Shoalhaven City Council


Desktop Landfill Site Identification Study

prepared for **Shoalhaven City Council**

by Locale Consulting

in association with

Environment & Natural Resource Solutions

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Executive Summary

Locale Consulting was engaged by Shoalhaven City Council's Waste Services Unit to undertake a desktop Study to identify a number of potential sites for a new landfill waste management facility. A new landfill is required to cater for the long-term needs of the Shoalhaven community, with the existing facility at 120 Flatrock Road, Mundamia (known as the West Nowra Recycling and Waste Facility) being assessed as only having 10 years' capacity remaining at the current rate of demand. This study forms an initial process of site identification to enable Council to undertake subsequent on-site investigations and detailed studies to confirm a preferred site at which detailed design and appropriate approvals can be pursued.

The Study has been undertaken utilising a three stage methodology, generally based on various best practice guidance, with additional localised criteria with an aim to best meet the needs of Council and the Shoalhaven community. The three stage methodology entailed:

- Stage 1: Review and elimination of key environmental and urban residential land, including buffers in accordance with best practice guidance (stage undertaken by Council);
- Stage 2: Review of remaining areas and elimination of land based on additional criteria including:
    - Heritage listings and scenic areas as identified in Shoalhaven LEP 2014;
    - Permeable soils (Quaternary geology groups);
    - Drinking water catchments;
    - Low lying land (potential of ground water contamination);
    - Operational accessibility (travel time and road safety); and
    - Other localised issues such as clusters of rural residential land, buffers to airports and other isolated and difficult to access terrain.
- Stage 3: Comparative review of remaining 10-12 sites in addition to the retention and expansion of the existing West Nowra Recycling and Waste Facility.

Initial consultation was made with the Federal Department of Defence, a number of State Government stakeholders, as well as groups internally within Council, including Shoalhaven Water and Strategic Planning. Consideration of their early feedback has been made during the application of the above methodology.

Outcomes of the work indicate three/four sites being potentially suitable, all of which are centrally located with a relatively high degree of separation from sensitive use, whilst maintaining a high level of access to key transportation routes including the Princes Highway. These sites are:

- South Nowra: Being the "preferred site" comprising of land adjoining the Nowra Rifle Club off Warra Warra Road to the south-east of the South Nowra industrial area. The area is partly Crown land and partly privately owned with a relatively high degree of separation from residential areas, very high quality access from a newly completed round-a-bout on the Princes Highway. The area potentially suitable for development of a landfill is relatively large, increasing the capacity for the future facility to be designed around any encumbrances identified in detailed studies;
- Blackbutt Range Road, Tomerong: Being a secondary preferred site, comprising of land to the south of Blackbutt Range Road with good access from Princes Highway. The site is owned in part by State Forests and partly by private owners, with good separation from residential areas but requiring access directly from the Princes Highway; and
- Turpentine Road, Tomerong: Being another secondary option with two areas being identified with potential along Turpentine Road. Sites are located to the north of the road at eastern end (near Princes Highway), or to the south of the road further west. Good existing access arrangements are available to the Princes Highway, through road access (steepness) and amenity issues will need to be further considered in detail. The options are large areas within which multiple suitable sites may be available, including Crown land.

In addition to these sites which ranked highly, other sites also retain potential should detailed studies identify key issues with the above areas.

In parallel with consideration of a potential new landfill site (which will require long lead times for approval and operations), options should also be investigated at the existing West Nowra landfill site to significantly prolong its lifespan by utilising the existing vegetated parcel in the south-eastern portion and relocating the existing animal shelter, which is located on land appropriately zoned for waste management purposes. Council is currently undertaking a detailed Environmental Impact Statement (EIS) for a Resource Recovery Park at the site and this will have implications for longer-term use through application of siting principles and biodiversity offsets.

The Study demonstrates that a number of sites are potentially available for use as a putrescible solid waste landfill, and that through careful site planning and effective communication with key stakeholders, the long-term landfill needs of the Shoalhaven community can be met in a responsible and effective way.

1. Introduction

1.1 Project Overview

Locale Consulting, in association with Environment & Natural Resource Solutions (**the Consultants**), were engaged by Shoalhaven City Council (**Council**) to undertake a desktop study to identify a number of potential sites for a new putrescible landfill waste management facility (**the Study**). A new landfill is required to cater for the long-term needs of the Shoalhaven community, with the existing facility at 120 Flatrock Road, Mundamia (known as the West Nowra Recycling and Waste Facility) being assessed as only having 10 years capacity remaining at the current rate of demand. This study forms the first stage of site identification, with subsequent on-site investigations needing to be undertaken to confirm site suitability.

1.2 Purpose of the Study

This study provides an assessment of planning, environmental and other considerations that are likely to exclude land as being suitable for use as a new landfill. The Study is desk-top based and utilises data provided by Council and others, as well as local knowledge of the locality and the practical requirements for such a facility.

The Report is divided into five key sections as follows:

- Section 1: Introduction – being this section, which provides background information and rationale for the need for the project;
- Section 2: Initial Consultation – provides an overview of consultation activities undertaken during the preparation of the Study including comments received and how these have been considered;
- Section 3: Methodology and Assessment – outlines the process undertaken in preparing the site assessment study, including the assumptions and considerations on an issue by issue basis and how these have been used to exclude land from further assessment;
- Section 4: Site Specific Comparative Review – provides a more detailed assessment of areas of land which are more likely to be suitable, subject to on-site assessment, including a comparative ranking of these sites; and
- Section 5: Conclusions and Recommendations - provides a summary of key outcomes and recommendations for further work to be undertaken to confirm suitability of land for the stated purpose.

1.3 Existing Situation and Need for New Facility

Waste management in the Shoalhaven Local Government Area (**LGA**) is serviced by Council and its contractors. At present the main solid waste (putrescible) landfill site is located at 120 Flatrock Road, Mundamia. This site services the putrescible and non-putrescible landfill needs for the LGA. The facility is publicly accessible and is also serviced by nine waste transfer stations located throughout the LGA, as well as the domestic collection service. One of the nine waster transfer stations also accommodates a smaller solid waste (non-putrescible) landfill, being located at 235 Huskisson Road, Huskisson. The location of existing waste facilities are shown in Figure 1.

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Client:	Shoalhaven City Council
Scale:	As shown
Revision:	0

Drawing: **Waste Transfer and Landfill Locations**

Figure 1

The existing landfill site is located approximately 7.5km by road to the west of Nowra and is commonly referred to as the "West Nowra Recycling and Waste Facility". The site is located over a series of allotments, utilising a large portion of the total site area, with a 14.5ha site remaining undeveloped and covered in native vegetation in the south-eastern corner. Part of this vegetated area has been identified for use as a Resource Recovery Park (**RRP**) to minimise the amount of waste going to landfill with the remainder potentially being identified for environmental offset purposes[1].

The existing landfill has been assessed by Council as having a landfilling capacity of approximately 10 years based on current landfilling quantities, which are currently approximately 62,000 tonnes per annum. With the introduction of the proposed RRP the extent of waste to landfill is anticipated to be reduced, though the extent that this may assist in extending the life of the existing landfill facility will need to be monitored over time and is subject to the recycling technology chosen. Further details and consideration of the future use of the existing West Nowra landfill is provided in Section 3.4.

In general terms, Council's current view is to maintain the existing model of having a single primary landfill site serviced by a series of waste transfer stations. Given the potential for the existing facility to reach capacity in the medium term, it is considered prudent to commence initial planning at the current time to identify potential sites for a new landfill to be developed.

1.4 Type of Waste Facility Envisaged

The purpose of this Study is to identify possible locations for a new landfill facility. For the purpose of determining the appropriate attributes of a new site, the following assumptions have been made about the type of facility to be developed:

- A minimum capacity to cater for demand over a 25 years period based on:
  - Estimated annual landfilled waste of 62,000 tonnes per year (whilst this level has been increasing, a consistent figure has been used as savings on this level can be assumed through additional processing measures such as the RRP);
  - Minimum waste compaction density of 0.85 tonnes per cubic metre;
  - Overall landfill site cross-sectional area of ~5,500m^2 (max 400m wide x 16m high x 0.87 efficiency);
  - Minimum landfill site area over 25 year period of ~14-15ha;
  - Approximate stockpiling areas of ~10ha;
  - Approximate areas of roads, building and other necessary infrastructure of ~8ha;
  - Buffer and contingency areas of 20-40%;
  - Total minimum land area of 40ha.
- Be suitable for scheduled activities under the *Protection of the Environment Operations Act* 1997 including:
  - Landfilling of general solid waste (putrescible and non-putrescible);
  - Landfilling of small quantities of hazardous (asbestos) and special wastes (tyres);
  - Waste processing and treatment; and
  - Storing, stockpiling and recycling within the site.

The facility is assumed to operate in a similar fashion to the existing West Nowra landfill site, being the only Council putrescible landfill in the LGA and being serviced by waste transfer stations in other localities.

[1] Draft Shoalhaven City Council West Nowra Resource Recovery Park Environmental Impact Statement: Volume 2 Appendix H – Flora and Fauna Assessment (GHD April 2014)

1.5 Background and Existing Information

1.5.1 Overarching Council Requirements

Council's overarching policy for delivery of services is encapsulated in the *Community Strategic Plan – Shoalhaven 2023* (**CSP**). The CSP identifies within its "Place" chapter, Strategy 2.4.6 relating directly to the management of landfill operations and the consideration of future landfill options. The *Delivery Program and Operational Plan 2013/2017* provides further details, with the Waste Services Unit being responsible for the appointment of a consultant to undertake a site identification study (Activity 4.2.6.3). This Study delivers on this activity.

1.5.2 Council's Waste Services Unit

Council's Waste Services Unit is responsible for the delivery of waste services and the implementation of Council policies and strategies in this area. In 2013 the Council commissioned a Waste Survey[2] to better understand the views of Shoalhaven residents with respect to waste issues. The survey included questions relating to the capacity of the West Nowra landfill and potential to externalise waste by taking it to another LGA for disposal. Despite being told that there is currently no alternative site available, less than a quarter of respondents supported the concept of disposing of waste outside of the LGA. Conversely almost 40% did not support such as proposal. This suggests that there is broad support for the concept of waste that is generated within the LGA also being disposed of in the same location. This outcome also suggests that preliminary planning such as the preparation of this Study will be necessary in the short to medium term to enable a new site to be identified and developed within the next 10 years.

1.5.3 Local Land-Use Planning Requirements

Council's Local Environmental Plan (**Shoalhaven LEP**) 2014 was gazetted in April 2014 and provides the basis for land use planning in the LGA. A landfill of the nature being considered in this document is defined as a *Waste or resource management facility* and is permissible in a number of zones as a consequence of requirements under *State Environmental Planning Policy (Infrastructure)*, including rural zones RU1 (*Primary Production*) and RU2 (*Rural Landscape*) and industrial zones IN1 (*General Industrial)* and IN3 (*Heavy Industrial)*[3]. The use is also permissible under the industrial zone IN2 (*Light Industrial*) as well as in the special purpose activity and infrastructure zones (SP1 and SP2) where annotated with such uses (as is the case for existing West Nowra landfill for example). Should land in other zones be identified as being suitable, a "Planning Proposal" (rezoning) could be undertaken to modify the land use zone to enable such a development to be permissible with consent.

Council is in the process of preparing a consolidated Development Control Plan (**DCP**) for the LGA. Existing DCPs and the consolidated version when adopted are unlikely to directly relate to the development of a landfill site, however there are some waste related controls such as the current DCP 93 relating to waste minimisation generally associated with any development. Council also applies their Contaminated Land Policy to the consideration of development applications, however it again does not specifically consider site selection of landfill development.

[2] Shoalhaven City Council – Waste Survey 2013 by IRIS Research (Final Report - December 2013)

[3] It is noted that Council does not currently have land zoned for IN3 – Heavy Industrial in the LGA

1.5.4 State Planning Requirements

There are a number of key planning and operational requirements at the State level. Waste management is generally overseen by the Environmental Protection Authority (**EPA**) who are responsible for the licencing and operation of these types of facilities under the *Protection of the Environment Operations Act* 1997. State Environmental Planning Policies (**SEPPs**), and particularly SEPP (Infrastructure) 2007, provides the key requirements for locating landfill facilities. Clause 123 of SEPP (Infrastructure) specifically relates to the development of waste disposal projects including landfills, and includes the following matters that must be considered in determining a development application:

(a) whether there is a suitable level of recovery of waste, such as by using alternative waste treatment or the composting of food and garden waste, so that the amount of waste is minimised before it is placed in the landfill, and

(b) whether the development:

> *(i) adopts best practice landfill design and operation, and*
>
> *(ii) reduces the long term impacts of the disposal of waste, such as greenhouse gas emissions or the offsite impact of odours, by maximising landfill gas capture and energy recovery, and*

(c) if the development relates to a new or expanded landfill:

> *(i) whether the land on which the development is located is degraded land such as a disused mine site, and*
>
> *(ii) whether the development is located so as to avoid land use conflicts, including whether it is consistent with any regional planning strategies or locational principles included in the publication EIS Guideline: Landfilling (Department of Planning, 1996), as in force from time to time, and*

(d) whether transport links to the landfill are optimised to reduce the environmental and social impacts associated with transporting waste to the landfill.

These requirements are further considered during the site selection processes undertaken in Sections 3 and 4 of this Study. The *EIS Guideline: Landfilling* is also reviewed below.

1.5.5 Best Practice Guidance

There are a number of best practice guides for the site selection of landfill locations. In NSW these include two companion guidelines that were published in 1996 but remain current (including being referenced by current legislation as described above). For comparative purposes, consideration has also been given to the more recent Victorian best practice guide published in 2010. These three guides are outlined below and form the basis of siting considerations for this Study.

EIS Guidelines for Landfilling - NSW Department of Urban Affairs and Planning (1996)

This *EIS Guidelines for Landfilling* (**EIS Guidelines**) identify important factors to be considered when preparing an environmental impact statement (**EIS**). Whilst not at the EIS stage at present, the EIS Guidelines highlights that there should be "*an early evaluation of alternatives*" which take into consideration factors identified in Part 4 of the document relating to "site selection procedures". This Study draws on this section, and others, to inform the site identification process.

Environmental Guidelines: Solid Waste Landfills - NSW Environmental Protection Authority (1996)

The *Environmental Guidelines: Solid Waste Landfills* (**Environmental Guidelines**) were developed as companion guidelines with the EIS Guidelines outlined above. While the EIS Guidelines provide advice about landfill site selection and the environmental assessment of new landfill proposals, the Environmental

Guidelines focus on the environmental management of landfills. While environmental management typically infers operational matters, the Environmental Guidelines are clear that many issues need to be considered both 'up front' during the planning process as well as during subsequent operation.

Best Practice Environmental Management for the Siting, Design, Operation and Rehabilitation of Landfills – Victorian EPA (2010)

As the title suggests, the Victorian Best Practice guide provides an all-encompassing document associated with the siting, design, operation and rehabilitation of landfill sites. The document highlights the "*first and most important consideration in the prevention of environmental impacts from landfill is selection of an appropriate landfill site*". A specific chapter is dedicated to "best-practice siting considerations", and given the more recent nature of this document, these considerations have been combined with those in the two NSW documents above to determine an appropriate assessment methodology.

2. Initial Consultation

Initial consultation has been undertaken with State Agencies and Council relating to the development of this Study. Further consultation is recommended as the project progresses to more detailed site studies and other considerations. This section provides an overview of preliminary consultations that have been undertaken as part of this Study.

2.1 Council Consultation

Formal meetings were conducted with Council on 16 April and 4 June 2014 regarding the project, being an Inception Meeting and Review Meeting respectively. These meetings were attended by staff from the Waste Services Unit and Strategic Planning. The Inception Meeting provided a range of background information and discussions relating to the project in general terms. The Review Meeting was designed to provide an overview of the methodology used to determine preferred sites, along with the practical application of the methodology to illustrate the resulting outcomes. This provided a sounding board approach with Council to ensure all issues had been addressed to an appropriate level of detail consistent with the desktop approach being utilised.

Council staff were also consulted on relevant matters during the preparation of the draft Study and are outlined below.

2.1.1 Shoalhaven Water

According to Shoalhaven Water[4], Council has responsibility for water and sewerage services for the Shoalhaven LGA and exercises their water supply and sewerage functions under the *Local Government Act* 1993. Council meets these responsibilities and delivers water and sewerage services through Shoalhaven Water, a defined Business Group of Council.

Shoalhaven Water were contacted to ensure that appropriate allowances were made to avoid potential for contamination of drinking water catchments among other issues. The consultants were advised that water supply storage dams and their catchments should be avoided. These include:

- Danjera Dam near Yalwal around 20km to the south-west of Nowra;
- Bamarang Dam around 10km to the south-west of Nowra;
- Porters Creek Dam around 10km to the west of Lake Conjola; and
- Cambewarra Dam.

Shoalhaven Water also suggested that sites should be clear of water supply infrastructure and that given the early stage of consideration, they would need to be further consulted as the project progresses. An additional meeting was held with Shoalhaven Water to discuss the potential sites, particularly where they potentially impact on water or sewer infrastructure. Outcomes of this meeting are addressed in the site specific reviews in Section 4.

2.1.2 Strategic Planning

Council's Strategic Planning Section were consulted at a number of stages as follows:

- During initial consultation by Council Waste Services Unit to identify land that was unsuitable for locating the proposed facility (see Section 3.2 for further details);
- During the procurement of data for the project; and

[4] Shoalhaven Water Strategic Business Plan 2011-2012

- In considering the sites/areas that were identified as potential sites after the preliminary land exclusion processes (see Section 3.3 for further details).

With respect to the 10 sites/areas identified by the consultants as not being excluded for reasons as described in Section 3.3, Council's Strategic Planning Staff provided review comments which have been considered in Section 4.

2.2 State Agency Consultation

State Agencies with a potential relationship to the project were contacted by email/letter requesting any input that they may have at this early stage of the project. Agencies contacted included:

- NSW Environmental Protection Agency;
- Office of Environment & Heritage;
- NSW Planning & Environment;
- Local Land Services;
- Road & Maritime Authority; and
- Crown Lands Division.

Where a response was received a summary is provided below. Council have indicated that these agencies will continue to be consulted as furthered detailed studies are undertaken to determine a future site.

2.2.1 NSW Planning & Environment

Comment was received from NSW Planning & Environment (**NSW P&E**) (formerly Planning & Infrastructure) highlighting the extensive new areas of residential and business zoned land as part of the recently gazetted Shoalhaven LEP 2014. Key issues raised in their response include:

- The need to consider access and transport arrangements at an early stage;
- Separation from existing and planned urban areas, as well as important environmental, agricultural and extractive resource areas; and
- The need for further consultation with the Nowra Bomaderry Project Control Group, of which they are a member, as well as the community in general.

