 19 June 2015.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.

A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

0	Aboriginal sites are recorded in or near the above location.
0	Aboriginal places have been declared in or near the above location. *

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (http://www.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Office of Environment and Heritage's Aboriginal Heritage Information Unit upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Office of Environment and Heritage and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date .Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

3 Marist Place, Parramatta NSW 2150
Locked Bag 5020 Parramatta NSW 2220
Tel: (02) 9585 6380 Fax: (02) 9873 8599

ABN 30 841 387 271
Email: ahims@environment.nsw.gov.au
Web: www.environment.nsw.gov.au

APPENDIX B

Jacqueline Collins
(Consultant Archaeologist)
Adise Pty Ltd
11 Camden Head Road
Dunbogan NSW 2443

Local Environmental Study
Phillip Drive, South West Rocks
NSW Mid-North Coast

Aboriginal Heritage Assessment

August 2004

Prepared on behalf of :

Connell Wagner
PO Box 19
University of Newcastle Union
Callaghan NSW 2308

SUMMARY

Background:

Kempsey Shire Council has resolved to prepare a draft Local Environmental Plan (LEP) to facilitate the rezoning of Lots 509 and 19 DP 850963, Lot 52 DP 831284, and Lot 84 DP 792945, Phillip Drive, South West Rocks, for residential purposes. To ensure consistency with the NSW Coastal Policy, Council has engaged Connell Wagner to undertake a formal Local Environmental Study (LES) ahead of LEP preparation. This report was prepared on behalf of Connell Wagner forms the Aboriginal heritage component of the LES.

The study area:

The study area comprises approximately 111.8 hectares of the coastal plain situated 0.58 to 1.95km inland of Trial Bay, between the settlements of South West Rocks and Arakoon on the NSW mid-north coast. It is bounded to the north by Phillip Drive and vacant allotments and residences fronting Phillip Drive, Waianbar Avenue and Currawong Crescent, to the east by a part of Hat Head National Park that encompasses Saltwater Lagoon, to the south by undeveloped land, and to the west by the South West Rocks Golf Course and Sewage Treatment Plant.

Assessment methodology:

This assessment includes a review and compilation of existing data, liaison with the Kempsey Local Aboriginal Land Council and Dunghutti Elders Council Aboriginal Corporation, and selective field survey assisted by Aboriginal representatives. The impact of future development on Aboriginal heritage values and resources is assessed and management recommendations appropriate to the requirements of the LES, including opportunities for impact mitigation within the future development context, are proposed.

Aboriginal involvement and consultation:

The study area falls within the territory administered by the Kempsey Local Aboriginal Land Council (LALC) and within the area of interest to the Dunghutti Elders Council Aboriginal Corporation (CAC) and the Figtree Aboriginal community of South West Rocks. Assistance with the field survey was provided by Sites Officers from these three groups. On completion of the survey, the results, site significance issues and management options were discussed and conservation priorities identified.

Birrogun's grave is a significant Aboriginal mythological site located in the South West Rocks Golf Course 250m west of the study boundary. Because it was clearly possible that any future residential development of the study area could have an impact on this site's spiritual qualities and attachments, consultation was undertaken with the Kempsey LALC and Dunghutti Elders CAC to this end.

However, Kempsey LALC and Dunghutti Elders representatives advised that the natural and spiritual qualities of this site and its surrounds have already been compromised to such an extent that the proposed development would have little further adverse effect on its contemporary cultural values. Figtree Aboriginal community field representative Greg Blair also supported this conclusion.

Dunghutti Elders CAC Sites Officer David Hoskins advised that a Bora/ceremonial ground is known to have once been situated somewhere near the north-eastern corner of the study area, although its exact location is uncertain. Inspection of the possible Bora ground location revealed high level disturbance caused by an abandoned horticultural enterprise and it was concluded that this site, if ever present within the study area, has been destroyed.

As a result of their consideration of the survey results and the environmental context and disturbance history of the study area and adjacent land, both the Kempsey LALC and Dunghutti Elders CAC indicated that they have no fundamental objections to future residential development of the study area providing the recommendations of this report are implemented.

Archaeological expectations:

A large number of Aboriginal occupation sites have been recorded at South West Rocks. These sites display a very strong association with well-drained ground, particularly foredunes and footslopes/natural rises bordering estuarine channels and swamps. In view of the study area's topographic character, it is predicted that archaeological evidence will be primarily restricted in its distribution to a hind dune on the north-east corner, and a slightly higher section of the drainage-impeded coastal plain in the south-west. This evidence is most likely to take the form of small scatters of shell and/or artefacts that may have been covered by aggrading sand. The study area's soils are strongly acid and unless interred in relatively recent times, or preserved within midden deposit, burials are unlikely to survive in the archaeological record. Although their survival probability is low, scarred trees may be present wherever ecologically mature trees occur.

Field survey coverage:

Approximately 15.6% (17.4ha) of the study area was inspected for surface evidence. Of this, it is estimated that around 36% was effectively covered, amounting to an overall effective coverage of 5.6% of the total study area.

Results and conclusions:

No artefacts, scarred trees or potential archaeological deposits were identified during the survey. The majority of the study area comprises extensively disturbed drainage-impeded lowland which is unlikely to have ever been selected for Aboriginal occupation in preference to the nearby coastal dunes and Macleay estuarine system. As the only naturally well-drained and reasonably intact parts of the landscape, the slightly higher land in the south-west, and the north-east hind dune in particular, are the only elements considered to have any real archaeological potential.

Management recommendations:

- Although isolated artefacts may occur in any part of the study area, any substantial undetected archaeological evidence is likely to be restricted in its distribution to the remnant woodland south and south-east of the Sewage Treatment Plant, and the hind dune adjacent to Phillip Drive in the north-east. Both these areas are well vegetated, offer very little survey exposure, and have some potential to contain undisturbed archaeological sites.

  Conservation of woodland vegetation in these potentially sensitive areas would concurrently offer protection to any undetected archaeological sites, and it is recommended that this factor be taken into account when development control measures are established for the study area.

- The densely vegetated hind dune adjacent to Phillip Drive on the north-east corner is considered to have a higher level of archaeological potential than any other part of the study area, and provides no survey exposure off a narrow fire break behind existing houses. Further survey or sub-surface investigation is highly unlikely to be effective and is not recommended.

  To ensure that archaeological sites, and burials in particular, are not destroyed in the event that this dune is to be developed, it is instead recommended that Sites Officers from the Kempsey LALC and Dunghutti Elders CAC be engaged to monitor all initial construction-related earthworks (including vegetation clearing) on the vegetated section of dune.