Reference is also made to the 1996 EIS Guidelines and Environmental Guidelines as discussed in Section 1.5.5.

2.2.2 Local Land Services

Comment was received from South East Local Land Services (**LLS**) who note that they are an approval authority for the clearing native vegetation as well as being responsible for the implementation of objectives under the *Native Vegetation Act* 2003 (**NV Act**). Particular objectives noted by LLS include:

- Preventing broadscale clearing unless it improves or maintains environmental outcomes; and
- Protecting native vegetation of high conservation value having regard to its contribution to such matters as water quality, biodiversity, or the prevention of salinity or land degradation.

LLS advises that consideration should be given to whether the NV Act applies to the proposal which will depend on the specific circumstances of the site and would be considered in further detail as the project progresses.

2.2.3 Roads & Maritime Services

The Roads & Maritime Services (**RMS**) response highlighted the need for careful consideration to be given to the suitability of the vehicular access arrangements in the site selection process. RMS specifically recommended the consideration of the following matters:

- That in the first instance, access should preferably be from a local road and not from a classified road (i.e. the Princes Highway);
- Compliance of the access arrangements (at the connection to the classified road network) with relevant Austroads guidelines (two key elements highlighted were sight distance and the intersection treatment/type);
- Need for detailed traffic analysis to assess any chosen site - this may be appropriate at an earlier stage than during final site selection; and
- The cost of providing intersection treatments and complying with sight distance requirements (or even if these are possible).

RMS indicate the desire to be further consulted once site options have been identified and the above assessments have been broadly applied to the site specific assessments at Section 4.2.5 and 4.2.6.

2.2.4 Office of Environment & Heritage

Office of Environment & Heritage (**OEH**) highlighted a number of points that required consideration. Their initial consideration was to avoid areas of known environmentally sensitive land, typically identified in the Shoalhaven LEP 2014. Other matters identified included:

- Avoiding sensitive land uses so as to minimise potential for impacts from noise, odour and the like;
- Avoiding areas of known threatened species including consulting the NSW Wildlife Atlas, OEH principles for the use of biodiversity offsets, EEC mapping (provided by Council) and avoiding areas of wildlife corridors and other environmentally sensitive areas of land identified in regional strategies and the like;
- Having regard to areas with the likelihood of objects and places of Aboriginal cultural heritage significance; and
- To include consideration of flood hazard and risk associated with flow paths through any identified potential site.

Additional information and resources to consider during the process were provided as attachments to the OEH response. Many of these issues have been addressed in the site selection process, particularly in terms of the broadscale exclusion of known environmental land and areas of flood potential. Others would be subject to more detailed site assessments going forward. Where available, records of threatened species and identification of habitat corridors and other environmental constraints have been identified on a site by site basis in Section 4.2.2.

2.3 Department of Defence Consultation

The Royal Australian Navy (**RAN**) has a long and celebrated connection with the Shoalhaven region where both the HMAS Albatross and HMAS Creswell bases are located[5]. Council has openly supported the presence of the RAN in the area and has over a number of years sought to protect its interests (and particularly the HMAS Albatross air field) through appropriate land use planning controls.

[5] Noting that HMAS Creswell is physically located in the adjoining Jervis Bay Territory (Federal jurisdiction), though has a close relationship with surrounding towns and villages of the Shoalhaven.

Contact was made with the Federal Department of Defence (**Defence**) with respect to the Study and the need for buffers to be applied around HMAS Albatross to protect the area from the potential for bird strike. Defence's Land Estate Planning Branch advised that their current policy for buffer distances to avoid bird strike associated with putrescible waste facilities is a recommended distance of 13km from the airport runway. It is noted that the existing facility is located approximately 5.5km from the nearest runway.

Given the early stage of site selection and planning, Defence indicate a preference for a precautionary approach in applying this maximum. This area is described on the Department of Defence issued plan in Figure 4 at Appendix A. Defence also advised that this would be the case for the HMAS Creswell air field in the neighbouring Jervis Bay Territory. Further consideration of setbacks from airports is provided in Section 3.3.4. Further consultation with Defence would be required to justify selection of areas below this maximum distance.

3. Methodology and Assessment

3.1 Methodology Overview

The Study has been undertaken as a desktop exercise utilising existing information from Council and other sources where available. The general basis of the methodology is as recommended in the Victorian Best Practice guide[6], which identified a two-step process as follows:

- *broad identification of candidate sites for a new landfill from a wider range of all possible sites; and*
- *ranking of the candidate sites in terms of their preference for use as a landfill.*

Based on information available and the project brief of Council, this two-step process has been interpreted into three stages as follows:

- Stage 1: Initial review by Council of areas considered to be unsuitable for development of a landfill due to known environmental and flood constraints, and the presence of residential development and the HMAS Albatross air field (including associated buffers where applicable);
- Stage 2: Secondary review by the consultants of areas considered to be unsuitable for development of a landfill due to additional environmental and socio-economic reasons; and
- Stage 3: Comparative analysis of potential sites as determined by Stage 1 and 2 above.

Outcomes of Stages 1 and 2 are provided in Sections 3.2 and 3.3 respectively, with the comparative analysis (Stage 3) presented in Section 4 of this Study. Recommendations based on this three stage assessment are then provided in Section 5.

3.2 Stage 1: Initial Review of Unsuitable Land

Council undertook a review of land within the LGA that is deemed unsuitable based on the following criteria:

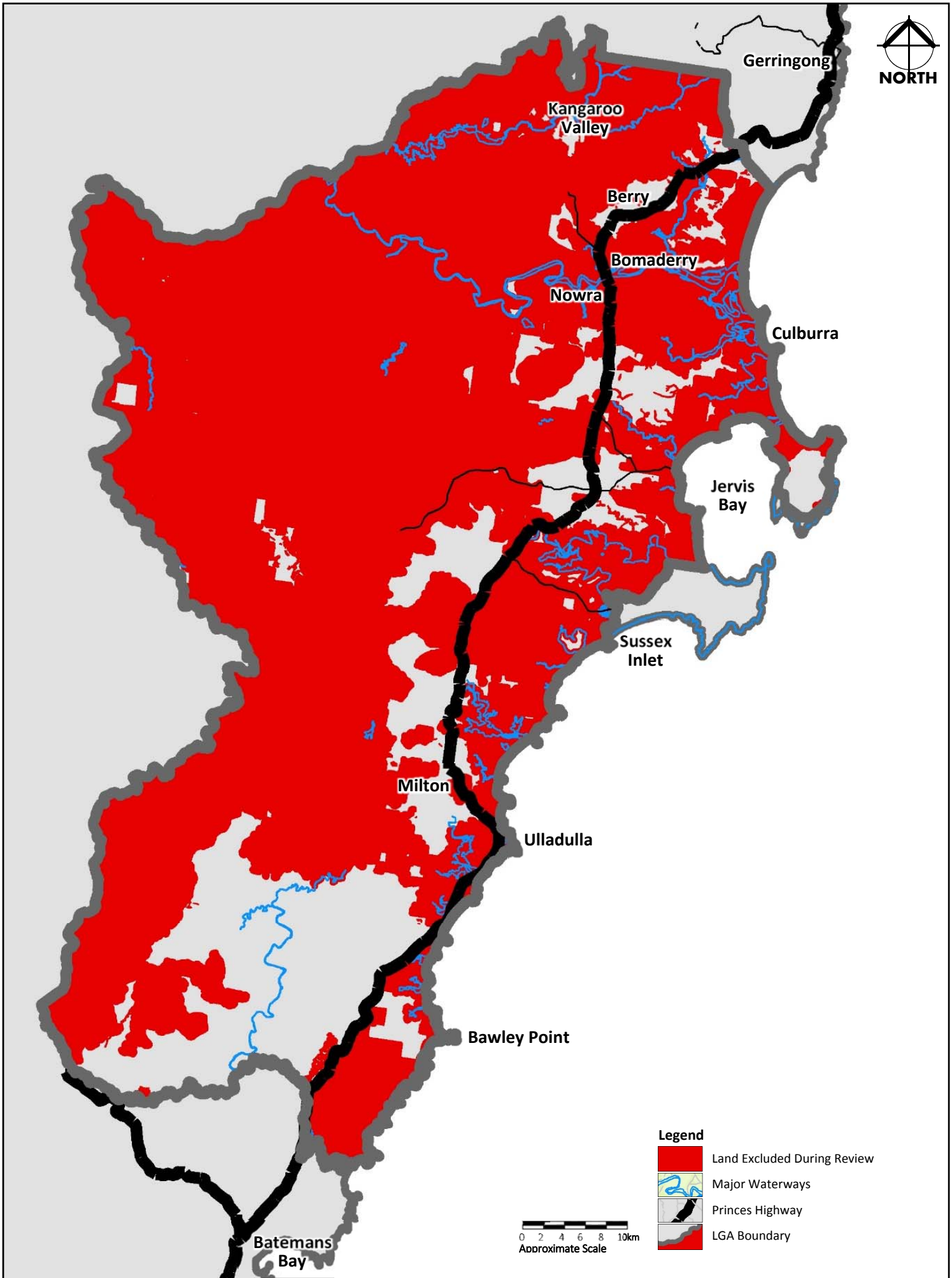
- HMAS Albatross Air Field (and including a 1km buffer zone – see section 3.3.4 for further comments);
- Areas identified as national parks or nature reserves (and including a 250m buffer zone);
- Land zoned as residential (including 250m buffer zone);
- Land identified as part of the *Jervis Bay Regional Environment Plan* and *Illawarra Regional Environment Plan* habitat corridors;
- Land identified as being SEPP 14 Wetlands or SEPP 62 Littoral Rainforests;
- Indicative areas of Endangered Ecological Communities;
- Areas located within the 1:100 year flood overlay; and
- Environmental zones as identified in Shoalhaven LEP 2014.

The criteria applied are generally in accordance with those identified in Table 1 of the EIS Guidelines, which identifies land considered to be "Environmentally Sensitive". The outcome of this stage is mapped in Figure 2.

3.2.1 Stage 1 Review

In addition to the areas identified in Council's review above, additional areas considered to be residential or urban in nature were identified, as well as areas of environmental zones as part of the *Shoalhaven LEP (Jerberra Estate) 2014*. These areas were also removed and highlighted in Figure 5 at Appendix A.

[6] Best Practice Environmental Management for the Siting, Design, Operation and Rehabilitation of Landfills – Victorian EPA (2010)



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Revision:	0

Drawing: **Land Excluded Under Initial Council Review**

Figure 2

3.3 Stage 2: Secondary Review of Unsuitable Land

The consultants undertook an additional broadscale review of land to further identify areas that are considered to be unsuitable for development of a landfill based on additional criteria identified in best practice guides and other practical issues, such as slope, proximity to clusters of rural residential housing, elevation above sea level and underlying geology. Due to the vast size of the LGA (being more than 4,500km^2), some criteria have been applied to determine general areas that are not considered to represent a feasible opportunity rather than being definitive. These criteria have been extrapolated from best practice guidance or from responses provided to initial consultations such as accessibility (see Section 2 for further details).

Criteria for exclusion of land and the resulting areas to be excluded are identified on an issue by issue basis in the sub-sections below.

3.3.1 Heritage Areas

Areas listed in Council's LEP 2014 as being heritage items (national, state or local) were identified and excluded consistent with Table 1 of the EIS Guidelines. These areas include a number of large tracts of rural land, particularly around Milton, but also around other localities such as Berry and Kangaroo Valley. Many heritage listed items are located in urban areas and have previously been excluded.

Areas that were excluded due to their Heritage values are identified in Figure 6 at Appendix A.

3.3.2 Scenic Areas

Areas listed in Council's LEP 2014 as being of scenic importance were identified and excluded consistent with Table 1 of the EIS Guidelines. These areas include a number of large tracts of rural land, particularly around Milton, but also around other localities such as Berry and Kangaroo Valley.

Areas that were excluded due to their scenic importance areas are identified in Figure 7 at Appendix A.

3.3.3 Drinking Water Catchments

The Sydney Catchment Authority (**SCA**) manages impacts associated with Sydney's drinking water catchments. Development in these catchments are required to meet the requirements of *SEPP (Sydney Drinking Water Catchment)* 2011, in particular to have a sustainable neutral or beneficial effect on water quality (referred to as NorBE). Catchment areas in or associated with the Shoalhaven include Fitzroy Falls Reservoir, Tallowa Dam and the Wingecarribee Reservoir.

Table 1 of the EIS Guidelines specifically identifies these areas and recommends a buffer of 3km from these water storage areas. However given other constraints also apply to these relatively isolated areas, it is considered to be prudent to exclude all drinking water catchment areas identified by SCA.

SCA drinking water catchment areas are identified in Figure 8 at Appendix A, and have been excluded from further consideration.

3.3.4 Separation from Air Fields (Bird Strike)

Separation of air fields or airports is important to avoid the incidence of 'bird strike' – that is conflict between birds and moving aircraft. Conflict between birds and aircraft can have significant impacts (both for life and property) and separation between air fields and bird attracting uses, such as putrescible landfill (where food and like waste products attract birds), is particularly important.

In the Shoalhaven LGA there are air fields at HMAS Albatross (and HMAS Creswell in the adjoining Jervis Bay Territory) which is used by a range of naval and other Defence aircraft, as well as a small air field south of

Berry (Jaspers Brush) which is primarily used by propeller driven air craft. Two other disused air fields were identified near Huskisson and Cambewarra but have been excluded from consideration due to their lack of use.

As identified in Section 2.3, Defence advice identifies a precautionary approach whereby they would apply a buffer of 13km for both the HMAS Albatross and HMAS Creswell air fields and this should be considered as a preferable outcome. However the National Airports Safeguarding Framework, agreed upon by State and Federal Transport Ministers in May 2012, provides for a national framework on aviation issues including separation of facilities from landfill sites. Attachment 1 of *Guideline C – Managing the risk of wildlife strikes in the vicinity of airports*, sets out land use types and recommended setbacks. This guideline suggests landfill facilities are inappropriate within 3km of airports, with mitigation measures being necessary within 8km, and monitoring to take place within 13km. The Victorian Best Practice guide further suggests that buffer distances can be differentiated between jet and propeller driver air craft, further reducing the buffer distances around propeller driven air fields to 1.5km.

As such, a minimum 3km buffer from HMAS Albatross and HMAS Creswell and a 1.5km buffer from the Jaspers Brush air field has been applied at this stage of the project. The policy position of Defence should be noted and will need to be further detailed in subsequent stages where sites are located within 8km or 13km of these sites.

Airfields and buffer areas are identified in Figure 9 at Appendix A.

3.3.5 Regional Geology

Areas mapped as Quaternary age deposits consisting of unconsolidated sediments have been excluded from consideration due to their permeable characteristics and risk of leachate entering groundwater systems. Areas of Quaternary deposits have been identified utilising the NSW coastal Quaternary geology (1:25,000) data pack (Troedson & Hashimoto 2005) which was compiled as part of the NSW Government's Comprehensive Coastal Assessment initiative. Large areas around Berry and the northern portion of the LGA were subject to these conditions.

Quaternary deposit areas are identified in Figure 10 at Appendix A.

3.3.6 Elevation above Sea Level

Elevation is an important consideration to ensure there is a satisfactory buffer between landfill sites and any underlying groundwater, noting the landfill cells are commonly located in excavations that are lower than the natural ground level. For the purposes of initial assessment, a level of 30m AHD has been identified and excluded as an initially conservative level to avoid potential for ground water contamination. It should be noted that the West Nowra Recycling and Waste Facility is positioned on ground with an elevation greater than 40m AHD. It is recommended that the site elevation and groundwater systems be further reviewed at the site specific level during the next stage of detailed studies.

The adopted buffer level is shown in Figure 11 at Appendix A, generally accords with Quaternary deposits and flood areas which have previously been excluded in Stage 1 and Section 3.3.5 respectively.

3.3.7 Topography / Steep Slopes

For the purposes of the Study, areas with a slope greater than 15^{o} have been considered as unsuitably 'steep'. These steep areas were identified and excluded due to difficult working terrain, access issues and drainage potential. Whilst this criteria results in fragmentation of many allotments, it provides a clear indication of areas of rugged landform that are unlikely to be suitable for landfilling.

Areas with slope above 15 degrees have been removed from consideration and are shown in Figure 12 at Appendix A.

3.3.8 Operational Accessibility

Important to the practical operation of any long-term landfill is the site's accessibility, both for trucks delivering waste (transfer and domestic collection), and for general public utilising the site on an ad-hoc basis. Operational accessibility is sometimes referred to as the "economic radius" or "haulage cost" whereby the distance (and therefore cost) of access can become an impost on Council and ratepayers/customers. There are three key considerations with respect to the distance and accessibility requirements:

Geographic access to the site for ongoing waste delivery/transfer: that is accessibility for trucks transferring or delivering waster to the site, typically from transfer stations or domestic/commercial waste collection. Accessibility is important for economic and environmental efficiencies – that is by minimising distances needed to be travelled by such vehicles and reducing travel time/cost and therefore associated transport emissions.

Geographic access to the site for ad-hoc users: A key ongoing issue for many local governments is the balance between accessibility / cost of disposal and the risk of illegal dumping. While cost of waste disposal is not a direct consideration at the initial site planning phase, the distance for servicing can be an issue, particularly for waste streams that cannot be accepted at waste transfer stations (such as hazardous items like asbestos).

Practical access to the site: in addition to the geographic accessibility to landfill sites, practical access is also an issue, such as having roads of an appropriate standard for travel and avoiding travel to areas with steep and winding roads. Areas such as Kangaroo Valley, Sassafras and to a lesser extent areas south of the St Georges Basin turn-off from the Princes Highway (i.e. south of the upgraded sections) are more likely to meet this criteria.

Given the majority of the population is located in the northern part of the LGA (primarily the Nowra/Bomaderry urban area with around 54% of the overall population) and a further quarter of the population is located in and around the Bay and Basin area, it is logical that the primary landfill facility for the LGA be located in close proximity to the main population centres of Nowra/Bomaderry and preferably between there and the Bay and Basin. Locations beyond 30 minutes from Nowra have therefore been excluded, generally being anywhere to the south of the Conjola State Forest, which also coincides with worsening road conditions in terms of winding and steep sections of the Princes Highway.

Two levels of accessibility has been defined in Figure 13 of Appendix A, one based on areas that are not considered to be have acceptable accessibility due to road conditions and a second level of accessibility based on the above distance/time from the main urban population of Nowra/Bomaderry. Areas outside of this criteria have been removed from further consideration.

3.3.9 Other Site/Area Specific Exclusions

Following the application of the above constraints, there remained a large number of locations that had not been excluded. Consideration of all these areas through a more detailed assessment was considered to be excessive and beyond the scope of the Study. Additional site specific consideration to identify anomaly sites and localised issues was therefore undertaken and these areas are specifically addressed here.

The locations excluded in this assessment have also been mapped in Figure 14 at Appendix A. Sites removed at this stage are typically located near pockets of rural residential land/numerous dwellings, are insufficient in size to cater for the proposed facility, or are considered to be inappropriate due to difficult accessibility (for example being located in bushland areas only accessible by long lengths of unsealed roads).

A summation of the key issues for each area, based on the numbering used in Figure 14, are provided here:

- Area 1 - West Nowra: Small sites well below the required 30-40ha. Close to future residential growth area (Mundamia Urban Release Area), University of Wollongong Campus and otherwise isolated lots with poor accessibility.
- Area 2 - Yerriyong: Hames Road area located to the south of Nowra, but within close proximity of HMAS Albatross (within 4-5km). Poor connectivity and heavy vehicle traffic through a cluster of rural residential dwellings. The land is privately owned and likely to be of high cost.
- Area 3 - Nowra Hill/South Nowra: Series of dwellings on Albatross Road and BTU Road, rural residential and rural housing to the south of South Nowra Industrial areas and adjoining correctional facility. Areas also within close proximity to HMAS Albatross (5-6km).
- Area 4 - Falls Creek: Large areas of rural residential housing and intensive/extensive agriculture, including areas along Parma Road, Turpentine Road and the Princes Highway. Area is also within close proximity to HMAS Albatross or in areas with poor road access and likely very high road access costs. Steeply sloping land and watercourses also traversing some parts of the area.
- Area 5 - Callala Bay area: Land to the north of Callala Bay/Beach being of size inadequate for a new facility, and arguably within an area which is too close to substantial urban development.
- Area 6 - Lake Wollumboola: Small sensitive catchment area where previous studies (for major development at Culburra) identifying that the lake is unlikely to sustain major development in the catchment.
- Area 7 - Tomerong area: Rural residential properties to the north and east of Tomerong. Previous general solid waste (non-putrescible) landfill proposal for regional waste was refused by the Joint Regional Planning Panel (JRPP).
- Area 8 - St Georges Basin area: Areas of rural residential housing (including large area along Island Point Road and The Wool Road), rural business and tourist accommodation. Small parcels of isolated land below the 30-40ha required. Area of paper subdivision where overall size is insufficient for future needs.
- Area 9 - Sussex Inlet: Land to the rear of rural residential and business properties fronting Sussex Inlet Road. Land is also isolated and generally insufficient in size to cater for future facilities. Areas adjoining SEPP 14 wetlands, new urban release areas and rural residential areas
- Area 10 - Wandandian: Land to the south-west of Wandandian village and within close proximity to Wandandian Creek. Pockets of rural residential land and several areas with access issues – particularly to the west of Wandandian Creek which is likely to require significant road upgrades, bridge construction and intersection treatments.
- Area 11 - Yerriyong / Jerrawangala State Forest area: Areas of difficult accessibility, steep slopes and poor quality road access (generally basic dirt roads).

3.4 Existing Facilities and Other Disturbed Land

In addition to the land identified through the Stage 1 and 2 processes outlined in previous sections, consideration has also been given to areas of existing disturbed land (quarries) and existing facilities. Preference is given in best practice guides, as well as in the *SEPP (Infrastructure)* 2007, for the development of existing disturbed land and to ensure that use of existing facilities is maximised. An overview of relevant sites and their potential to be used for landfill purposes is outlined below.

3.4.1 Existing Landfill Facilities

As outlined in Section 1.3, there are two operational landfill sites in the Shoalhaven, a small general solid waste (non-putrescible) facility at Huskisson and the general solid waste (putrescible and non-putrescible) landfill at West Nowra. The Huskisson site is not considered to be appropriate for putrescible waste landfilling purposes given the close proximity of the site from sensitive environmental areas including Currambene Creek / Jervis Bay. Jervis Bay Road is also a key tourist route to the township of Huskisson and a

significant increase in utilisation by heavy vehicles and potential for litter impacts along the length of this road is unlikely to be in the long-term interests of the location.

With respect to the West Nowra landfill site (being the area zoned for the purposes of "*Waste/Resource Management Facilities*"), there is presently a 14.5ha portion of the site which remains undeveloped in the south-eastern part of the site (being Lot 1 DP1104402). Only small areas on the edges of the existing facility (often in place as buffers or maintenance/fire access roads) are otherwise available. This 14.5ha site has been the subject of detailed investigations for the purposes of developing a new Resource Recovery Park (**RRP**). Those investigations identify 3.5ha as being required for the purposes of the RRP, with the remaining 11ha being used to partially offset the loss of habitat in the 3.5ha area[7].

Whilst not used as part of the landfill site, the adjoining Council owned animal shelter is also zoned for Waste/Resource Management Facilities. The animal shelter site, located in the north-eastern part of the facility, is approximately 3.5ha in size and leased for a two year period to the RSPCA for the purpose of operating the centre at a nominal rent[8]. This site is highly disturbed and fenced and at a broad level, is unlikely to have the extent of biodiversity values associated with the area being proposed for the RRP. It is further noted that the use of the site for an animal shelter facility would not be permissible under the current zone if the operation was to be established in the present day.

A generic layout of the site, incorporating the existing facilities and proposed RRP as per the current proposal are shown in Figure 15 at Appendix A.

As identified on the existing layout plan, the area proposed to be set aside for biodiversity offset purposes is well located and integral to the existing site. Similarly, the Council animal shelter also adjoins the existing operational landfill site and is within the land zoned for the purposes of a waste/resource management facility (noting that this zoning is a recent change as a result of the gazettal of the Shoalhaven LEP 2014). Both of these land parcels present additional opportunities for further development of the landfill, potentially extending its life significantly. It is however noted that both sites present some constraints, the proposed biodiversity offset land being of ecological significance, and the existing animal shelter requiring relocation of that facility.

Nevertheless, given the proposed "Offset Strategy" for the Resource Recovery Park is yet to be prepared/finalised, there would seem to be opportunity to further consider the future use of the existing West Nowra landfill site through one of more of the following:

- Expansion of the landfill into the area currently identified for biodiversity offset – this would potentially result in a "fifth stage" of landfill cells and may necessitate alternative offsets being identified off site as part of the RRP project offset strategy;
- Expansion of the landfill into the area currently utilised by the animal shelter, or alternatively locate other facilities here to enable use of other parts of the site for landfill cells;
- Repositioning of the proposed RRP to either an east-west location in the northern portion of the currently vegetated allotment to enable better utilisation of the southern portion for the purposes of landfill cells, or relocation of the RRP to the existing animal shelter site (and relocation of that facility), to enable the entire vegetated lot to be considered for future landfill cells; or
- Investigation of options to further increase the height of previously utilised landfill areas – for example increasing the height of previously capped Stage 1 areas should they be found to be stable and suitable.

[7] Draft Shoalhaven City Council West Nowra Resource Recovery Park Environmental Impact Statement: Volume 1 (GHD April 2014)

[8] Based on Minutes of the Ordinary Meeting of the Council of the City of Shoalhaven - 23 November, 2012

Benefits of utilising the existing area primarily include:

- Established and suitable transportation links being available, meaning that potentially cost prohibitive road improvements for connections in a new location would be avoided (at least for an extended period);
- An existing level of community expectation and understanding that the site is used and zoned for the purposes of landfill and therefore avoiding the likelihood of community opposition to a new site being developed; and
- Avoiding the need for significant levels of new supporting infrastructure being required – that is that the size of land needed to service the desired 25 year period on the current site would be in the region of 10-12 hectares, instead of the 34-40 hectares for a new site where a range of supporting infrastructure would need to be located to support the actual landfill operation.

A layout plan visually demonstrating these options is shown in Figure 16 at Appendix A

On the basis of these options potentially being available, and the benefits that may be obtained from more intensive use of the site, the existing West Nowra landfill site has been retained as a potential future site for comparative review along with new sites in Section 4.

3.4.2 Existing Disturbed Sites

As outlined in *SEPP (Infrastructure)* 2007, existing disturbed land such as quarries/extractive industry sites are identified as being preferable locations for new solid waste landfills. As such, and despite any previous exclusion, existing quarry/extractive industry sites have been identified, based on Shoalhaven LEP 2014 extractive industry buffer areas and others known to the consultants, for further review. These sites are outlined in Table 1 below, including comments on the potential of these sites to be suitable for a future landfill use.

Table 1: Existing Quarry/Extractive Industry Sites

Site Location	Comment
Boral Quarry, Burrier Road, Burrier	Located on/adjoining the Shoalhaven River and therefore inappropriate for landfill purposes. The site is also relatively isolated and in an area that may be difficult to access. The site is believed to be privately owned.
South Nowra Quarry, Princes Highway, South Nowra	Located adjoining Princes Highway, the quarry site is relatively small (less than 10ha) and in close proximity to the adjoining correctional facility (essentially being a residential use). The site is therefore not considered to be suitable. The site is believed to be privately owned.
Comberton Quarry, Forest Road, Comberton	Identified as land with potential for use as a landfill site and subject to assessment in Section 4 of this document. The site is privately owned.
Hellhole Road Quarry, Blackbutt Road, Yerriyong	Relatively isolated site with poor road access. Site is also adjoining environmental zones, buffer to which would significantly impact on the use of the disturbed quarry area. The site is also part of a biodiversity corridor and contains creek lines which all impact of the potential use of the site and for these reasons the site is assessed as not being considered as suitable.

Site Location	Comment
Tomerong Quarry, Parnell Road, Tomerong	The quarry is located to the south-east of the village of Tomerong, set between a number of rural residential and rural properties. While the site has potential to be suitable, it was removed due to access to the site having significant impacts on residential streets, particularly access through the Tomerong village area. A landfill proposal was refused by the Joint Regional Planning Panel in the locality for similar (amongst other) reasons. The site is believed to be privately owned.
Lemon Tree Road Quarry, Termeil	Based on aerial photography of the areas, the site appears to be a rehabilitated or unused quarry, however the site is located in an area that is well beyond what is considered to be a reasonable economic catchment (haulage cost) being more than an hour from the main population base in Nowra/Bomaderry.

As outlined in the table above, there are limited opportunities for utilisation of existing quarry/extractive industry sites, though where applicable (as in the case of the Comberton Quarry) these have been included in the comparative site assessment at Section 4.

3.5 Summary of Remaining Sites/Area

As outlined in Section 3.1, the purpose of undertaking the assessment and exclusion process through Stages 1 and 2 was to establish between 6 and 10 sites for which additional comparative site consideration would be undertaken. An outline of these remaining sites/areas is provided Table 2 and shown in Figure 3. These sites/areas are the subject of comparative assessment in Section 4 of this Study. Plans of each site is provided in Appendix B.

Table 2: Potentially Suitable Site – Overview Information

Site #	Location Name	Tenure	Legal Description	Site Area (Est. Ha)	Land-use Zone/s (Permissibility of landfill use in brackets)
1	Bamarang	Private Land	Parts of the following: Lot 1 - 5 DP1181699, Lot 3 - 4 DP1013115, Lot 1 and 6 DP1161782	156	RU2 – Rural Landscape (permitted)
2	South Nowra	Crown Land / Private Land	Parts of the following: Lot 7314 DP1163622, Lot 7-8 DP1154597, Lot 4 DP1092381	290	RU2 – Rural Landscape (permitted)
3	Coonemia Road	Private Land	Parts of the following: Lot 51 - 53 DP1124845, Lot 1 and Lot 5 DP870441	69	Part Deferred (SLEP 1985 Part 1(b) – Arterial and Main Road Protection, Part 1(d) – General Rural) Part RU1 – Primary Production, RU2 – Rural Landscape, SP2 – Sewerage Treatment Plant (permitted in RU1 and 2 only)
4	Comberton Quarry	Private Land / Forestry Land	Parts of the following: Lot 1 DP725955, Lot 1 - 2 DP1008950, Lot 53 DP755928	400	RU2 – Rural Landscape (permitted) RU3 – Forestry (not permitted)
5	Comberton Grange	Private Land	Parts of the following: Lot 59 - 61 DP755928, Lot 145 DP1080081, Lot 1 DP725955	65 (north) 120 (south)	RU2 – Rural Landscape (permitted)
6	Jervis Bay Road	Private Land / Forestry Land	Parts of the following: Lot 2 DP846470, Lot 92, 110, 150 - 152, 156 DP755965, Lot 26 - 27, 37, 64 DP755928	200	RU2 – Rural Landscape (permitted) RU3 – Forestry (not permitted)
7	Blackbutt Range Road	Forestry Land / Private Land	Parts of the following: UPN – 116486, Lot 26, 30, 48, 53 DP755965	420+	RU2 – Rural Landscape (permitted) RU3 – Forestry (not permitted)

Site #	Location Name	Tenure	Legal Description	Site Area (Est. Ha)	Land-use Zone/s (Permissibility of landfill use in brackets)
8	Turpentine Road Options	North-west: Forestry Land / Private Land	Parts of the following: UPN – 97718, Lot 75 – 76, 188, 196 DP755968, Lot 107 DP755965	270	RU2 – Rural Landscape (permitted) RU3 – Forestry (not permitted)
		North-east: Forestry Land / Private Land	Parts of the following: UPN – 94675, Lot 24, 30, 53, 103, 109 DP755965, Lot 45 DP755968, Lot 1 - 4 DP1158140, Lot 3 DP812890	300	RU2 – Rural Landscape (permitted) RU3 – Forestry (not permitted)
		South: Crown Land / Private Land	Parts of the following: Lot 52 - 53, 190, 193, 194 - 195 DP755968	190	RU2 – Rural Landscape (permitted)
9	Bay & Basin	Private Land	Parts of the following: Lot 4 DP1025939, Lot 5 DP1027705	240	RU2 – Rural Landscape (permitted)
10	Princes Highway South	Crown Land / Private Land	Parts of the following: Lot 97 DP755968, Lot 7 DP863133	45	RU2 – Rural Landscape (permitted)
11	West Nowra Landfill	Council Land	Lot 436 DP808415, Lot 342 DP257515, Lot 1 DP1104402, Lot 1 DP870268, Lot 1 DP847203, Lot 1 DP1018193	68	SP2 – Waste/Resource Management Facility (permitted)

Sites/Areas for Comparative Review

1 Bamarang

Area off Yawal Road west of existing facility – approx. 156ha

2 South Nowra

Area off Princes Highway. Part existing pistol club site – approx. 290ha

3 Coonemia Road

Areas east and west of Coonemia Road. Existing sewerage treatment facility – approx. 69ha

4 Comberton Quarry

Existing quarry off Forest Road. Subject to major project proposal – approx. 400ha

5 Comberton Grange

Same land holding as 4 above - off Forest Road. Subject to major project proposal – approx. 185ha

6 Jervis Bay Road

Forestry area off Jervis Bay Road – approx.. 200ha

7 Blackbutt Range Road

Forestry area adjoining Princes Highway – approx. 420+ha

8 Turpentine Road Options

Three (or more) possible options on large forestry and other parcels – approx. 700+ha

9 Bay & Basin

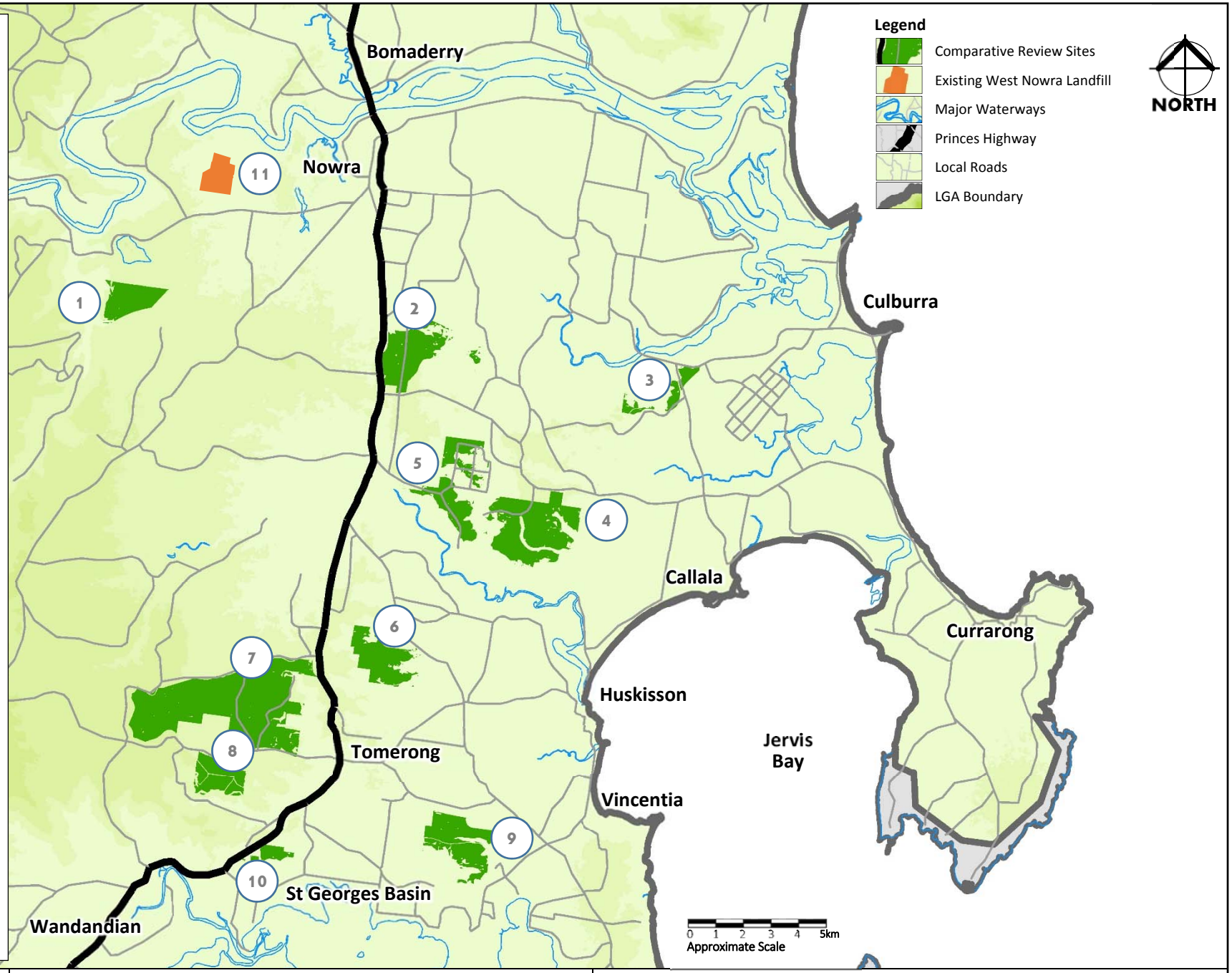
Area off The Wool Road – approx. 240ha

10 Princes Highway South

Area off Princes Highway – approx. 45ha

11 West Nowra Landfill (Existing)

Existing facility expansion – approx. 20ha



localé consulting

Project:	Desktop Landfill Site Identification Study
Client:	Shoalhaven City Council
Scale:	As shown
Revision:	0

Drawing: **Comparative Review Sites**

Figure 3

4. Site Specific Comparative Review

This section provides a comparative desktop review of sites identified through the assessment undertaken in Section 3. Additional information has been sourced where available to supplement data provided by Council and other readily available sources. Key issues are identified and sites compared with a summary of all key issues provided in Table 10 at Section 4.3.