- Due to the perceived low density of the archaeological resource and poor detection conditions in undisturbed areas, further survey work at Development Application stage would be unlikely to produce positive results. Providing the recommendations of this report are implemented and the legislative requirements of the National Parks and Wildlife Act (1974) are upheld, no further surface survey work is recommended in the study area.

- The Kempsey LALC and Dunghutti Elders CAC have advised that they have no fundamental objections to future development of the study area providing: woodland fringing Saltwater Lagoon is retained in its current condition; and Aboriginal representatives are engaged to monitor initial earthworks on the north-east hind dune adjacent to Phillip Drive to ensure that burials are not accidentally destroyed.

- Prior to commencement of any vegetation clearing or construction activities associated with the proposed residential development, it is recommended that all construction contractors and their employees be advised of their legal obligations with regard to Aboriginal cultural materials.

Should any material evidence thought to be of Aboriginal origin be discovered or exposed during any stage of the development, work must immediately cease in that locality. The Department of Environment and Conservation, Kempsey LALC and Dunghutti Elders CAC should then be contacted for management advice and clearance given by these organisations before work resumes in the subject area

TABLE OF CONTENTS

1 INTRODUCTION 1
1.1 Study background 1
1.2 Location of the Environmental Study area 2
1.3 Potential development impact on Aboriginal sites 2

2 ENVIRONMENT AND LANDUSE EFFECTS 5

3 CULTURAL CONTEXT 6
3.1 Landuse and economy 6
3.2 Mythology 7

4 ABORIGINAL INVOLVEMENT AND CONSULTATION 8

5 ARCHAEOLOGICAL CONTEXT 9
5.1 Registered Aboriginal sites in the study locality 9
5.2 Past surveys in the study locality 10
5.3 Past surveys in the study area 11
5.4 Potential site types in the study area 11
5.5 Predicting site locations 13

6 FIELD INVESTIGATION 14
6.1 Constraints to site preservation 14
6.2 Survey strategy and procedure 14
6.3 Survey coverage 15

7 SURVEY RESULTS 17

8 CONCLUSIONS 17

9 SIGNIFICANCE ASSESSMENT 18
9.1 Management principles and the concept of significance 18
9.2 Significance of the study area 19

10 STATUTORY OBLIGATIONS 19

11 MANAGEMENT RECOMMENDATIONS 20
11.1 Potential undetected site locations 20
11.2 Further archaeological assessments 21
11.3 Aboriginal concerns 21
11.4 General recommendations 22

REFERENCES 23
GLOSSARY 26

APPENDIX

A Correspondence from the Kempsey Local Aboriginal Land Council and Dunghutti Elders Council Aboriginal Corporation 27
B Field survey report from Figtree Aboriginal community representative Greg Blair 28

LIST OF TABLES

1 Study area location details 2
2 Recorded sites within one kilometre of the study area 9
3 Survey coverage data 17

LIST OF FIGURES

1 The study area in relation to the distribution of known Aboriginal sites at South West Rocks 3
2 Proposed structure plan 4
3 Location and description of survey units 16

1 INTRODUCTION

1.1 Study background

Kempsey Shire Council has resolved to prepare a draft Local Environmental Plan (LEP) to facilitate the rezoning of Lots 509 and 19 DP 850963, Lot 52 DP 831284, and Lot 84 DP 792945, Phillip Drive, South West Rocks, for residential purposes.

In accordance with specifications of the Department of Infrastructure, Planning and Natural Resources, a Local Environmental Study (LES) is required to ensure consistency with the NSW Coastal Policy ahead of LEP preparation. Kempsey Shire Council has engaged Connell Wagner to prepare a formal LES in response to this requirement. The LES is designed to make recommendations regarding the most suitable future use of the subject land, based on a comprehensive assessment of relevant environmental, physical, social, cultural, infrastructure, and statutory issues and matters.

This report was prepared on behalf of Connell Wagner and aims to identify and assess features of Aboriginal cultural heritage significance with a view to maintaining their special qualities, and protecting them from undesirable development. To provide the level of information necessary for planning requirements and comply with the provisions of the National Parks and Wildlife Act (1974) and Environmental Planning and Assessment Act (1979), this assessment includes:

- Literature review and compilation of existing data;
- Consultation with the Kempsey Local Aboriginal Land Council and Dunghutti Elders Council Aboriginal Corporation to determine the location of any sites/places of particular social or spiritual significance, identify contemporary Aboriginal cultural issues applicable to the study area, and establish conservation priorities;
- Selective field inspection of the study area to determine its archaeological potential and identify sites and archaeologically sensitive landforms that would warrant conservation or further assessment;
- Assessment of the impact that future development may have on the Aboriginal cultural heritage resource; and
- Management recommendations appropriate to LES requirements, including opportunities for impact mitigation and site protection.

1.2 Location of the Local Environmental Study area

The study area comprises approximately 111.8 hectares of land situated 0.58 to 1.95km inland of Trial Bay, between the coastal settlements of South West Rocks and Arakoon on the NSW mid-north coast. It is bounded to the north by Phillip Drive and vacant allotments and residences fronting Phillip Drive, Waianbar Avenue and Currawong Crescent, to the east by a part of Hat Head National Park that encompasses Saltwater Lagoon, to the south by undeveloped land, and to the west by the South West Rocks Golf Course and Sewage Treatment Plant (Figure 1).

Table 1. Study area location details

Local Government Area:	Kempsey
County:	Macquarie
Parish:	Arakoon
1:25,000 topographic map:	South West Rocks 9536-3-S
Local Aboriginal Land Council:	Kempsey

1.3 Potential development impact on Aboriginal sites

Under the current structure plan proposal most of the study area would be developed for residential purposes, with a light industrial area in the vicinity of the Sewage Treatment Plant. Existing bushland corridors would be retained, including all trees bordering Hat Head National Park and upper Saltwater Creek (Figure 2).

The proposed future development would require landscape modifications, including vegetation removal, land leveling and filling, road construction, and the installation of stormwater drainage and in-ground services. Any Aboriginal artefacts occurring within the depth range of necessary earthworks would be displaced at the time of development itself, but many of the activities associated with residential and industrial uses- the excavation of driveways, carparks and building foundations, landscaping etc, introduce ongoing sources of disturbance which add to the cumulative degradation and loss of archaeological sites.

Unless identified and salvaged, or retained within conservation zones, it is anticipated that all Aboriginal sites occurring off the natural bushland corridors will eventually be destroyed as a result of the development.