4.1 General Methodology

Within each issue specific topic area, information is provided relevant to each site – presented within a table format. Indicators are provided as to how these issues may impact with regard to the need for longer term studies and investigations. For comparative purposes, three levels of indicator are used in the form of a "traffic signal". These indicators, as shown below, provide a quick reference of the impact of the issue for each site.

Green – issue can generally be managed and the site is broadly suitable for landfill purposes.

Amber – issue may be detrimental and requires further investigation or consideration before proceeding.

Red – Likely terminal issue that is unlikely to be resolved and the site is therefore unsuitable for further consideration.

4.2 Comparative Review Issues

The following key issues areas have been reviewed for all sites:

- Existing and Surrounding Land Use and Planning;
- Environmental Constraints;
- Geology and Soils;
- Topography and Surface Water;
- Infrastructure; and
- Amenity, Climatic Conditions and Aboriginal Heritage.

These are presented in the sub-sections below.

4.2.1 Existing and Surrounding Land Use and Planning

A key consideration at the site level is the existing use of the site and surrounding activities – particularly sensitive uses, such as educational, residential and health establishments. Also important to consider is the proposed future use of land – for example where development applications have been submitted or remain outstanding. Table 3 provides a comparative summary of these issues.

Table 3: Existing and Surrounding Land Use and Planning Comparative Review

Site #	Existing Site Use/Zone	Surrounding Uses	Comment	
1 - Bamarang	RU2 – Rural Landscape Partially cleared rural land. Some highly disturbed land areas and others more contiguous with surrounding forest.	Bamarang storage dam/reservoir to north. Bamarang Nature Reserve/ Colymea State Conservation Area to west and rural residential to east.	Potential for impacts on water source (reservoir), rural residential areas, future urban release and conservation lands.	

Table 3: Existing and Surrounding Land Use and Planning Comparative Review

Site #	Existing Site Use/Zone	Surrounding Uses	Comment	
2 - South Nowra	RU2 – Rural Landscape Generally forested land. Recreational use (Nowra Rifle Club) on Crown Land. Allotments adjoining Highway generally vacant with electrical easement running north to south.	South Nowra Industrial land to north-west, Highway to west and State Forest to south and east. Some rural residential properties adjoining to south.	Generally isolated from sensitive uses. Potential impact on Rifle Club to be considered, but sufficient area for both uses.	
3 - Coonemia	SP2 – Special Purposes (Sewerage Treatment Plant), RU1 – Primary Production, RU2 – Rural Landscape and deferred areas – 1(b) and 1(d) Sewerage Treatment Plant with surrounding farmland. Shoalhaven Water expanding REMS on-site in future. Southern portions and east of Coonemia Road generally forested.	Jervis Bay National Park and Lake Woolumboola conservation areas to south and east. Rural residential and farmlands to north.	Potential for impacts on key environmental surrounds. Significant conflict with sewerage works expansion and need for rezoning (on SP2 land). Given Shoalhaven Water future requirements, site is deemed inappropriate.	
4 - Com-Quarry	RU1 – Primary Production, RU2 – Rural Landscape, RU3 – Forestry Forested land with existing quarry and small water supply dam. Part Currumbene State Forest. Site part of current major project application.	SEPP14 wetlands and sensitive environmental corridor to south. Otherwise well separated from adjoining uses.	Potential for impacts on conservation lands, though possible to be well separated. Site inappropriate due to current planning application.	
5 - Com-Grange	RU1 – Primary Production, RU2 – Rural Landscape Areas of forested lands and farmlands on lower elevations adjoining Currumbene Creek. Site part of current major project application.	Forestry land to north, Currumbene Creek and rural/residential property to south, with large areas of forested land to adjoining areas.	Generally well isolated from sensitive uses. Site inappropriate due to current planning application.	
6 - JB Road	RU2 – Rural Landscape, RU3 – Forestry Areas of forested lands including part of the Tomerong State Forest.	Forestry land continues to north and west with rural residential beyond. Further private forested and rural land to south.	Generally well isolated from sensitive uses, with some isolated nearby dwellings and rural residential lands. Rezoning required of forestry land.	

Table 3: Existing and Surrounding Land Use and Planning Comparative Review

Site #	Existing Site Use/Zone	Surrounding Uses	Comment	
7 - B-butt Range	RU2 – Rural Landscape, RU3 – Forestry Areas of forested lands including part of the Yerriyong State Forest. Electrical easements present and substation recently installed.	Forestry land continues to west and north, with residential areas further north. Turpentine Road rural residential further south with some farmland to south/ east.	Generally well isolated from sensitive uses. Needs consideration of some isolated dwellings and electrical substation. Rezoning required of forestry land.	
8 - Turpentine	RU2 – Rural Landscape, RU3 – Forestry Areas of forested lands including part of the Yerriyong State Forest. Electrical easements and forestry roads present.	Jerrawangala National Park to west with rural residential areas dispersed along Turpentine Road. Forested land with occasional farmland to south/ east.	Generally well isolated from sensitive uses, with some consideration of isolated dwellings.	
9 - Bay & Basin	RU2 – Rural Landscape Areas of forested lands with some cleared farmland/rural areas.	Jervis Bay National Park to north, with residential villages and rural residential land to south and west.	Potential for impacts on National Park and surrounding residential land uses given urban densities.	
10 - H-way South	RU2 – Rural Landscape Generally forested lands with occasional rural dwelling.	Residential villages and rural residential land to south and east. Highway adjoins to west with isolated rural dwellings in surrounds.	Potential for impacts on surrounding residential land uses given urban densities.	
11 - West Nowra	SP2 – Waste/Resource Management Facility Existing landfill operation with areas of forested land and animal shelter.	Rural and urban residential land to south, with forested environmental land to north, east and west including Bamarang Nature Reserve.	Whilst constrained, existing land specifically zoned for purpose and existing use has been operational for many years.	

4.2.2 Environmental Constraints

Landfill sites have both direct and indirect impacts on flora and fauna species including:

- Clearing of vegetation/loss of habitat;
- Potential for spreading of plant disease and noxious weeds;
- Impacts from litter on native wildlife;
- Creation of new habitats for scavenger and predatory species; and
- Impacts from increased traffic movement.

Broadscale vegetation identification and threatened species data has been used to provide a preliminary examination of potential flora and fauna constraints. Proximity to known reserves and habitat corridors also provides a broader understanding of the site context. These considerations are discussed in Table 4.

Table 4: Environmental Constraints Comparative Review

Site #	Threatened Species	Vegetation	SLEP 2014 Overlays	Comment	
1 - Bamarang	Major portion of site identified as bristlebird habitat. Yellow-bellied glider and little lorikeet recorded on-site. Glossy black-cockatoo nearby.	Range of vegetation types including areas of Wet and Dry Sclerophyll Forests including Red Bloodwood, Blackbutt, Spotted, Stringy and Grey Gum.	Identified as habitat corridor and significant vegetation in SLEP 2014. Several watercourses and adjoining area of scenic protection.	Site has significant environmental constraints which would require detailed investigation and negotiation of offsets.	
2 - South Nowra	Yellow-bellied glider recorded on site. Green and golden bell frog on adjoining land to south. Small areas of bristlebird habitat (north-east).	Primarily grassy Wet Sclerophyll Forests including Spotted Gum, Grey Ironbark.	Small area of habitat corridor land in east of site. Otherwise minimal overlay impacts.	Generally appears to have limited environmental constraints given area of site available.	
3 - Coonemia	Yellow-bellied glider and glossy black-cockatoo nearby, but limited identified species on-site.	Wet Sclerophyll Forest including Bloodwood, Blackbutt, Spotted Gum to west of Road, Blackbutt, Turpentine, Bangalay to west.	Area to west of Road habitat corridor (east is deferred). SEPP 14 wetland to north.	Site has some environmental constraints requiring more detailed investigation, particularly the northern portion.	
4 - Com-Quarry	Large areas of bristlebird habitat and yellow-bellied glider on the site. Coastal and Swamp Forest at eastern edge.	Primarily shrubby Dry Sclerophyll Forests including Red Bloodwood, Scribbly Gum on higher elevations with Wet Sclerophyll Forest (Blackbutt, Turpentine, Bangalay) lower.	Areas of habitat corridor and significant vegetation adjoining. SEPP 14 wetlands adjoining to south.	Site has some environmental constraints requiring more detailed investigation, particularly to the south.	
5 - Com-Grange	Areas of bristlebird habitat and Coastal and Swamp Forest in western portion. Glossy black cockatoo identified in southern portion.	Large cleared areas, with Dry Sclerophyll Forests including Red Bloodwood, Blackbutt and Spotted/Scribbly Gum on higher elevations with areas of Wet (Blackbutt/ Bangalay and Ironbark/Woollybutt) lower	Areas of significant vegetation in southern portion as well as riparian land. Areas not previously cleared identified as Jervis Bay Habitat Corridor.	Northern portion generally with limited constraints due to previous clearing. Southern portion of high value and unlikely to be suitable.	

Table 4: Environmental Constraints Comparative Review

Site #	Threatened Species	Vegetation	SLEP 2014 Overlays	Comment	
6 - JB Road	Masked owl and Biconvex Paperbark recorded in close proximity to the site.	Grassy to shrubby Wet Sclerophyll Forest including Spotted Gum – Grey Ironbark and Blackbutt, Turpentine, Bangalay.	Parts of the site being habitat corridor under SLEP 2014 and part of the Jervis Bay Habitat Corridor	Site has some environmental constraints requiring more detailed investigation.	
7 - B-butt Range	Black glossy cockatoo, powerful and masked owls identified in western portion of site.	Grassy Wet Sclerophyll Forest including Spotted Gum, Grey Ironbark in eastern portion, with shrubby Dry Sclerophyll Forest with Sivertop Ash and Red Bloodwood to the west.	Habitat corridor and significant vegetation overlays are present in southern/western areas of the site. Some watercourses are also present in this area.	Some areas in the western portion of the site have environmental constraint, however the preferred eastern portion is generally well suited.	
8 - Turpentine	Portion of bristlebird habitat in southern section and yellow-bellied glider home range on eastern edge.	Primarily shrubby Dry Sclerophyll Forests including Red Bloodwood, Scribbly Gum or Wet (Spotted Gum, Blackbutt). Areas of wet (Blackbutt, Turpentine – Bangalay) in western portion.	Scattered areas of significant vegetation and habitat corridor, but with other areas without overlays. A number of watercourses that would need to be considered.	Site has some environmental constraints, but with more detailed investigation, suitable sites are likely to be possible given extent of area available.	
9 - Bay & Basin	Several powerful owl, yellow-bellied glider and Biconvex Paperbark recorded on-site. Large portions identified as yellow-bellied glider home range.	Primarily grassy Wet Sclerophyll Forests including Spotted Gum and Blackbutt.	Large areas covered by habitat corridor.	Site has several environmental constraints requiring more detailed investigation.	
10 - H-way South	Powerful owl, yellow-bellied glider and Biconvex Paperbark recorded on-site. Large portion identified as yellow-bellied glider home range.	Primarily Wet Sclerophyll Forests including Spotted Gum and Blackbutt.	Identified habitat corridor throughout site and a number of watercourses on the limited site area.	Several constraints on a site of minimal size. These are unlikely to be overcome in a way that retains a useable space.	
11 - West Nowra	Recent detailed EIS studies identify a number of threatened species located on and around the site.	Cleared or disturbed areas with some Dry Sclerophyll Forests (Scribbly Gum-Slivertop Ash)	Forested areas identified as habitat corridor with areas of scenic protection around.	Several constraints with some detailed investigations already completed.	

4.2.3 Geology and Soils

Beyond the broadscale exclusion of Quaternary geology, there are a number of other geological and soils related issues that require consideration. A key risk mitigation issue is the potential for pollution of groundwater by leachate, potentially occurring in areas of known shallow groundwater tables, or where rising groundwater tables or groundwater recharge zones. According to the Victorian Best Practice guide, preferred sites for landfills are those that minimise risk to groundwater pollution by providing a natural, unsaturated attenuation layer beneath the liner for contaminates – particularly through naturally attenuating soils such as clayey areas. Indicators such as geology, soil depth and water bore records can provide useful background data to assist with identifying suitable areas.

In addition, other considerations with respect to soils include identification of previously contaminated areas (based on Council's Contaminated Lands register (**CLR**)), potential for acid sulfate soils[9] (**ASS**), as well as the presence of previous mine activities (and risk of subsidence) and karst (cave) environments. These issues are examined in Table 5, though review of mine subsidence[10] and karst[11] mapping suggests that neither of these are likely to be an issue in the Shoalhaven and as these results are consistent for all sites they have not been included in the table below.

Table 5: Geology and Soils Comparative Review

Site #	ASS/ Contamination	Geology/ Water Bores/Soil Depth	Comment	
1 - Bamarang	Class 5 (low risk) of ASS. Nearby areas identified on CLR – associated with gas-fired power station.	Permian sedimentary sequences (siltstone, shale, sandstone, conglomerate). No water bores within 1km. Three stock and domestic bores situated south-east of the site with depths of ~50m. Site mapped within Nowra Soil Landscape Group (no), moderately deep 50-100cm, brown podzolic soils with low permeability.	Limited by shallow soil with potential rock outcrops. Ground may be suitable pending site inspections to confirm soils depth.	
2 - South Nowra	Class 5 (low risk) of ASS.	Site is generally Permian with Quaternary deposits along watercourse to the north-east. No water bores within 1km, nearest being ~2km from site with depth of 36m. Nowra Soil Landscape, moderately deep 50-100cm, brown podzolic soils, low permeability.	Ground may be suitable pending site inspections to confirm soils depth.	
3 - Coonemia	Generally Class 5 (low risk) of ASS, with Class 2 (higher probability) to the immediate north.	Permian sedimentary sequences. No water bores within 1km. Area is mapped within Greenwell Point Soil Landscape Group (gp), shallow structured loams <50cm or moderately deep 50-100cm brown podzolic soils with high organic matter and shrink-swell potential.	Ground may be suitable but potentially limited by soil depth and likely elevated permeability.	

[9] Based on Shoalhaven LEP 2014 and Council State of the Environment mapping for the area.

[10] See http://www.minesub.nsw.gov.au/templates/mine_subsidence_board.aspx?edit=false&pageID=3758

[11] See http://www.environment.nsw.gov.au/resources/geodiversity/NSWKarstmap.pdf

Table 5: Geology and Soils Comparative Review

Site #	ASS/ Contamination	Geology/ Water Bores/Soil Depth	Comment	
4 - Com-Quarry	Class 5 (low risk) of ASS, with Class 2 (higher probability) to the south. One site identified on CLR to north in adjoining national park.	Site generally Permian with some Tertiary Volcanics (Tv) present in east, centre and west of the site. One stock and domestic bore recorded within site. Nowra Soil Landscape, moderately deep 50-100cm, brown podzolic soils, low permeability.	Ground may be suitable pending site inspections to confirm soils depth.	
5 - Com-Grange	Class 5 (low risk) of ASS, with Class 3 (lower potential) to the south. One site identified on CLR to north in adjoining national park.	Permian sedimentary sequences. No water bores within 1km. Nowra Soil Landscape, moderately deep 50-100cm, brown podzolic soils, low permeability.	Ground may be suitable pending site inspections to confirm soils depth.	
6 - JB Road	Class 5 (low risk) of ASS.	Generally Permian sedimentary sequences with some Quaternary alluvium near southern boundary. No water bores within 1km. No published soil maps available.	Ground may be suitable pending site inspections to confirm soils depth.	
7 - B-butt Range	Class 5 (low risk) of ASS.	Permian sedimentary sequences. Five bores registered within 1km of the site (Turpentine Road/ Princes Highway) with depth 36 – 100m. No published soil maps available.	Ground may be suitable pending site inspections to confirm soils depth.	
8 - Turpentine	Class 5 (low risk) of ASS.	Permian sedimentary sequences. Two bores within 1km with depth of 36m at north boundary, and 38m ~800m to south-east. No published soil maps available.	Ground may be suitable pending site inspections to confirm soils depth.	
9 - Bay & Basin	Class 5 (low risk) of ASS, with Class 3 (lower potential) to the south.	Generally Permian sedimentary sequences with Quaternary deposits along some waterways. No water bores within 1km. No published soil maps available.	Ground may be suitable pending site inspections to confirm soils depth.	
10 - H-way South	Class 5 (low risk) of ASS.	Permian sedimentary sequences. Four bores within 1km of site with depths between 31-92m registered for stock and domestic purposes (low yields <1L/s). No published soil maps available.	Ground may be suitable pending site inspections to confirm soils depth.	
11 - West Nowra	Class 5 (low risk) of ASS.	Permian sedimentary sequences. Monitoring bores registered at the site. Disturbed landscape within Nowra Soil series, moderately deep 50-100cm, brown podzolic soils, low permeability.	Ground likely to be suitable based on known existing facility.	

4.2.4 Topography and Surface Water

Consideration of topography and the presence of surface water is important to ensure any proposed site avoids pollution of the adjoining creeks, rivers and other waterways. Topography is also important to ensure that areas are practically suitable for use, whilst avoiding visual amenity issues and the like. The climatic conditions of the area are also important with respect to rainfall, wind and the potential for other forms of localised pollution such as odour and dust (climatic conditions are further considered in Section 4.2.6.

The EIS Guidelines recommend the landfill sites be avoided "*within watercourses or within 40 m of a permanent or intermittent watercourse*". Shoalhaven LEP 2014 identifies waterways throughout the LGA and have been reviewed on a site by site level in conjunction with NSW base and topographical maps on the NSW Government Spatial Information Exchange. Topographic elements and presence of watercourses are outlined in Table 6.