2 ENVIRONMENT AND LANDUSE EFFECTS

The study area lies on the coastal plain west of the Smoky Cape Range, where it straddles the Hat Head and Clybucca Soil Landscape units. These are both low-relief swamp landscapes featuring back-barrier beach ridge swale swamps composed of poorly drained acid peats, podzols and humic gleys. Soils are strongly acid, of low fertility, and have a permanently high water table (Eddie 2000). Prior to sea level stabilisation around 6,000 years ago, the Smoky Cape Range would have been an offshore island (Hails 1968), the study area forming as a result of sand deposition since that time.

Although runoff is presently discharged via a network of artificial drains, the study area was originally drained by a small creek (referred to here as upper Saltwater Creek) that flows into Saltwater Lagoon through the southern section. However, the creek channel was augmented during the early 1980's to provide better drainage to the adjacent golf course and is no longer in its natural condition. Saltwater Lagoon is a shallow saline lake with swampy margins that exits to the ocean through Saltwater Creek on the northern side of Phillip Drive. The western edge of the Saltwater Lagoon wetland is fringed by a low sand rise contained within Hat Head National Park adjacent to the north-eastern study boundary.

The vast majority of the study area comprises flat drainage-impeded lowland. The naturally swampy nature of this area is reflected in an 1878 account that describes it as "an immense plain covered with long reedy swamp grass. In wet weather this is a marsh" (Town and Country Journal, cited in Carey 1993:20-30). From an archaeological perspective, the only topographic features of any note are a low densely vegetated hind dune in the north-east, and a slightly higher and better drained forested section of the plain in the south-west.

Much of the study area has been highly disturbed as a result of drain excavation, road construction, vegetation clearing, slashing, ploughing and land leveling, and features a combination of full sand exposures and sparse heath regrowth. At least 6ha in the north-western part of the area has been used to cultivate potatoes in the past (B. Laut pers comm.). Despite disturbance, the study area still supports several natural vegetation communities. These have been mapped by Parker (2002) and include Needlebark stringybark, Red bloodwood, Banksia, Paperbark and Prickly tea-tree open forest around Saltwater Lagoon (most within Hat Head NP); a corridor of Scribbly gum, Hakea, Red gum, Swamp mahogany and Coastal wattle tall open woodland extending from Saltwater

Lagoon along upper Saltwater Creek, becoming scattered in the west; Red gum, Swamp mahogany and Coastal wattle tall open woodland in the far west adjacent to the golf course; Banksia and Tea-tree tall closed shrubland in the swampy south-eastern part of the area; and Sedgeland, recorded in places along water bodies and roads, and within the woodland and shrubland communities.

3 CULTURAL CONTEXT

3.1 Landuse and economy

Linguistic evidence indicates that Ngaku, a dialect of the Dunghutti language, was traditionally spoken in the lower Macleay district (Eades 1979:250-1). As with other parts of Australia, the Dunghutti operated within a series of nested social groupings. The hearth group, comprising a man, his wife or wives and their children, formed the basic socio-economic unit and several hearth groups would often co-operate, forming highly flexible 'bands' which would gather and then disperse as conditions demanded (Godwin 1990:97). During the course of everyday life, residential bands were usually made up of "small parties of eight to ten men, with their women and children, for the greater convenience of hunting etc, and these detached companies roam(ed) over any part of the country within the prescribed limits of the main tribe to which they belong(ed)" (Hodgkinson 1845:222).

The broad picture of the Dunghutti at the time of first European contact was of a "vigorous and healthy people, the majority of whom lived on the floodplain and its surrounds, relying heavily on aquatic resources" (Callaghan 1980:25). The population is said to have been "very numerous about Trial Bay" (Massie 1846). While early reports suggest that fish provided a local dietary staple (eg Hodgkinson 1845:22), shellfish, and terrestrial plants and animals, especially those from the river's gallery rainforests, were also integral to the economy (Callaghan 1980:24). Evidence suggests that the country was regularly burnt to assist in hunting (Sullivan 1982:121). Cook, for instance, sailed past the study locality in 1770 and observed so many Aboriginal fires that he named Smoky Cape as a result (Beaglehole 1955:315-6).

A wide variety of the Macleay region's material items were made from wood, bark and plant fibre. These include spears, boomerangs, clubs, shields, digging sticks, containers, canoes, and woven nets and bags (Campbell 1978:93-4). Aboriginal people controlled the natural fracture properties of fine-grained stones to produce a variety of cutting and scraping tools, many of which were used to manufacture and maintain these types of perishable items. The cultural assemblage also included spears barbed with “jagged bits” of flint or glass (Henderson 1851:2, 144).

3.2 Mythology

Myths, or sacred stories, accounted for the existence of both Aboriginal people and their environment, providing tangible links between the two. Some myths associated with landscape features explain the origin of aspects of the natural world, while others are concerned with the exploits and travels of Dreaming deities and culture heroes. A well-known site (#22-4-35) reflecting this latter type of myth is situated on a low bedrock ridge in the centre of the South West Rocks Golf Course approximately 250m west of the study area. The site, marked by a naturally occurring granite boulder, represents the grave of the culture hero Birrogun (often referred to as the ‘Aboriginal Jesus’), who was speared during a tribal battle.

Unfortunately, the site is not in its natural condition. A 60 acre (24.3ha) area including Birrogun’s grave was dedicated as a recreation ground/racecourse in 1892, but periodic race meetings were held there from as early as 1878 (Carey 1993:44-5,102). Two separate accounts of the Birrogun myth related to Robinson (1989:68,70) indicate that the grave site was located in the racecourse, “where the winning post is” (John Flanders, cited in Robinson 1989:70). Birrogun’s grave was later encompassed by the South West Rocks Golf Course, and in the 1960’s its marking boulder was moved to the side to make way for the seventh fairway (Gumbaynggir Language and Culture Group 1992:32; G. Blair pers comm.). The site also comprised a number of Paperbark trees (into which Birrogun’s mother transformed his enemies following his death) but few, if any, of these have survived golf course development.

Birrogun’s grave represents the end point in a cycle of myths that trace Birrogun’s journey south from his Valla homeland, spiritually connecting the Dunghutti people with their Gumbaingirr neighbours to the north. Several detailed accounts of Birrogun’s travels and exploits have been published (Smythe 1948; Ryan 1964; Robinson 1965, 1989; Hoddinott 1978; Nayutah and Finlay 1988; Gumbaynggir Language and Culture Group 1992).

Particular places linked to Birrogun's journey, including places along the Nambucca River, Mount Yarrahapinni, and his South West Rocks grave, are of enduring cultural significance despite modern modifications.