Table 6: Topography and Surface Water Comparative Review

Site #	Topography	Watercourses	Comment	
1 - Bamarang	Undulating topography with steep areas along western boundary dipping ~80m to Calymea Creek. Draining west and east from central ridgeline.	Calymea Creek tributaries along western boundary and from the north. Cabbage Tree Creek lines on eastern fringe.	Area constrained by steep slopes to west and several drainage lines/ waterways. Remaining area minimal.	
2 - South Nowra	Undulating topography with several ridges and valley, draining north or north east from ~70m to 10m AHD.	Browns Creek commences through western portion, with Rotton Creek tributaries at large intervals through eastern portions.	Several large areas remain that would be likely to provide for effective buffering from water courses.	
3 - Coonemia	Generally gentle slopes north-north west from 40m-20m AHD.	No significant drainage lines, site drains into Crookhaven River between 0.6 and 1.5km to the north (including associated aquaculture licences). Saltwater Swamp reserve is situated ~850m west of the site.	Topography suitable, with no identified watercourses. Potential impact on sensitive Crookhaven aquaculture areas to be further considered.	
4 - Com-Quarry	Undulating with significant topographic relief between 10-70m AHD, particularly in the southern portions.	North/ western areas drain west to Georges / Currambene Creek, with ridge through centre resulting in eastern portion draining east to Bid Bid and Callala Creek. Dam situated immediately below quarry site.	Several constrained areas, particularly in the southern portion with large area in northern part of site with landfill potential.	
5 - Com-Grange	Site is split into two portions characterised by undulating hills and drainage features between ~20-50m AHD. Large ridge areas in north western portion.	Southern portion dissected by regular drainage lines. Southern portion also narrow and in close proximity to Currambene Creek. North portion is dissected by Georges Creek, but with areas of elevated land remaining.	Several constrained areas, particularly in the southern part of the site. Minimal sized area in northern part of site remains.	

Table 6: Topography and Surface Water Comparative Review

Site #	Topography	Watercourses	Comment	
6 - JB Road	Undulating terrain with subtle ridge extending southeast from an elevation high of 60m AHD centrally in the site.	Drainage lines through the site with rural dams down gradient. Parma Creek Nature Reserve is located around 800 m to the south-west.	Potentially suitable area of sufficient size in elevated location through the central portion of the site.	
7 - B-butt Range	Western portion is characterised by undulating terrain with steep areas approaching Tomerong Creek. Elevation ranges from 190m-70m AHD in the east.	Tomerong Creek drains east through the site fed by a number of minor tributaries which intersect parts of the area.	Two potential areas, one north and one south of creek line. Northern area having the more accessible topography.	
8 - Turpentine	Topographic highs to the west of the area sloping gradually towards the north-east with steeply sloping areas to the south and east generally along the site boundaries.	Several watercourses associated with Tomerong and Suffolk Creeks. Western portion particularly affected, along with parts of the east and southern boundaries.	Large area on the southern side of Turpentine Road appears suitable, along with potential on the eastern part of the area. Western area unlikely to be suitable due to terrain.	
9 - Bay & Basin	Relatively gently sloping areas ranging between 20-50m AHD from high central ridge line down to Tomerong Creek/ Worrowing Waterway in South and Moona Moona Creek in the north.	Watercourses affecting areas away from the main ridge line on the periphery of the site.	Two potentially suitable areas across middle to northern part of the site, however both drainage catchments connected to sensitive receiving waters (Jervis Bay/St Georges Basin).	
10 - H-way South	Undulating elevation between 20-40m AHD, draining to the south-east to St Georges Basin.	Four minor drainage lines divide the site area with drainage into Pats Bay, St Georges Basin.	Insufficient area available due to intersection of site by drainage features. Further detailed studies needed to ascertain if watercourses could be impacted.	
11 - West Nowra	Relatively flat site along ridge line. More steeply sloping at western boundary and further to the east associated with watercourses.	Mundamia Creek to west and Cabbage Tree Creek to east, both connecting to the Shoalhaven River. Site predominately draining to west.	Areas not developed for landfill purposes (including animal shelter) suitable for future use.	

4.2.5 Infrastructure

Availability of infrastructure is important for the operation of facilities, and particularly where the lack of necessary infrastructure is likely to result in significant financial costs. Most fundamentally is the provision of suitable road capacity, including suitability in terms of safety and weight capacity of access roads and major intersections. As highlighted by correspondence received from RMS, preference is for access from

secondary roads where good connections to primary road (the Princes Highway) already exist (rather than the creation of new).

Provision of mains electricity, reticulated sewer and mains water are also considered important, but could be managed in other ways if necessary (though likely at a higher ongoing cost).

Table 7: Infrastructure Comparative Review

Site #	Transport and Road Access	Other Infrastructure	Comment	
1 - Bamarang	Access to site via Yalwal Road as per existing West Nowra Landfill. Internal connection past Bamarang Reservoir required – new road ~2km.	Close proximity to Bamarang water supply zone, with main traversing part of the site. Electricity likely along Yawal Road, but no sewer system connection. Adjoins Eastern Gas Pipeline, though connection unlikely.	Access through Nowra continues as existing and assessment of suitability required. New access road via Reservoir requires appropriate buffer. Water/ electrical access may be possible nearby.	
2 - South Nowra	Adjoins recently upgraded highway connection (round-a-bout) at Warra Warra Road. Internal access road required. Location in close proximity to urban population.	Close connections via South Nowra industrial areas for water / electrical infrastructure. Sewer system connection unlikely.	Excellent access to highway a significant benefit. Relatively close proximity to South Nowra industrial areas also suggests infrastructure connections would be available nearby.	
3 - Coonemia	Access roads available via Forest Road or Culburra Road, both suitable, though may result in heavy traffic in residential/rural residential areas. Internal access potentially via existing Council (Shoalhaven Water) infrastructure.	Possible connections for water/electrical via existing Shoalhaven Water facilities to west of Coonemia Road. May also have potential for REMS connection.	Whilst potential exists for good infrastructure access and vehicular movements, the site is a long distance from the Princess Highway and therefore potentially isolated.	
4 - Com-Quarry	Access via Forest Road, with recently upgraded intersection with Princes Highway. Internal access road required, potentially mirroring quarry access road with improvements to Forest Road intersection.	Limited infrastructure is currently available to the site and site specific investigations would be required. A water main is located at the eastern end of the site, but other services are not located nearby.	Access to the Princess Highway may be acceptable given recent upgrades, with site access possible with new access intersection. Other infrastructure availability would need to be assessed in detail.	
5 - Com-Grange	Access via Forest Road, with recently upgraded intersection with Princes Highway. Internal access road and access point to be identified. Existing Forest Road connections (fire trails) unlikely to be suitable.	Limited infrastructure is currently available to the site and site specific investigations would be required.	Access to the Princess Highway may be acceptable given recent upgrades, with site access requiring additional review. Other infrastructure availability would also need to be assessed in detail.	

Table 7: Infrastructure Comparative Review

Site #	Transport and Road Access	Other Infrastructure	Comment	
6 - JB Road	Access to Princes Highway via Jervis Bay Road, with site access potentially via Pepper Road (possible fire road). Access intersection investigations required for site distance.	Electrical services along Jervis Bay Road, with water servicing properties in the area. Sewer unlikely to be available.	Several infrastructure issues to be resolved, particularly site access arrangements.	
7 - B-butt Range	Access to Princes Highway via Blackbutt Range Road. Intersection upgrade may be required, with sight distance likely to be sufficient.	Adjoins electrical substation, though water and sewer unlikely to be immediately available.	Potentially good location in terms of direct highway access with intersection upgrade whilst minimising impact on residential streets. Some road upgrades likely to be required along with other infrastructure.	
8 - Turpentine	Turpentine Road is generally suitable though steep for access, with potentially suitable connection to Princes Highway. Road deteriorates prior to west option. Access to east and south options possible, west option much more difficult.	Electrical services available to Turpentine Road (east and south options). Water and sewer services not available.	East and south options well located for electrical services and vehicular access (subject to possible intersection upgrades and assessment of grades). West option access much more difficult and unlikely to be overcome.	
9 - Bay & Basin	Access from The Wool Road does not penetrate the desired area of the site, with Parnell Road access inadequate (not all weather) and undesirable due to travel through residential areas.	Adjoining several residential areas, infrastructure including water and electrical are likely to be possible.	Despite access to other infrastructure, neither road access option is likely to be suitable in the circumstances.	
10 - H-way South	Direct access to Princes Highway may be possible, but only with substantial intersection upgrade. Sight distance and site constraints would need to be confirmed and may be unacceptable.	Adjoining several residential areas, though some distance from urbanised area. Infrastructure likely to be possible with extension to the site.	Access to the site is likely to be very difficult, particularly gaining RMS approval and meeting relevant standards for sight distance.	
11 - West Nowra	Existing access through increasingly urbanised areas, though historical presence means that an existing level of expectation would exist.	Existing facilities and infrastructure generally available (including constructed facilities such as dams and irrigation). No sewer connection.	Increasing urbanisation was envisaged by the Nowra Bomaderry Structure Plan which also identifies landfill expansion on the site. Road access earmarked for improvement with urban release areas.	

4.2.6 Amenity, Climatic Conditions and Aboriginal Heritage

Amenity issues associated with landfill include odour, dust, noise and visual impact. Whilst separation distances have been applied at a broad scale and in line with best practice recommendations, the potential for impacts may still be of concern in certain circumstances and are particularly relevant to heavy vehicle travel paths and longer-distance views to potential landfill areas (i.e. amenity issues that are not necessarily mitigated through separation buffers).

One of the key factors in terms of odour (as well as potential for spread of contaminants during rainfall events) is the prevailing climatic conditions. Particular elements include rainfall, wind and atmospheric stability. In terms of rainfall, the Shoalhaven generally has higher rainfall in late summer, with drier periods in winter, spring and early summer. The long-term average monthly rainfall levels in various areas of the Shoalhaven are shown in Table 8, which highlights an increased level of rainfall along coastal areas, such as Jervis Bay and Ulladulla, whilst areas such as HMAS Albatross and particularly Nerriga (adjoining the western boundary of the LGA) are more inland from the coast and have a lower level of rainfall over time.

Table 8: Long-Term Average Monthly Rainfall – Shoalhaven Locations

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Tot
Nerriga Composite 1898 – 2014	67.7	65.5	74.4	56.5	60.6	73.0	61.3	56.0	53.3	62.5	65.1	64.9	761
Nowra (HMAS Albatross) 2000-2014	61.3	144.7	102.3	60.9	52.3	107.7	63.6	30.7	41.2	66.0	76.9	70.1	878
Jervis Bay (Pt Perpendicular) 2001-2014	80.9	142.0	109.7	113.3	123.9	151.1	120.4	59.5	55.3	80.1	86.4	76.0	1196
Ulladulla 1989-2014	80.3	116.6	107.9	102.5	106.9	114.7	72.3	53.5	75.8	80.1	87.7	63.9	1060

The GHD Draft EIS for the West Nowra[12] RRP identifies that dispersion of odour under light stable winds generates the maximum off-site impact. Atmospheric stability and modelling from the EIS suggest impacts are found to spread more predominantly towards to the east and south-east, associated with the light but stable winds from the north to west.

Based on these climatic elements, the siting and location of a new landfill would preferably be located in an area of reduced rainfall to assist in reducing risk of surface water run-off, whilst being well separated from sensitive receivers, particularly from the east and south-east.

Seismic conditions are also an important consideration, with impacts potentially significant in the context of the stability of landfills, resulting fault lines, cracks and penetration to underground water sources. Whilst the Victorian Best Practice Guide identifies Australia as being a generally stable seismic continent, earthquakes do occur from time to time. According to Geosciences Australia[13], around the area of the sites being considered, there has been limited occurrence of earthquakes, with four records of very small magnitude (1.5 – 1.8). There are no neotectonic features in the locality – including feature/fault lines, which are a key indicator to stability according to the Victorian Best Practice guide.

[12] Appendix D – Air Quality Assessment March 2014

[13] http://www.ga.gov.au/earthquakes/searchQuake.do (search area N-34.85, S-35.1, E150.78, W150.45)

A review of Council's Aboriginal Land Claim Database identified a number of land claims on or adjoining subject sites. A search of the Aboriginal Heritage Information Management System (**AHIMS**) was also undertaken for each area, with outcomes recorded in Table 9.

Table 9: Amenity and Heritage Comparative Review

Site #	Amenity	Aboriginal Heritage	Comment	
1 - Bamarang	Located away from the coast with reduced rainfall and good visual separation. Rural residential around 1.2km to east. Traffic through urban residential areas east on Yawal Road.	Six sites identified at or near the site on AHIMS search. Aboriginal land claim within or adjacent to the site.	Generally well separated, though potential impact to rural residential to east and haulage through urban areas to be considered. High potential for Aboriginal heritage.	
2 - South Nowra	Located away from the coast adjoining urban industrial area. Rural residential and new urban development around 1.7-2km to south or north-east. Isolated dwellings 1.2 – 1.5km to west.	No sites or claims indicated by searches.	With appropriate visual buffers, amenity impacts are unlikely given proximity to industrial area (and associated heavy vehicle movements). Well separated from sensitive receptors.	
3 - Coonemia	Generally surrounded by reserves, with limited potential for impacts to south, east or west. Views from Culburra Road to site to be considered.	One Aboriginal site identified at or near the site on AHIMS search.	High degree of separation from external uses on southern portion. Northern portion in close proximity to dwellings on Culburra Road (<500m).	
4 - Com-Quarry	Northern portion within large forested area, with low potential for amenity impact. Southern portion with potential for distant views from south and impacts from odour to south and east.	Three Aboriginal site identified at or near the site on AHIMS search.	Whilst high degree of separation, landform and odour drift potential to south / east. Northern portion having greater potential. Aboriginal heritage potential.	
5 - Com-Grange	Northern portion within large forested area, with low potential for amenity impact. Southern portion with potential for distant views from south and impacts from odour to west and south.	Three Aboriginal site identified at or near the site on AHIMS search. Aboriginal land claim within or adjacent to the site.	Whilst high degree of separation, landform and odour drift potential to west / south. Northern portion having greater potential. Aboriginal heritage potential.	
6 - JB Road	Several areas of rural/residential dwellings surrounding the site, though predominantly west and north-east. Within forestry areas and able to be visually screened.	No sites or claims indicated by searches.	Separation distances acceptable, though potential for impacts in several directions.	

Table 9: Amenity and Heritage Comparative Review

Site #	Amenity	Aboriginal Heritage	Comment	
7 - B-butt Range	Non-coastal location with areas of rural/residential dwellings to north and south-east. Within forestry areas and able to be visually screened from highway and surrounds.	One Aboriginal site identified at or near the site on AHIMS search. Aboriginal land claim within or adjacent to the site.	Separation distances acceptable, with surrounding areas generally at higher levels. Visual impacts able to be mitigated.	
8 - Turpentine	Pockets of rural/residential development, particularly at intersection with Princes Highway and around 2.5km, then 4km to the west. Traffic / noise impacts a concern.	Three Aboriginal site identified at or near the site on AHIMS search. Aboriginal land claim within or adjacent to the site.	Traffic noise a potential concern, along with odour to surrounding residential pockets. Aboriginal heritage potential.	
9 - Bay & Basin	Areas of rural/residential, tourist accommodation and urban to north, west, south and south-east. Reasonable separation, though sensitive receptors in all directions. Traffic / noise impacts a concern.	Two Aboriginal site identified at or near the site on AHIMS search.	Traffic noise a potential concern, along with odour to surrounding tourism and urban residential areas. Some aboriginal heritage potential.	
10 - H-way South	Pockets of rural/residential in several directions with urban development (Basin View) to south-east along valleys – potential for odour and noise concerns. Views from highway to be mitigated.	One Aboriginal site identified at or near the site on AHIMS search. Aboriginal land claim within or adjacent to the site.	Potential concern of odour and noise to urban areas to south-east. Areas for view mitigation/buffer detrimentally impacts on site size.	
11 - West Nowra	Existing landfill situation. Future urban areas to south and east, with continued impacts of haulage through urban areas. Otherwise well separated from sensitive uses and	Two Aboriginal site identified at or near the site on AHIMS search. Detailed studies undertaken, concluding low archaeological potential. Aboriginal land claim within or adjacent to the site.	Impacts mitigated by existing landfill operations having existed for many years, though new urban areas to south being a new consideration for future expansion.	

4.3 Comparative Summary

The comparative assessment process provides a strong indication of the potential suitability of a number of sites. Key outcomes for each site are summarised below, with Table 10 overleaf providing a visual summary of the previous comparison sections.

1 - Bamarang: The site is relatively well located and potentially suitable for the proposed use, however its location adjoining the Bamarang Reservoir raises some concerns, particularly for Shoalhaven Water who have requested suitable buffers from the water storage to form part of any future design. New access arrangements and infrastructure provision are also likely to be costly, whilst impacts resulting from the transportation of waste through current and future urban areas is not desirable.

Outcome: The site is not considered to be suitable unless other preferred sites are found to be inadequate.

2 - South Nowra: The site is well located with direct access to the Princes Highway via Warra Warra Road. Central to the key Nowra/Bomaderry population, the site is easily accessible. Provided that a co-operative tenure arrangement can be made with the Nowra Rifle Club and the Crown, the site has the potential to be a long-term (25+ years) landfill site with large areas available for future use.

Outcome: The site is considered to be potentially suitable and the preferred site for further investigations.

3 - Coonemia Road: The site has some advantages in terms of potential resource sharing between areas of Council (Shoalhaven Water) (access roads and the like). However the use of the site is not considered possible from Shoalhaven Water's perspective given plans for future expansion of the REMS system at this location. The area also has several environmental / amenity constraints, particularly in the northern portion, as well as being significantly separated from the primary access road through the area (Princes Highway).

Outcome: The site is not considered to be suitable unless other preferred sites are found to be inadequate and suitable arrangements can be agreed with Shoalhaven Water to co-share the southern area.

4 - Comberton Quarry: The northern portion of the site, potentially incorporating the quarry, is potentially suitable. The southern portion is less well suited and not considered to be suitable for environmental, amenity and infrastructure cost reasons. Nevertheless, whilst the Shaolin Temple proposal remains current, the site is not considered to be available nor the use for a landfill desired.

Outcome: The site is not considered to be suitable unless the Shaolin Temple proposal is abandoned and other preferred sites are found to be inadequate. Under these circumstances, the northern portion of the site may be suitable.

5 - Comberton Grange: Like the Comberton Quarry site, the northern portion of the site is potentially suitable, while the southern portion has a range of environmental, amenity and infrastructure cost implications. Similarly, the site forms part of the Shaolin Temple proposal and whilst this proposal remains current the site is not considered to be available.