4 ABORIGINAL INVOLVEMENT AND CONSULTATION

The study area falls within the territory administered by the Kempsey Local Aboriginal Land Council (LALC) and within the area of custodianship of the Dunghutti Elders Council Aboriginal Corporation (CAC). The area is also of interest to the Figtree Aboriginal community of South West Rocks. The field survey component of this assessment was undertaken with the assistance of Kempsey LALC Sites Officer and Dunghutti Elder Harold Smith and Figtree Aboriginal community representative Greg Blair on the 18th of May 2004. Dunghutti Elders CAC Sites Officer David Hoskins was unavailable on this day and participated in a further inspection with the consultant on the 25th of June 2004.

On completion of the field survey, the results were discussed with Harold Smith, Greg Blair and David Hoskins and management recommendations developed accordingly. Correspondence subsequently received from the Land Council and Dunghutti Elders CAC is reproduced in Appendix A, and a fieldwork report from Greg Blair in Appendix B.

As discussed in Section 3.2 above, Birrogun's grave (#22-4-35) is a significant mythological site located in the South West Rocks Golf Course only 250m west of the study boundary. Because it was clearly possible that any future residential development of the study area could have an impact on this site's spiritual qualities and attachments, consultation was undertaken with the Kempsey LALC and Dunghutti Elders CAC to this end. However, as advised orally by the Sites Officers during the survey and outlined in the Appendix A correspondence, Birrogun's grave is considered to be adequately buffered by the golf course itself. As related in the Land Council correspondence, the natural and spiritual qualities of its surrounds have already been compromised to such an extent by relocation of the marker stone, development of the golf course, a sports ground to the north, housing estates to the south and west, and construction of the Sewage Treatment Plant to the east, that residential development of the study area would have little further adverse effect on the site's contemporary cultural values. Figtree Aboriginal community representative Greg Blair also supported this conclusion.

Dunghutti Elders CAC Sites Officer David Hoskins advised that a Bora/ceremonial ground is known to have once been situated somewhere near the north-eastern corner of the study area, although its exact location is uncertain. Inspection of the possible Bora ground location revealed high level disturbance caused by an abandoned horticultural enterprise and it was concluded that this site, if ever present within the study area, has been destroyed.

As a result of their consideration of the survey results and the environmental character and past disturbance of the study area and adjacent land, both the Kempsey LALC and Dunghutti Elders CAC have advised that they have no fundamental objections to future residential development of the study area providing the recommendations of this report are implemented.

5 ARCHAEOLOGICAL CONTEXT

5.1 Registered Aboriginal sites in the study locality

While none occur within the study area itself, 63 sites have been so far registered on the DEC (Department of Environment and Conservation) Aboriginal Heritage Information Management System between the Macleay River/Spencers Creek and coastline north of Jerseyville. These include six sites within a kilometre of the study boundaries, details for which are given in Table 2. Sites in the wider study locality are plotted on Figure 1.

South West Rocks has a remarkably large number of surviving Aboriginal sites in comparison to other parts of the NSW mid-north coast. Shell middens make up 84% (n=53) of the registered sites in this area, burials 8% (n=5, of which two are found in middens), open campsites (stone artefact scatters) and natural mythological sites each 3% (n=2), and Bora ceremonials with carved trees 2% (n=1).

Table 2. Recorded sites within one kilometre of the study area

Site No.	Location/name	Site Type	Environmental context
22-4-35	Birrogun's grave	Natural mythological	Crest of bedrock spur.
22-4-08	Arakoon	Midden	Frontal dune.
22-4-90	South West Rocks	Midden/burial	Wetland margin.
22-4-48	Spencers Creek	Burial ground	Footslope of sand ridge near perennial creek.
22-4-18	Big Smoky	Midden	Bedrock footslope adjacent to wetland.
22-4-94	Spencers Creek	Midden/open camp	Sand plain near perennial creek.

As the most common site type, middens cluster along the present and former shores of the Macleay estuarine system, where they form distinctive mounds of cockle (in basal layers) and oyster shell (in upper layers). These estuarine middens are believed to have been occupied between 5,000 and 2,000 years ago, and reflect silting up of the open estuary and formation of confined mangrove communities (Sullivan 1982:115-6). Many smaller pipi shell middens have also been recorded in frontal dunes along South Smoky Beach. The pipi middens appear to be more recent than their estuarine counterparts and reveal little reliance on non-coastal resources (Connah 1976). Overall, archaeological evidence indicates an Aboriginal economy that was strongly influenced by local environmental conditions (Collins 1995:11).

5.2 Past surveys in the study locality

Systematic research into the prehistory of the Macleay Valley commenced in 1969 with an academic survey of coastal middens conducted by Campbell. Site #22-4-08 was recorded on the frontal dune at Arakoon during this survey.

Campbell's initial work was followed by a more intensive academic investigation involving the excavation of two shell middens at Clybucca and Stuarts Point north of the Macleay River, and two middens at Maguires Crossing further south (Connah 1975,1976). The range of radiocarbon dates obtained from the middens indicates that Aboriginal people were occupying the area at least 5,000 years ago, at that time depending exclusively upon estuarine shellfish resources. The resource base later broadened to include fish and land animals (Knuckey 1999).

Occupation of the coastline itself is believed to have occurred only within the last one to two thousand years (Egloff and Oxley 1989:20). Two of these recent coastline sites (#22-4-46 and 47), situated beside a small creek at the base of Smoky Cape, were excavated by Hughes (1979), revealing 60-75cm deep cultural deposits composed of open shore and rock platform shellfish, with small quantities of fish, bird and macropod bone.

Archaeological work has also been undertaken in response to individual development proposals at South West Rocks. This work has included a ground-probing radar survey of a reported post-contact Aboriginal burial ground at Spencerville (Collins and Griffin 1993), and a shovel test pit and auger investigation of land adjacent to a series of middens that stretch along a former embayment of the Macleay River (Collins 1995).

Two small land parcels (each approximately one hectare) covering the hind dune between the study boundary and Phillip Drive have been surveyed by Sites Officers from the Kempsey LALC. The first of these was inspected by Leslie Donovan in 1996, and encompassed the area now developed as the Waianbar Avenue residential subdivision. No archaeological materials were detected. The adjoining allotment (Lot 506 DP 827889) was surveyed by Kempsey LALC Sites Officer Harold Smith with the assistance of the present consultant in 2001. At least one third of this allotment consisted of fully exposed eroded sand sheets, but no archaeological materials were apparent (Smith 2001).