Outcome: The site is not considered to be suitable unless the Shaolin Temple proposal is abandoned and other preferred sites are found to be inadequate. Under these circumstances, the northern portion of the site may be suitable.

6 - Jervis Bay Road: The site has some potential, though the locality and importance of the area for tourism is a key issue. Access arrangements and infrastructure costs are potentially high, whilst environmental impacts and community acceptance are also likely to be of concern.

Outcome: The site is not considered to be suitable unless several other preferred sites are found to be inadequate.

7 - Blackbutt Range Road: The site appears to be potentially suitable, with direct Highway access being a critical issue to be resolved with RMS. Recent upgrades to adjoining electrical substation suggests access may have been improved in recent times which may benefit this site. Environmental constraints would need to be considered in further detail.

Outcome: The site is considered to be suitable, though the South Nowra site remains the preferred location and this site would be considered as a secondary preference only.

8 - Turpentine Road Options: Two options appear to be potentially suitable at Turpentine Road. Key issues to be resolved in this area include access arrangements (any implications of the steep access road) and potential for associated amenity impacts and how these may be mitigated. Options in the eastern portion and in the southern portion, including possible access to Crown land, could be further investigated, though areas further to the west would appear to be inappropriate for access and servicing needs.

Outcome: The site is considered to be suitable, though the South Nowra site remains the preferred location and this site would be considered as a secondary preference only.

9 - Bay & Basin: The Bay & Basin site has significant access issues (particularly from Parnell Road), and being within an area with several surrounding residential/urban uses, has the potential for amenity concerns and community opposition is relatively high.

Outcome: The site is not considered to be suitable unless several other preferred sites are found to be inadequate.

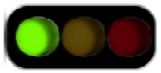
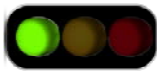
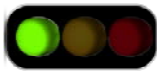
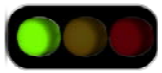
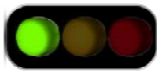
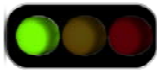
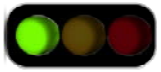
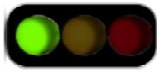
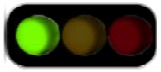
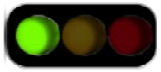
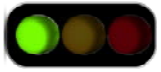
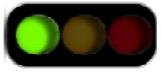
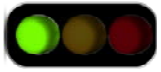
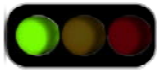
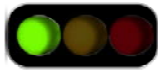
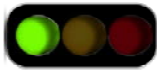
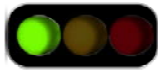
10 - Princes Highway South: The southern-most potential site is relatively small, with a number of issues such as environmental impacts, amenity concerns and access arrangements all potentially being terminal to the site being available. Mitigation measures for issues are also likely to fragment the site and result in the available area being insufficient.

Outcome: The site is not considered to be suitable and is the least preferred option.

11 - West Nowra Landfill: A key advantage to the West Nowra landfill site is the existing favourable zoning and existing operations that have a level of community acceptance (having operated in this location since the early 1970's). Future potential includes utilising a currently vegetated parcel in the south eastern corner, as well as the Council owned animal shelter site that is included in the "waste management" zoning. This would necessitate relocation of the animal shelter to another location, but which is considered to be feasible in the context of the landfill site costs.

Outcome: The site is considered to have options available for the continued use and expansion, subject to further detailed environmental studies and relocation of the existing animal shelter.

Table 10: Comparative Summary

Site #	Site Name	Land-use & Planning	Environment	Geology & Soils	Topography & Watercourses	Infrastructure	Amenity & Aboriginal Heritage	Comments
1	Bamarang							Not preferred.
2	South Nowra							Preferred new site.
3	Coonemia Road							Northern area not suitable for environment and amenity reasons. Southern area not suitable due to conflict with Shoalhaven Water.
4	Comberton Quarry							Not available due to major project proposal. Southern portion not suitable.
5	Comberton Grange							Not available due to major project proposal. Southern portion not suitable.
6	Jervis Bay Road							Not preferred.
7	Blackbutt Range Road							Potential site – secondary preference.
8	Turpentine Road							Potential site – secondary preference (east and south options only. West option not suitable).
9	Bay & Basin							Not suitable.
10	Princes Highway South							Not suitable.
11	West Nowra							Expansion options encouraged.

5. Conclusions and Recommendations

The Study has identified a number of potential alternatives for the siting of a future putrescible solid waste (putrescible and non-putrescible) landfill as envisaged in Section 1.4. Additionally, the Study highlights potential for the expansion of the existing landfill located at 120 Flatrock Road, Mundamia (known as the West Nowra Recycling and Waste Facility) as an alternative or in conjunction with new site investigations. Together these options should provide the Shoalhaven community with ongoing waste management facilities for the long-term.

Preferred Site

The preferred site identified by the desktop site selection process is located off Warra Warra Road at South Nowra. The site is partly Crown land and partly privately owned. Being zoned RU2 – Rural Landscape, the use for the purposes of a solid waste landfill is permissible. The siting of a landfill within the area should be undertaken based on more detailed studies, however locating within the Crown land portion may enable negotiation with a single land holder (the Crown) and facilitate acquisition and development.

Critical to the site layout would be the incorporation of the existing Nowra Rifle Club, who are understood to have a Permissive Occupancy agreement over some or all of the land. Discussions with the Club would therefore be an important step with preliminary investigations suggesting that the site could easily facilitate both uses.

Alternative Sites

Alternatives for development of a new landfill to South Nowra would include sites at Blackbutt Range Road and Turpentine Road, Tomerong. While these sites have positive attributes, they are considered to be secondary preferences to the South Nowra site outlined above.

Another potential alternative to development of a new site, or in conjunction with new site investigations, is the review and further investigations into options for the expansion of the existing West Nowra site. This could include full or partial development of the existing vegetated areas (south-eastern corner), incorporation of the Council animal shelter site (north-eastern corner), expansion into previous buffer zones or reuse of previously capped areas (additional height). This process should also incorporate the philosophy of not sterilising parts of the site even if expansion at the current time is not considered to be possible (i.e. avoiding the use of on-site offsets wherever possible).

5.1 Recommendations

To facilitate the conclusions identified above with respect to preferred and alternative site development, the following recommendations are provided:

Recommendation 1: Council's Waste Services Unit undertake a targeted consultation process within Council and with identified external stakeholders to discuss preferred site/s and options and to identify any issues to be further addressed during more detailed studies. Key stakeholders should include:

- RMS – regarding access arrangements and connections to the Princes Highway;
- Nowra Bomaderry Project Control Group / NSW Planning & Environment – regarding consistency with Strategic Planning for the area;
- Crown Lands – regarding existing tenure arrangements on the preferred site and processes to enable Council to undertake on-site investigations – particularly soils depth and suitability; and
- Department of Defence – regarding setback distances and mitigation measures associated with bird strike.

Recommendation 2: That Council:

- Reconsider the previously understood position not to relocate the existing animal shelter despite the facility being located on land zoned for the purposes of waste management;

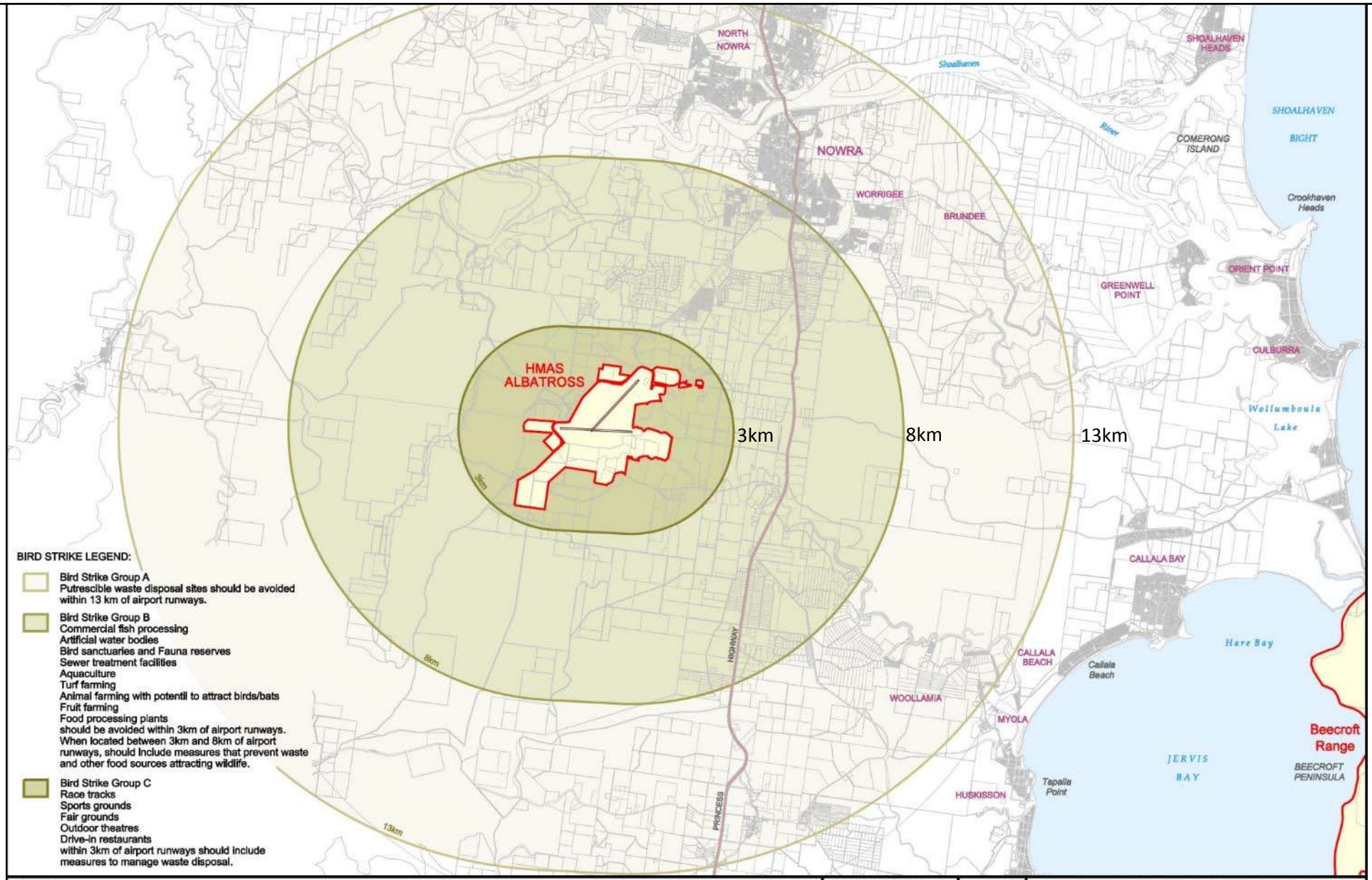
- consider the potential to locate the proposed Resource Recovery Park on the animal shelter site so as to avoid the extent of offsetting requirements being considered by the current RRP proposal (or if utilising the animal shelter site for this purpose is not possible, investigate other uses that may be possible on the site with a view to increasing the availability of other areas for landfill purposes); and
- Avoid sterilising the south-eastern corner for the purposes of landfill expansion by ensuring the need for any offsets is provided off-site (i.e. to keep the option for expansion open).

Recommendation 3: Following exploration of these options (and any site specific studies that may be required to confirm the suitability of alternative sites), consider whether a new landfill facility is required at this time or whether expansion of the existing landfill is the preferred course of action. This may need to consider for example, the cost of biodiversity offsets versus costs of developing a new site.

Recommendation 4: Undertake detailed studies and obtain relevant approvals ensuring appropriate time-frames are available.

Appendix A

Report Figures



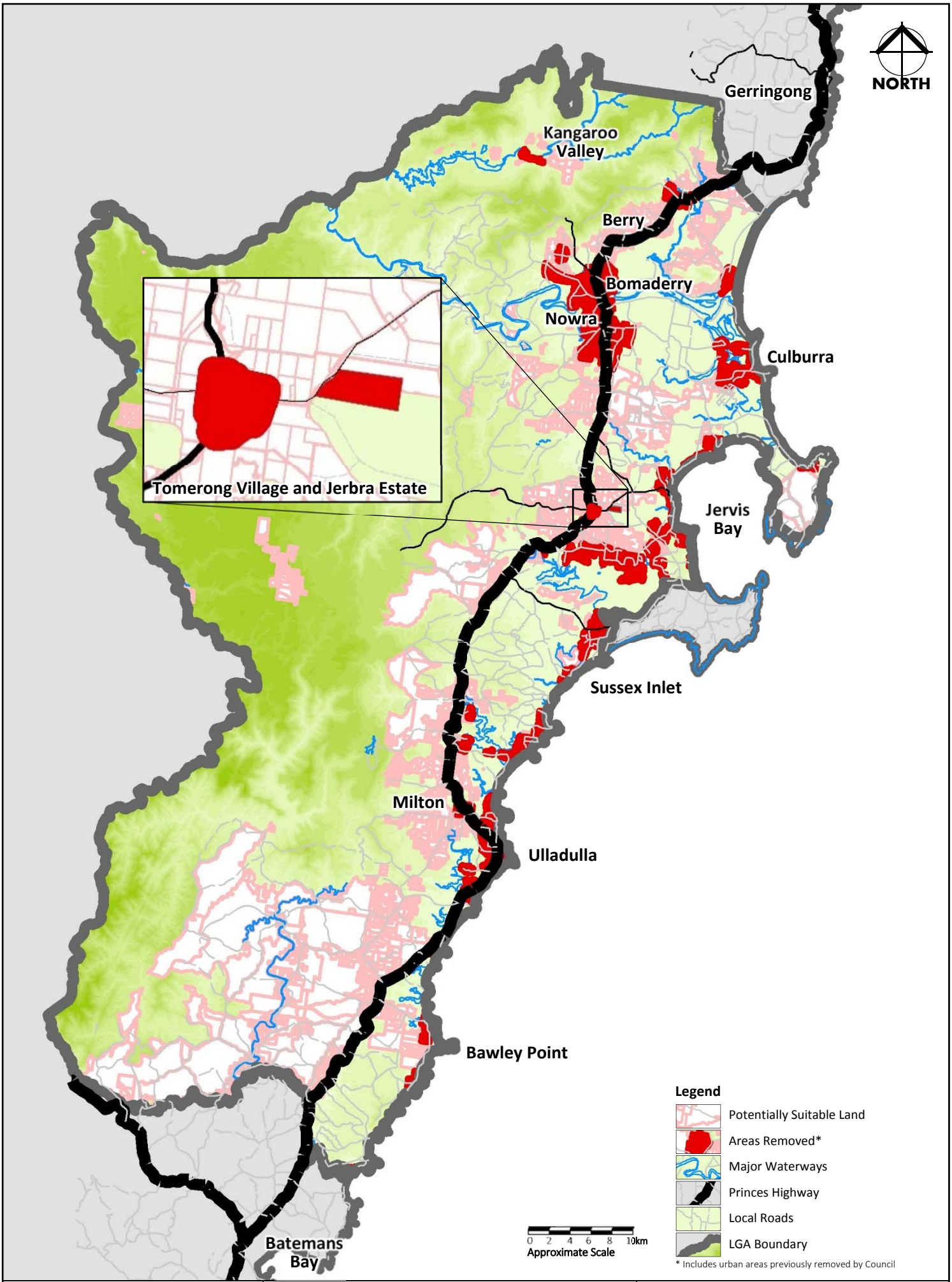
localé consulting

Project:	Desktop Landfill Site Identification Study
Client:	Shoalhaven City Council
Scale:	As shown
Revision:	0

Drawing: **HMAS Albatross Bird Strike Buffer Plan**

Source: Department of Defence – Estate Planning Branch

Figure 4

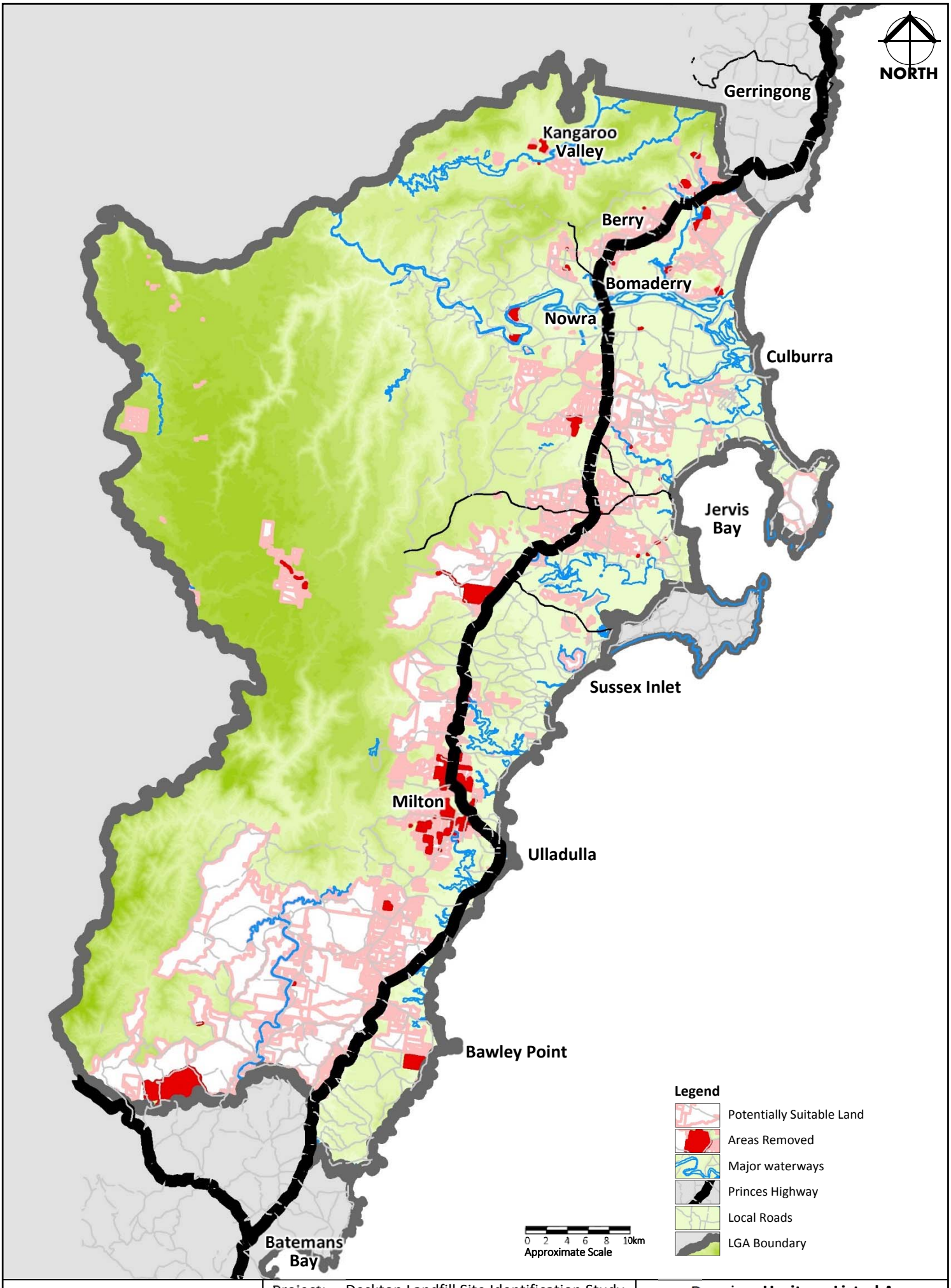


localé consulting

Project:	Desktop Landfill Site Identification Study
Client:	Shoalhaven City Council
Scale:	As shown
Revision:	0