5.3 Past surveys in the study area

A 60ha section of the study lowland (then Lot 510 DP 850963) was surveyed by Kempsey LALC Sites Officer Neville Cohen in 1997 in response to a previous development proposal. No archaeological materials were detected despite three days of survey and high visibility conditions provided by a recent fire. Mr Cohen also consulted with Elders from the South West Rocks Aboriginal community but there was no knowledge of culturally significant sites in the area (Cohen 1997a).

In addition to the field survey mentioned above, Neville Cohen monitored drain digging through the study area, returning for an additional two days to monitor the spreading out of drain spoil/topsoil. Again, no archaeological materials were detected (Cohen 1997b).

Although there are no available written records of these inspections, Harold Smith and Greg Blair advised that the vegetated hind dune in the north-eastern corner of the study area, and the better drained area in the south-west have also been inspected by Land Council representatives in the past, both with a nil result.

5.4 Potential site types in the study area

On the basis of information gained through a review of background environmental, ethnohistorical and archaeological data, and the results of past surveys at South West Rocks, there is some likelihood of the following types of Aboriginal sites surviving in the study area.

Stone artefact scatters (open campsites)

This type of site can range from as few as two stone artefacts to an extensive scatter containing a variety of tools and flaking debris, sometimes with associated materials such as bone, shell, ochre, charcoal and hearth stones.

An artefact scatter does not necessarily mark a place where actual camping was carried out, but may instead be the product of specialised and/or short-term activities involving some level of stoneworking (eg the manufacture or rejuvenation of a single tool during hunting, or whilst in transit from one camp to another) (Hiscock 1988:19). Artefact scatters may occur as surface concentrations or as dateable stratified deposits, and can provide information on such things as patterns of Aboriginal landuse, movement and exchange.

Isolated stone artefacts

Isolated artefacts can be located anywhere in the landscape and represent either the remnant of a dispersed artefact scatter (open campsite), or the simple loss or random discard of artefacts.

Scarred trees

These are trees that bear scars caused through the removal of bark or wood for making material items such as canoes, shields and containers, or which have been marked for other reasons (eg toe-holds to aid climbing). Because scarred trees are usually associated with domestic activities, their distribution often correlates with the distribution of artefact scatters and middens (Rhoads 1992, cited in Long 1998:28).

Shell middens

Shell middens are the most common kind of archaeological evidence on the lower Macleay. They are generally found near water sources and represent the remains of Aboriginal meals of shellfish. Some middens are thin surface scatters which have constituted little more than a meal for a small group gathering food away from a main camp, while others are well consolidated deposits representing consistent use by large groups of people over hundreds or even thousands of years.

Aboriginal middens differ from natural shell beds in that they comprise predominantly mature specimens of edible mollusc species. They may also contain faunal remains, stone artefacts and charcoal and ash from cooking fires. Aboriginal burials have been recorded in direct association with midden deposits at South West Rocks.

Burials

Aboriginal burials on the mid-north coast are most commonly found as unmarked graves in sand or midden deposits in sand. The burials are normally simple primary interments (Meehan 1971). Due to their subsurface context burials are seldom detectable during surveys of undisturbed surfaces.

Natural mythological sites

Unlike archaeological sites, natural mythological sites are natural landscape features which have not been modified by Aboriginal people. Usually, these sites are of spiritual significance and remain an integral part of contemporary Aboriginal culture. As discussed in Section 3.2, Birrogun's grave natural mythological site (#22-4-35) is located 250m west of the study boundary.

Natural mythological sites and other spiritually-significant places are not located through the usual process of site survey but rather, with the help of Aboriginal people with traditional knowledge of specific areas. Consultation with such individuals was undertaken during the present assessment in an effort to ascertain whether any natural mythological or otherwise culturally-significant sites/locations (including Birrogun's grave) would be adversely affected by future residential development of the study area.

5.5 Predicting site locations

It has long been recognised that archaeological sites recur in favourable environmental settings. Predictive models take advantage of these redundancies by exploiting contrasts between environmental characteristics of places where sites do and do not occur. Providing the data is good it is possible to make predictions from a relatively small sample of known locations to a much broader area (Warren 1990:201).

A large number of Aboriginal occupation sites have been recorded at South West Rocks. These sites display a very strong association with well-drained ground, particularly foredunes and footslopes/natural rises bordering estuarine channels and swamps. In view of the study area's topographic character, it is predicted that archaeological evidence will be primarily restricted in its distribution to the hind dune on the north-east corner, and the slightly higher section of plain in the south-west. This evidence is most likely to take the form of small scatters of shell and/or artefacts which may be concealed beneath aggrading sand.

The location of burial sites within the landscape is difficult to predict, based on current information. However, as discussed in Section 2, soils of the study area are strongly acid. Organic materials degenerate rapidly under acid conditions (Davis 1987:27; Dowman 1970:21) and unless interred in relatively recent times, or preserved within a midden deposit, burials are unlikely to survive in the study area's archaeological record.

Although their survival probability is low, scarred trees may be present wherever ecologically mature trees occur.

6 FIELD INVESTIGATION

6.1 Constraints to site preservation

While ethnographic data and known site distribution patterns can be used to develop archaeological expectations for any given area, the current location and condition of archaeological materials, along with their potential for discovery during survey, is determined by many factors other than where and how those materials were originally abandoned.

The study area has been subject to a variety of mechanical activities that will have compromised the survival potential of its cultural heritage resource. Although remnant woodland remains along the margin of the Hat Head NP and adjacent to the Sewage Treatment Plant in the south-west, most of the study area has been cleared of its natural vegetation and is highly disturbed. A number of gravelled roads have been constructed, and a network of drainage ditches excavated. Extensive leveling of the lowlands appears to have been carried out north of upper Saltwater Creek, with drain spoil spread across the harrowed and regularly slashed surfaces. At least 6ha in the north-western part of the area has been used in crop cultivation.

As outlined in Section 2, the course of upper Saltwater Creek has been augmented and modified to provide better drainage. The natural banks have been removed, the creek now presenting as a 'U-profile' drainage channel.

6.2 Survey strategy and procedure

Field survey of the Local Environmental Study area was conducted with the assistance of Kempsey LALC Sites Officer and Dunghutti Elder Harold Smith and Figtree Aboriginal community representative Greg Blair on the 18th of May 2004, and with the assistance of Dunghutti Elders CAC Sites Officer David Hoskins on the 25th of June 2004. The weather was fine and lighting was conducive to the detection of archaeological materials. A logbook was maintained to record relevant environmental observations, and photographs taken to document the various levels of surface exposure and visibility. Selected plates have been included in this report to provide a general overview of survey conditions.