Drawing: **Urban and Additional Environmental Areas**

Figure 5

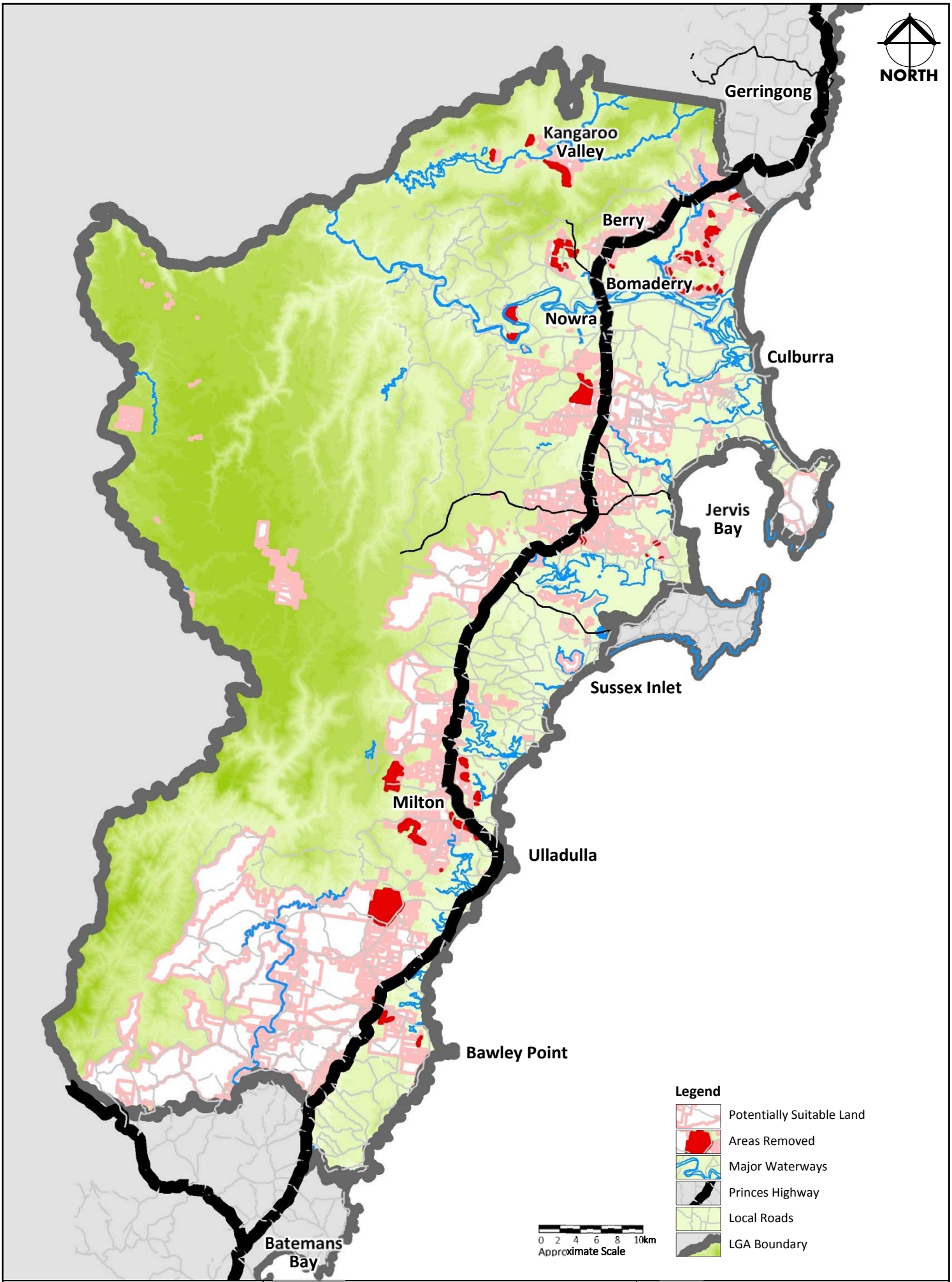


localé consulting

Project:	Desktop Landfill Site Identification Study
Client:	Shoalhaven City Council
Scale:	As shown
Revision:	0

Drawing: **Heritage Listed Areas**

Figure 6

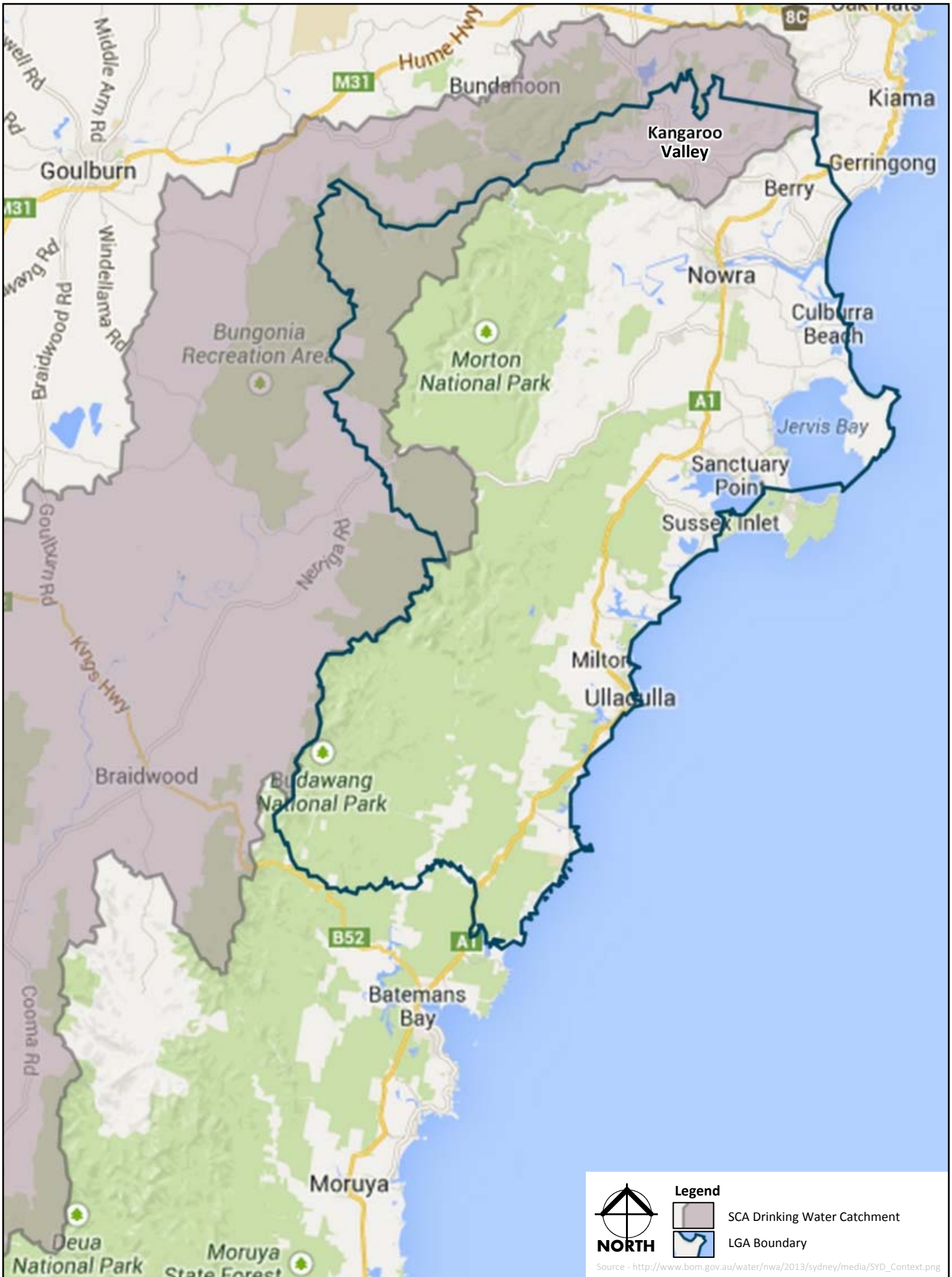


localé consulting

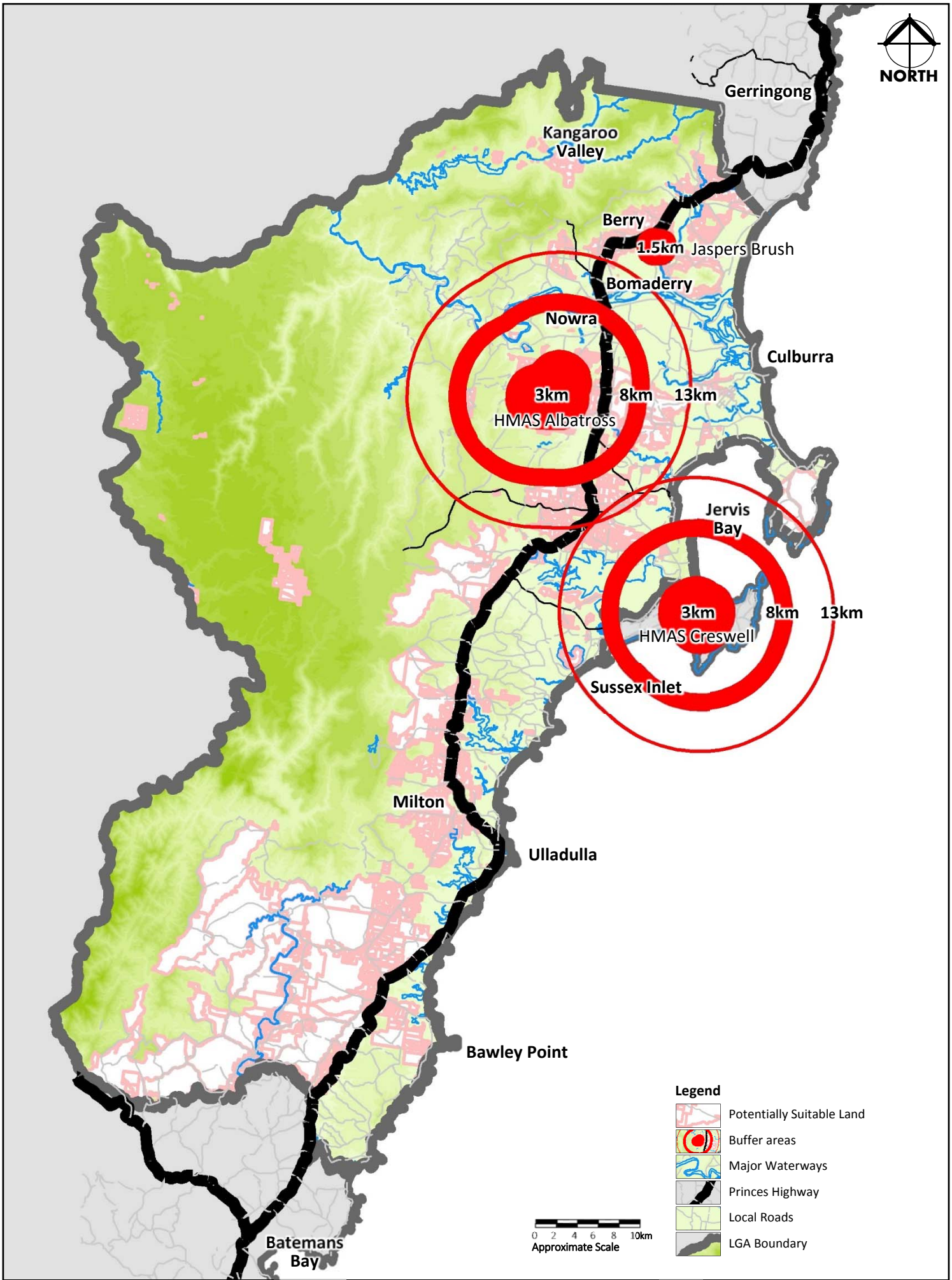
Project:	Desktop Landfill Site Identification Study
Client:	Shoalhaven City Council
Scale:	As shown
Revision:	0

Drawing: **Scenic Protection Areas**

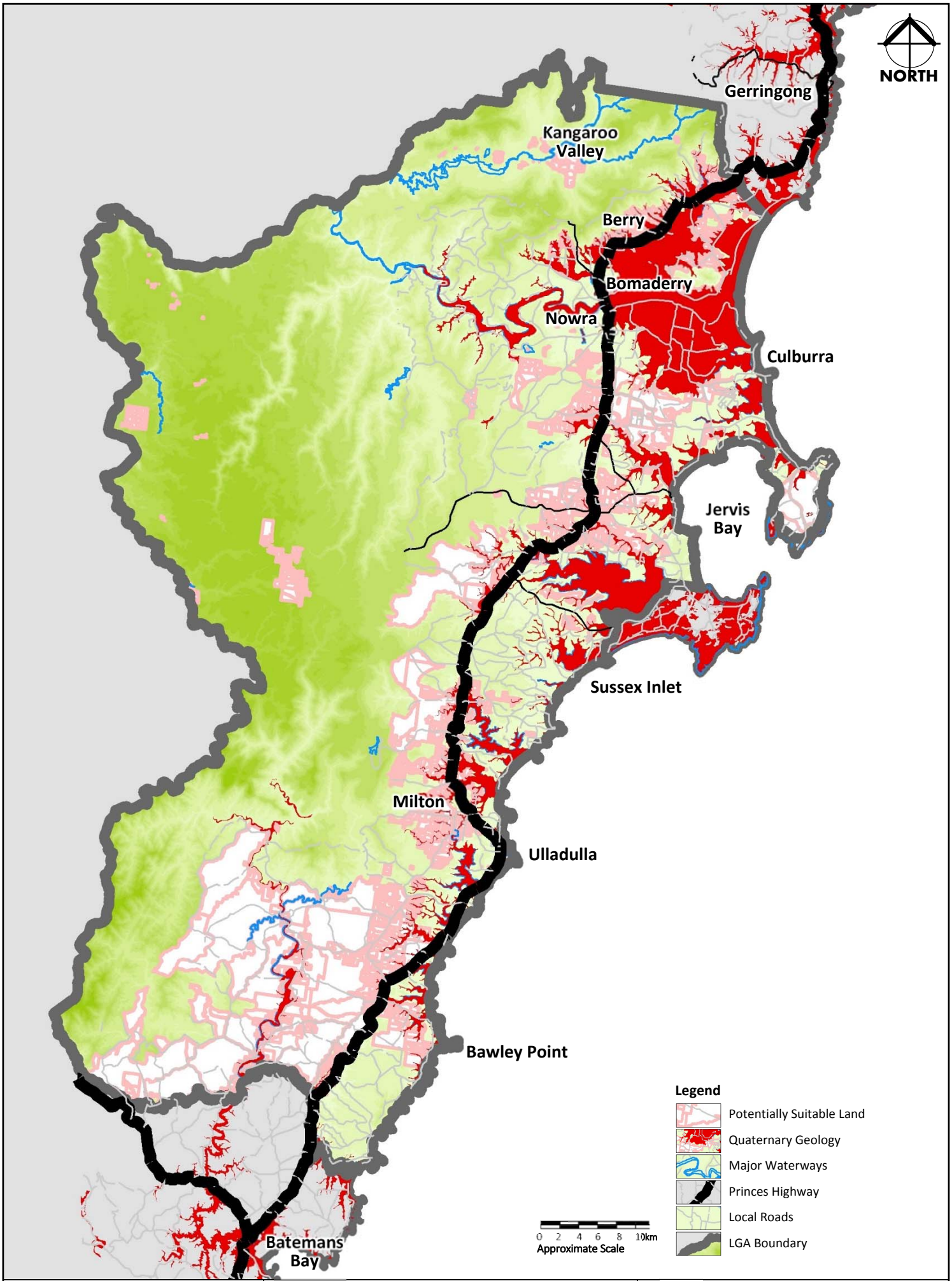
Figure 7



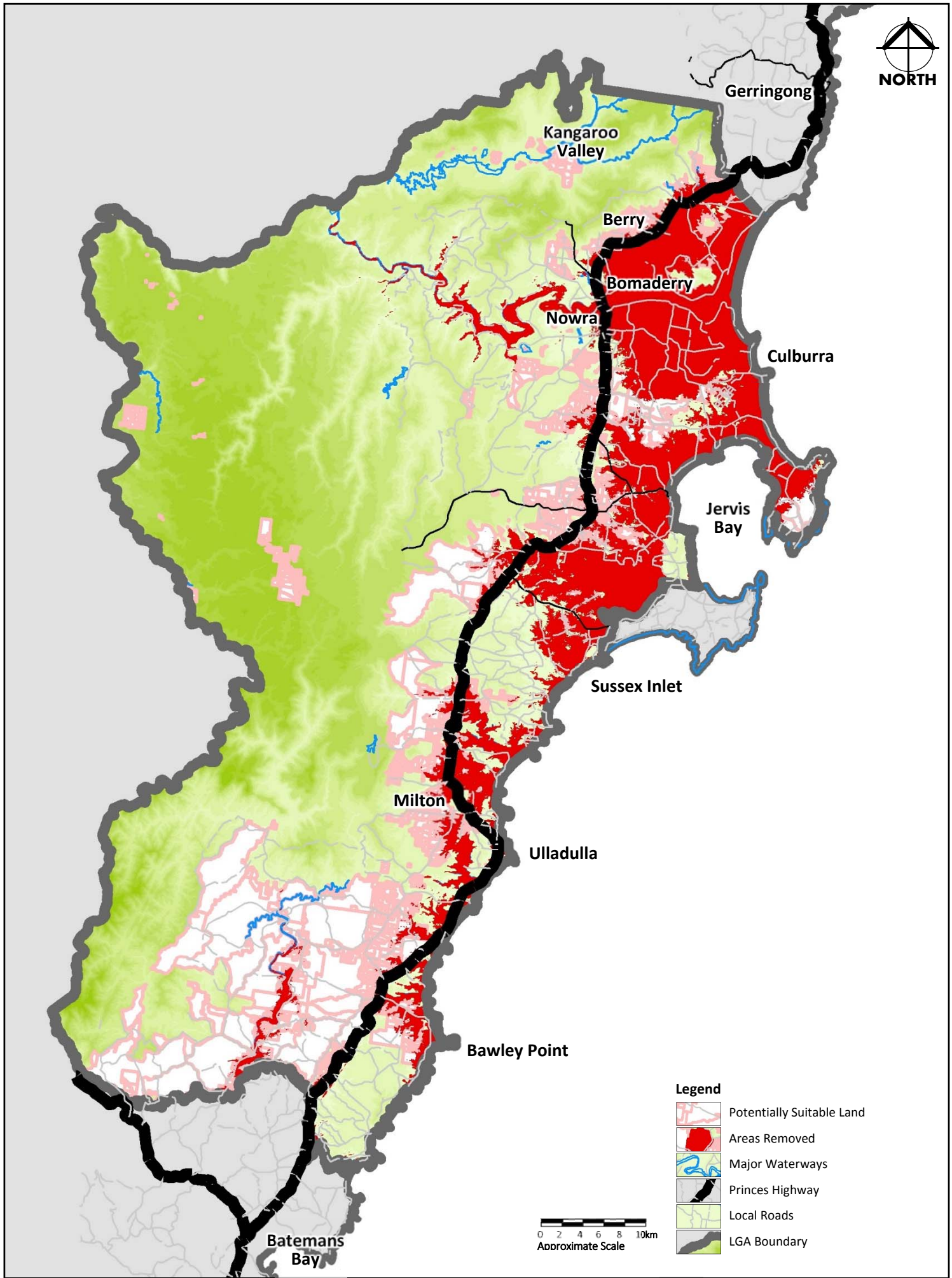
localé consulting	Project: Desktop Landfill Site Identification Study	Drawing: **SCA Drinking Water Catchment - Shoalhaven**
	Client: Shoalhaven City Council	
	Scale: NTS	**Figure 8**
	Revision: 0	