Owing to the study area's low-lying topography, level of mechanical disturbance and the likely types and distribution of archaeological sites, it was considered that blanket survey coverage was not warranted. Instead, a selective sampling strategy was adopted to maximise coverage of less disturbed surfaces and subsurface sediments (drain cuttings), and to inspect areas identified as being of potential cultural heritage value. In addition to the detailed surface survey, a general reconnaissance was made in order to locate and inspect all of the remaining mature trees for evidence of Aboriginal scarring.

The survey was completed using a combination of parallel transects and single traverses, with the distance between surveyors tailored to suit the type of exposure being inspected. On linear features such as drains, two surveyors walked the margins, checking the opposite cutting for subsurface evidence. Elsewhere, the inspection was carried out by two or three surveyors walking up to five metres apart, resulting in the coverage of a 10-15m wide strip. Particular attention was paid to degraded surfaces which were more conducive to artefact exposure and detection than those churned during recent slashing and harrowing.

6.3 Survey coverage

Land covered in the field, representing approximately 15.6% (17.4ha) of the study area, is shaded on Figure 3 (see summary details, Table 3) in relation to the survey units into which the area was divided to assist with reporting and coverage analysis. Owing to dense vegetation and mechanical disturbance, not all of the surveyed land provided conditions suitable for detecting surface sites.

The concept of coverage analysis has been developed as a means of specifying the proportion of a surveyed sample that permitted site detection. To generate data sufficient for evaluating the potential for and distribution of undiscovered sites, variables constraining site detection were estimated for all survey units. These include an estimation of the mean frequency with which surface exposures were encountered, as well as an estimation of the quality of visibility on those exposures (mean frequency of bare ground suitable for artefact detection).

Once the variables of exposure and visibility are taken into account, it is estimated that around 35.8% of the survey sample was subject to effective coverage (Table 3). This amounts to an overall effective coverage of 5.6% of the total study area.

In view of the study area's topographic character and disturbance history, and the environmental context of areas that provided useable exposures, the effective survey sample is considered to have been satisfactory for the purposes of assessing the nature, extent and distribution of the archaeological resource.

Table 3. Survey coverage data

Survey unit	Surveyed area (m^2)	% of surface exposed	% visibility on exposures	Effective coverage (m^2)	No. sites recorded
A	500	50	100	250	0
B	15,250	5	100	763	0
C	47,000	30	100	14,100	0
D	200	50	50	50	0
E	1,500	20	100	300	0
F	15,400	70	100	10,780	0
G	36,500	90	100	32,850	0
H	2,000	30	100	600	0
I	0	0	0	0	0
J	4,000	10	100	400	0
K	0	0	0	0	0
L	41,000	5	50	1,025	0
M	9,200	10	100	920	0
N	1,200	10	100	120	0
TOTAL	173,750			62,158	0

7 SURVEY RESULTS

No artefacts, scarred trees or potential archaeological deposits were identified during the survey.

8 CONCLUSIONS

The majority of the study area comprises extensively disturbed drainage-impeded lowland which is unlikely to have ever been selected for Aboriginal occupation in preference to the nearby coastal dunes and Macleay estuarine system. While it is possible that campsites were established in suitable places along upper Saltwater Creek, the creek channel has been altered and its original banks modified and/or removed in the process.

As the only naturally well-drained and reasonably intact parts of the study landscape, the slightly higher land in the south-west, and the north-east hind dune in particular, were the only elements considered to have any real archaeological potential.

Due to dense vegetation, survey inspection of the south-west rise was primarily restricted to roadsides and a drain cutting, resulting in the effective coverage of a 920m^2 sample of the remnant woodland. No archaeological evidence was found and while this result suggests a low overall level of sensitivity, the possibility of undetected sites (middens and burials), particularly in proximity to the creek channel, cannot be entirely ruled out. As shown on Figure 2, much of the woodland would be retained under the auspices of the proposed development structure plan. Providing the ground surface is not modified during understorey clearing, conservation of the woodland would concurrently offer protection to potential undetected archaeological sites.

The hind dune on the north-eastern corner of the study area supports a dense Needlebark stringybark and Banksia woodland with a impenetrable shrubby understorey. A 5m wide 50% exposed fire break behind the houses in Waianbar Avenue provided the only survey visibility. However, cleared parts of the same dune to the immediate west have been previously surveyed without success (Section 5.2), and a number of houses have been built on the higher dune crest to the east. In the absence of adequate survey coverage it nevertheless remains possible that undetected Aboriginal sites, especially burials, may occur on the dune. Given the very dense vegetation and small size and unobtrusive nature of burials, the only method likely to reveal the presence of such sites would be the monitoring of land clearing operations.

9 SIGNIFICANCE ASSESSMENT

9.1 Management principles and the concept of significance

Assessments of the significance of cultural heritage sites and places are fundamental to their management. Significance can be assigned to particular sites or places, or to a grouping of sites and/or places within an area. The heritage value of a site or site grouping is taken to include its ‘aesthetic, historic, scientific or social significance, or other significance, for current and future generations of Australians’ (Australian Heritage Council Act 2003). With respect to Aboriginal sites and places, the two most important significance criteria are social and scientific.

While sites which are considered to be scientifically significant are usually also of significance to the Aboriginal community, others that may be of outstanding importance to the Aboriginal community may have little or no scientific value.

DEC management policies support the objective of conserving all significant Aboriginal sites/places as resources for research, vehicles for interpreting history and culture, and as elements in landscapes. The National Parks and Wildlife Act (1974) is designed to ensure that the Aboriginal cultural heritage resource is carefully managed, and that unmitigated destruction of archaeological material does not occur.

9.2 Significance of the study area

Aboriginal cultural/social significance

On the basis of advice received from the Kempsey LALC and Dunghutti Elders CAC (Section 4 and Appendix A) and the nil survey result, the study area is not known to contain any surviving sites or places of cultural/social significance to the Aboriginal community.

The Kempsey LALC and Dunghutti Elders CAC have advised that they consider Birrogun's grave natural mythological site (#22-4-35) to be adequately buffered by the South West Rocks Golf Course, and that residential development of the study area would have little further adverse effect on the spiritual qualities of this significant site.

Archaeological/scientific significance

No archaeological sites have been recorded in the study area, nor is there a high expectation that significant undetected sites will occur.

10 STATUTORY OBLIGATIONS

The **National Parks and Wildlife Act 1974** (as amended) provides the primary basis for the statutory protection and management of Aboriginal sites in NSW and the administration of legislation pertaining to sites is currently the responsibility of the Department of Environment and Conservation (DEC).

Under the terms of the National Parks and Wildlife Act an Aboriginal object is defined as-

> 'any deposit, object or material evidence, not being a handicraft made for sale, relating to indigenous and non-European habitation of the area that comprises NSW, being habitation both prior to and concurrent with the occupation of that area by persons of European extraction.'

In accordance with the Act an Aboriginal object may not be knowingly disturbed, defaced, damaged or destroyed without written authority from the DEC. The provisions apply to all Indigenous archaeological sites regardless of whether or not they have been registered with the DEC. If any proposed development will or is likely to damage, deface, desecrate or destroy an Aboriginal object, a Section 90 Heritage Impact Permit must first be granted by the DEC Director-General. Such a permit is normally only issued following review of a specialist report, consideration of the object's significance, advice from the local Aboriginal community and consideration of all alternative conservation options. Except where destruction of an object/group of objects is or will be demonstrably unavoidable, DEC policy is to require conservation in its original location and context.

11 MANAGEMENT RECOMMENDATIONS

The management recommendations presented in this section are designed to minimise future development impacts on Aboriginal heritage resources, and are based on-

- The provisions of the National Parks and Wildlife Act 1974, which states that it is an offence to knowingly disturb, deface, damage or destroy an Aboriginal object without an appropriate DEC permit;
- Advice from Kempsey Local Aboriginal Land Council and Dunghutti Elders Council Aboriginal Corporation representatives;
- Results of the DEC register search and background research into the history and archaeology of the South West Rocks area;
- Results of the field survey;
- The assessed significance of the study area;
- A consideration of the potential impact of the proposed future development on Aboriginal sites and values.

11.1 Potential undetected site locations

Although isolated artefacts lost or discarded during itinerant resource-gathering activities may occur in any part of the study area, any substantial undetected archaeological evidence is likely to be restricted in its distribution to the remnant Scribbly gum woodland south and south-east of the Sewage Treatment Plant, and the hind dune adjacent to Phillip Drive in the north-east. Both these areas are well vegetated, offer very little survey exposure, and have some potential to contain undisturbed archaeological sites. Aboriginal occupation sites are also possible on the low sand rise edging Saltwater Lagoon in Hat Head National Park.

Conservation of woodland vegetation in these potentially sensitive areas would concurrently offer protection to any undetected archaeological sites, and it is recommended that this factor be taken into account when development control measures are established for the study area.

11.2 Further archaeological assessments

The densely vegetated hind dune adjacent to Phillip Drive on the north-eastern corner is considered to have a higher level of archaeological potential than any other part of the study area, and provides no survey exposure off the narrow fire break behind the existing houses. Further survey or sub-surface investigation is highly unlikely to be effective and is not recommended.

To ensure that archaeological sites, and burials in particular, are not destroyed in the event that this dune is to be developed, it is instead recommended that Sites Officers from the Kempsey LALC and Dunghutti Elders CAC be engaged to monitor all initial construction-related earthworks (including vegetation clearing) on the vegetated section of dune.

Although only 15.6% of the study area was covered in the field, the survey included all substantial exposures likely to contain significant evidence. Due to the perceived low density of the archaeological resource and poor detection conditions in undisturbed areas, further survey work at Development Application stage would be unlikely to produce positive results. Providing the recommendations of this report are implemented and the legislative requirements of the National Parks and Wildlife Act (1974) are upheld, no further surface survey work is recommended in the study area.

11.3 Aboriginal concerns

The Kempsey LALC and Dunghutti Elders CAC have advised that they have no fundamental objections to future development of the study area providing: the existing Needlebark stringybark woodland fringing Saltwater Lagoon is retained in its current condition (given that the Lagoon margin may contain undisturbed occupation sites); and Aboriginal representatives are engaged to monitor initial earthworks (including vegetation clearing) on the north-eastern hind dune adjacent to Phillip Drive to ensure that burials are not accidentally destroyed (Appendix A).

11.4 General recommendations

Prior to the commencement of any vegetation clearing or construction activities associated with residential development of the study area, it is recommended that all construction contractors and their employees be advised of their legal obligations with regard to Aboriginal cultural materials. This advice should be given in writing and a copy forwarded to the DEC Northern Aboriginal Heritage Unit (Coffs Harbour) for its records.

Should any material evidence thought to be of Aboriginal origin be discovered or exposed during any stage of the development, work must immediately cease in that locality. The DEC, Kempsey LALC and Dunghutti Elders CAC should then be contacted for management advice and clearance given by these organisations before work resumes in the subject area

REFERENCES

Beaglehole, J.D. (ed) 1955 The Journal of James Cook Volume 1. The Voyage of the Endeavour, 1768-1771. Cambridge University Press.

Callaghan, M. 1980 *An analysis of the molluscan remains from the Macleay River midden sites*. BA (Hons) Thesis, University of New England.

Campbell, V. 1969 *A field survey of shell middens of the lower Macleay Valley, with reference to their possible and potential methods of investigation*. BA (Hons) Thesis, University of New England.

1978 *Ethnohistorical evidence on the diet and economy of the Aborigines of the Macleay River valley*. In I. McBryde (ed), Records of Times Past. Australian Institute of Aboriginal Studies, Canberra. Pp 82-100.

Carey, C. 1993 Tales of Trial Bay. An early History of South West Rocks. Jabiru Printing, Kempsey.

Cohen, N. 1997a *Correspondence from Neville Cohen to Wayne Sines, Chairperson, Kempsey Local Aboriginal Land Council.* Correspondence provided by Connell Wagner.

1997b *Correspondence from Neville Cohen to Wayne Sines, Chairperson, Kempsey Local Aboriginal Land Council.* Correspondence provided by Connell Wagner.

Coleman, J. 1978 *The analysis of vertebrate faunal remains from four shell middens in the lower Macleay district*. BA (Hons) Thesis, University of New England.

Collins, J. 1995 *Archaeological investigation and midden site conservation at proposed Waterview Heights Estate, South West Rocks*. Report to Randale Pty Ltd.

Collins, J. and S. Griffin 1993 *Archaeological and ground probing radar investigation of a proposed Aboriginal cemetery site at Spencerville, mid-north coastal NSW.* Report to Kempsey Shire Council.

Connah, G. 1975 *Current research at the Department of Prehistory and Archaeology, University of New England*. Australian Archaeology, 3:28-31.

1976 *Archaeology at the University of New England, 1975-6*. Australian Archaeology, 5:1-6.

Davis, S.J.M. 1987 The Archaeology of Animals. Batsford, United Kingdom.

Dowman, E.A. 1970 *Soils*. In Conservation in Field Archaeology. Methuen, London. Pp.7-34.

Eades, D. 1979 *Gumbaynggir*. In R.M.W. Dixon and B.J. Blake (eds), Handbook of Australian Languages. Australian Institute of Aboriginal Studies, Canberra. Pp.244-385.

Eddie, M. 2000 Macksville-Nambucca Soil Landscape Sheet 9436, 1:100,000. NSW Department of Land and Water Conservation.

Egloff, B. and J. Oxley 1989 *Aboriginal and prehistoric cultural resources. Kempsey Shire heritage study*. Report to Kempsey Shire Council.

Godwin, L. 1990 *Inside information: settlement and alliance in the late Holocene of northeastern NSW*. Unpublished Ph D Thesis, University of New England.

Gumbaynggir Language and Culture Group 1992 Gumbaynggir Yuludarra (Gumbaynggir Dreamings). Volume 1. Gumbaynggir Language and Culture Group, Nambucca Heads.

Hails, J. 1968 *The late Quaternary history of part of the mid-north coast, NSW, Australia*. Institute of British Geography, 44:133-147.

Henderson, J. 1851 Excursions and Adventures in NSW with Pictures of Squatting Life in the Bush. 2 Volumes. W. Shoberl, London.

Hiscock, P. 1988 *Prehistoric settlement patterns and artefact manufacture at Lawn Hill, northwest Queensland*. Unpublished Ph D Thesis, University of Queensland.

Hoddinott, W.G. 1978 *The languages and myths of the New England area*. In I McBryde (ed), Records of Times Past. Australian Institute of Aboriginal Studies, Canberra. Pp 52-64.

Hodgkinson, C. 1845 Australia from Port Macquarie to Moreton Bay. T and W Boone, London.

Hughes, P.J. 1979 *Excavation of Smoky Cape sites*. Report to the NSW National Parks and Wildlife Service.

Kempsey Local Aboriginal Land Council 1996 *Report of an archaeological survey of Lot 510 DP 850963 Waianbar Avenue, South West Rocks*. Correspondence held by the Kempsey LALC.

Knuckey, G. 1999 *A shell midden at Clybucca, near Kempsey, NSW*. Australian Archaeology, 48:1-11.

Long, A. 1998 *An assessment of scarred trees and a stone arrangement at Timbarra, Tenterfield, north east NSW*. Report to the National Parks and Wildlife Service.

Massie, R.G. 1846 *Macleay letter book No 1 and 2, 1842-1848*. Macleay Valley Historical Society archives.

Meehan, B. 1971 *The form, distribution and antiquity of Australian Aboriginal mortuary practices*. Unpublished MA Thesis, University of Sydney.

National Parks and Wildlife Service (NPWS) 1988 *Hat Head National Park, plan of management*. National Parks and Wildlife Service, Sydney.

Nayutah, J. and G. Finlay 1988 Our Land Our Spirit. Aboriginal Sites of the North Coast of NSW. North Coast Institute for Aboriginal Community Education, Lismore.

Parker, P. 2002 *A flora and fauna survey of Lots 509, DP 850963, 19 DP 882846 and 52 DP 831284 South West Roc*ks. Report to Saltwater Developments Pty Ltd.

Robinson, R. 1965 The Man Who Sold His Dreaming. Rigby, Sydney.

1989 The Nearest the White Man Gets. Aboriginal Narratives and Poems of NSW. Hale and Iremonger, Sydney.

Ryan, J.S. 1964 Land of Ulitarra. University of New England, Armidale.

Smith, H. 2001 *Report of a field inspection for Aboriginal sites on Lot 506, DP 827889 Phillip Drive, South West Rocks*. Report to Hill Top Planners.

Smythe, W.E. 1948 *Elementary grammar of the Gumbainggar language (north coast of NSW)*. Oceania Monograph No 8, University of Sydney.

Sullivan, M.E. 1982 *Aboriginal shell middens in the coastal landscape of NSW*. Unpublished Ph D Thesis, Australian National University.

Warren, R.E. 1990 *Predictive modelling in archaeology: a primer*. In K.M.S. Allen, S.W. Green and E.B.W. Zubrow (eds), Interpreting Space: GIS and Archaeology. Taylor and Francis, London. Pp 90-111.

GLOSSARY

ARCHAEOLOGICAL SITE
A place containing cultural materials of sufficient quality and quantity to allow inferences about human behaviour at that location (Plog *et al* 1978:383).

ARTEFACT
Any object having attributes as a consequence of human activity (Dunnell 1971).

BORA/CEREMONIAL GROUND
While there are a number of different types of Bora ground, most common on the north coast is that composed of one or a pair of raised earth circles ranging in size from two to 40m in diameter. The Bora ground functioned as a stage for various initiation rites (Byrne 1989:18).

DUNE
A moderately inclined to very steep ridge or hillock built up by the wind (Speight 1990:30).

ESTUARY
A stream channel close to its junction with the sea, where the action of channelled stream flow is modified by tides and waves (Speight 1990:30).

HOLOCENE
The most recent epoch of geological time; the upper division of the Quaternary Period (Lapidus 1987:274).

PLAIN
A large very gently inclined or level element, of unspecified geomorphological agent or mode of activity (Speight 1990:32).

SWAMP
An almost level, closed, or almost closed depression with a seasonal or permanent water table at or above the surface, commonly aggraded by overbank stream flow (Speight 1990:33).

Glossary References

Byrne, D. 1989 Aboriginal Heritage of the North Coast. A Discussion Paper. Department of Planning, Grafton.

Dunnell, R.C. 1971 Systematics in Prehistory. Free Press, New York.

Lapidus, D.F. 1987 Dictionary of Geology. Collins, London.

Plog, S., F. Plog and W. Wait 1978 *Decision making in modern surveys*. In M. Schiffer

(ed), Advances in Archaeological Method and Theory, 1:383-421.

Speight, J.G. 1990 *Landform.* In R.C. McDonald, R.F. Isbell, J.G. Speight, J. Walker and M.S. Hopkins (eds), Australian Soil and Land Survey: Field Handbook. Second Edition. Inkata Press, Sydney. Pp.9-57.

APPENDIX A:

Correspondence from the Kempsey Local Aboriginal Land Council
and Dunghutti Elders Council Aboriginal Corporation

APPENDIX B:

Field survey report from Figtree Aboriginal community representative Greg Blair