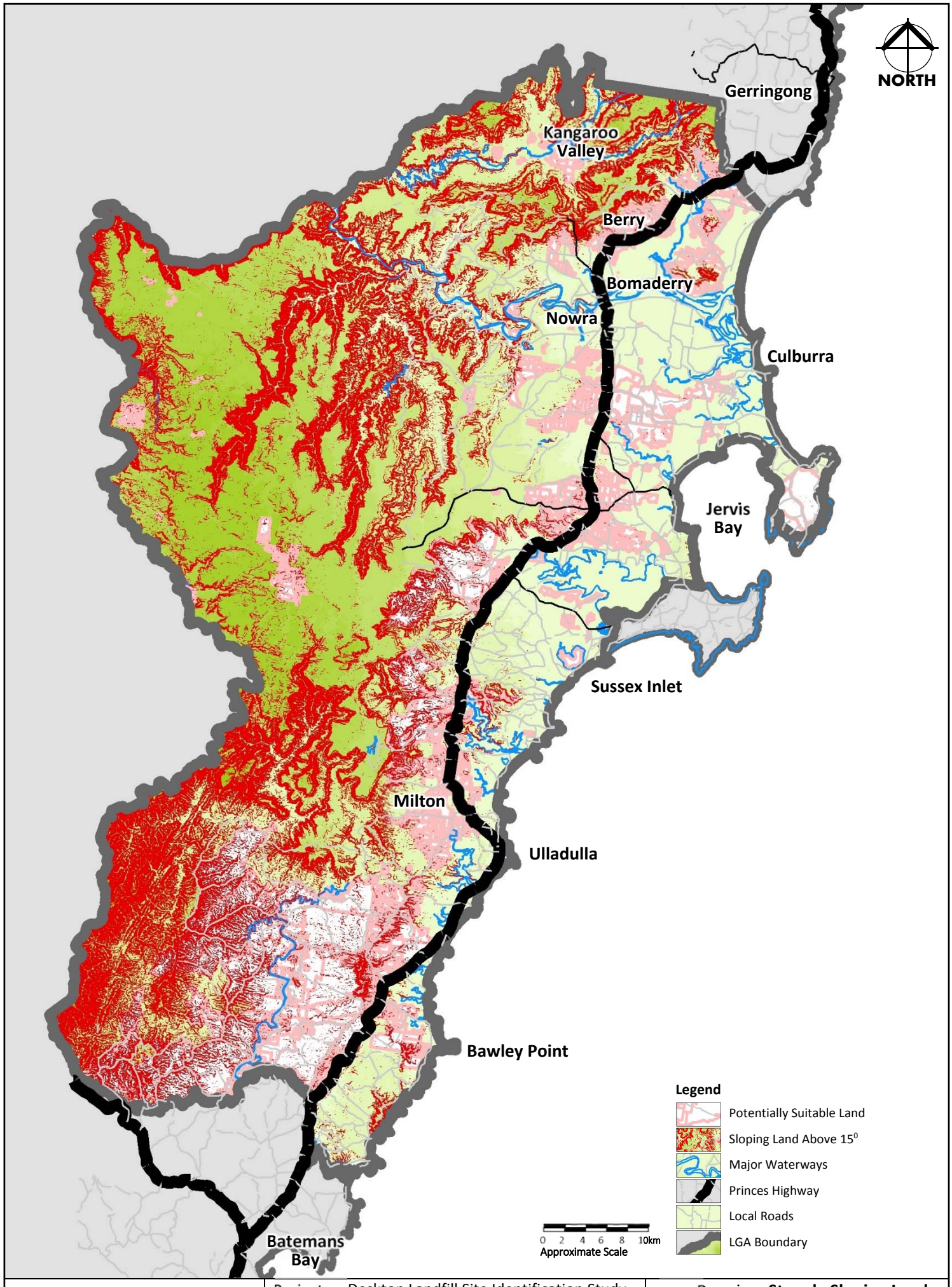
localé consulting	Project: Desktop Landfill Site Identification Study	Drawing: **Airfield Buffer Areas**
	Client: Shoalhaven City Council	
	Scale: As shown	**Figure 9**
	Revision: 0	



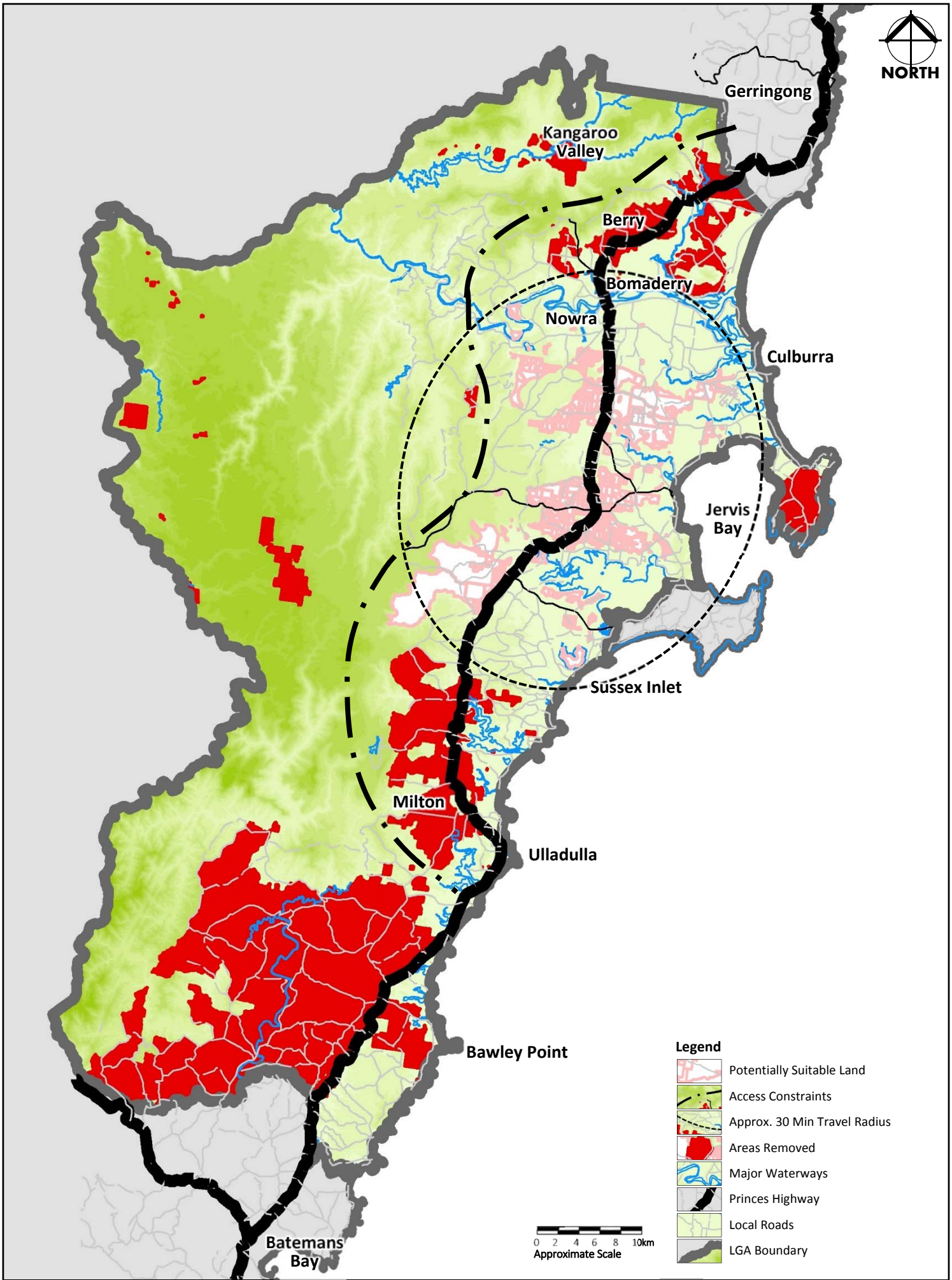
localé consulting	Project: Desktop Landfill Site Identification Study	Drawing: **Regional Geology (Quaternary aged deposits)**
	Client: Shoalhaven City Council	
	Scale: As shown	**Figure 10**
	Revision: 0	



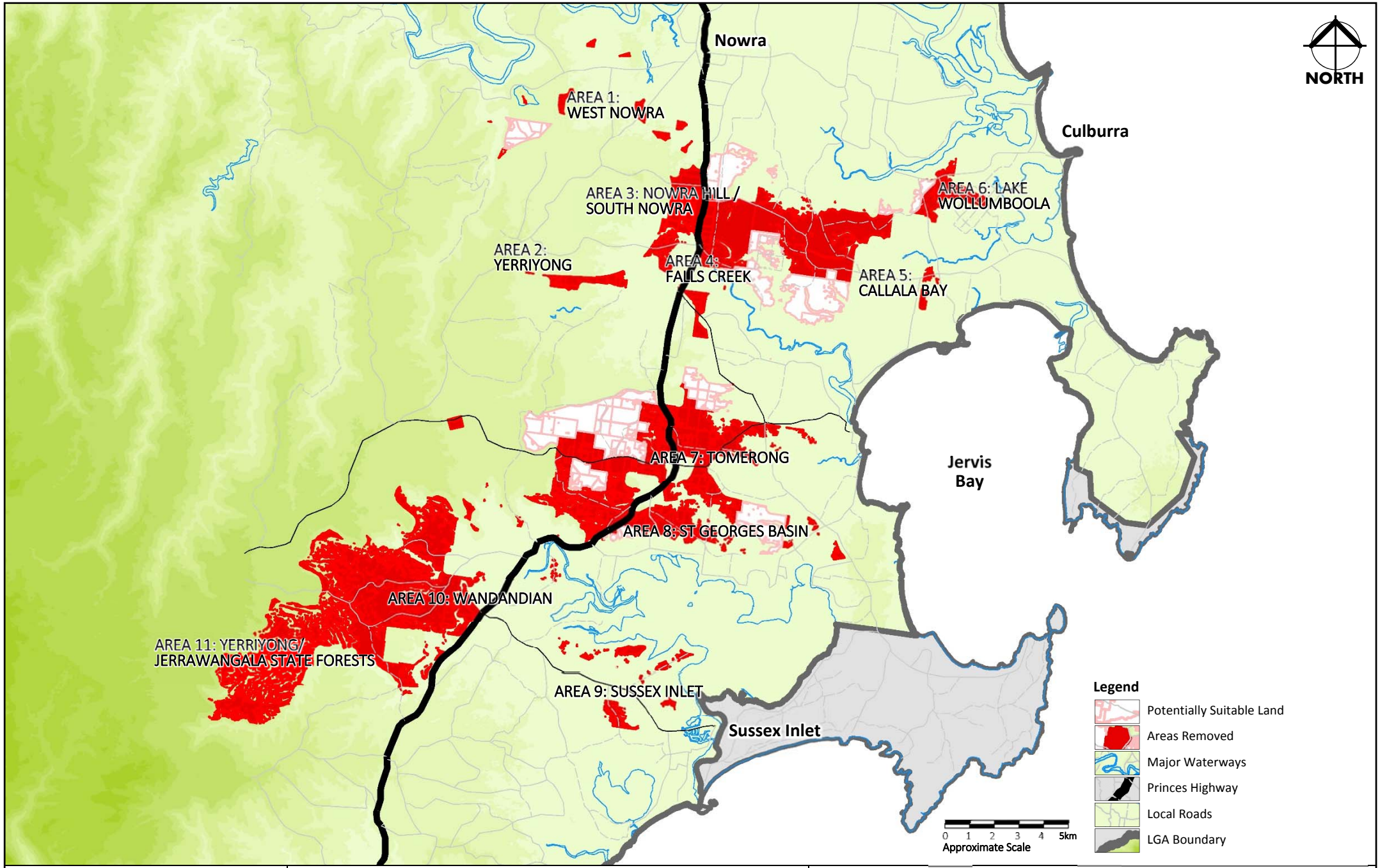
localé consulting	Project: Desktop Landfill Site Identification Study	Drawing: **Vertical Elevation (30m AHD)**
	Client: Shoalhaven City Council	
	Scale: As shown	**Figure 11**
	Revision: 0	



localé consulting	Project: Desktop Landfill Site Identification Study	Drawing: **Steeply Sloping Land (Above 15⁰)**
	Client: Shoalhaven City Council	
	Scale: As shown	**Figure 12**
	Revision: 0	



localé consulting	Project: Desktop Landfill Site Identification Study	Drawing: **Areas of Limited Accessibility**
	Client: Shoalhaven City Council	
	Scale: As shown	**Figure 13**
	Revision: 0	

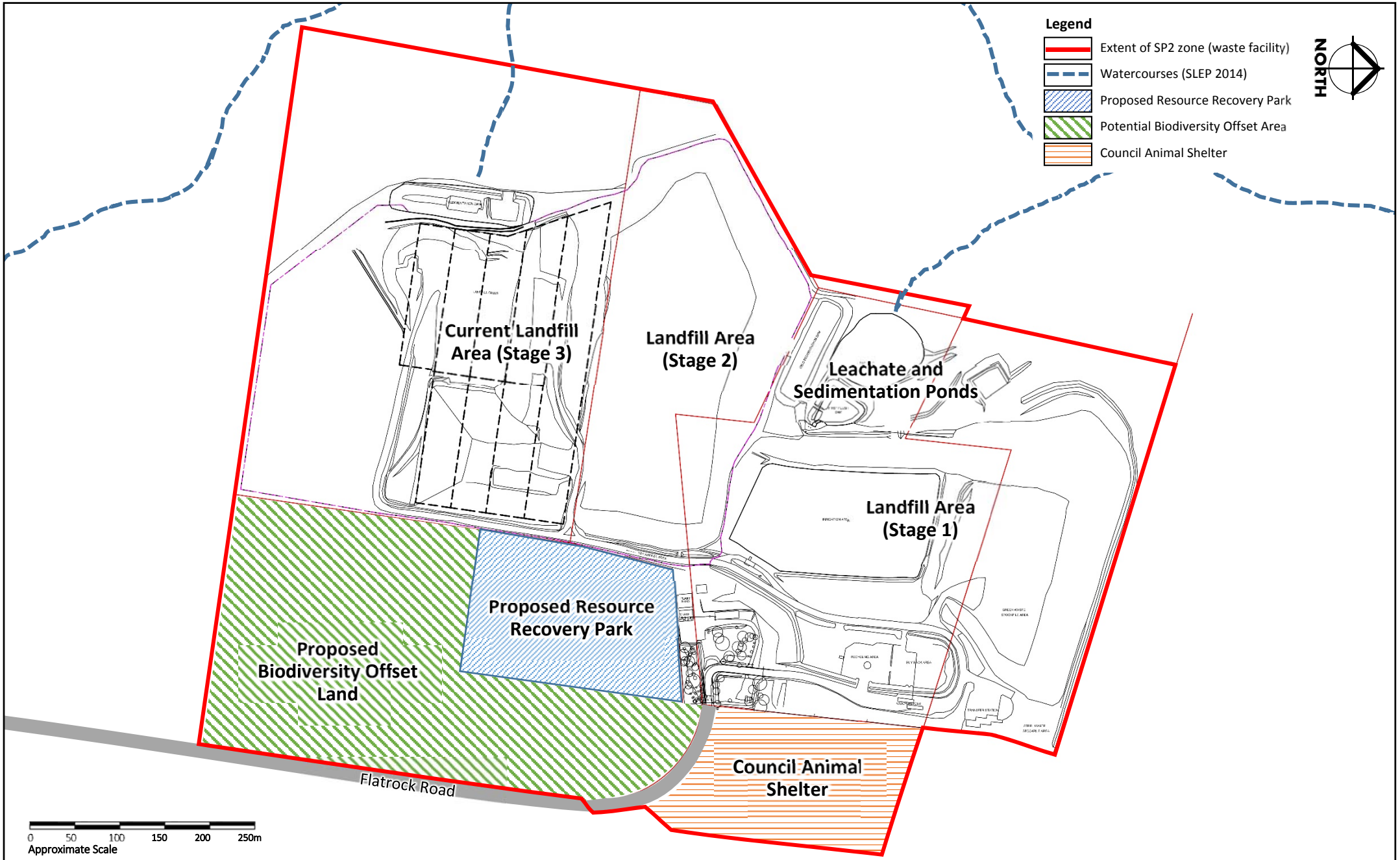


localé consulting

Project:	Desktop Landfill Site Identification Study
Client:	Shoalhaven City Council
Scale:	As shown
Revision:	0

Drawing: **Site Specific Exclusions**

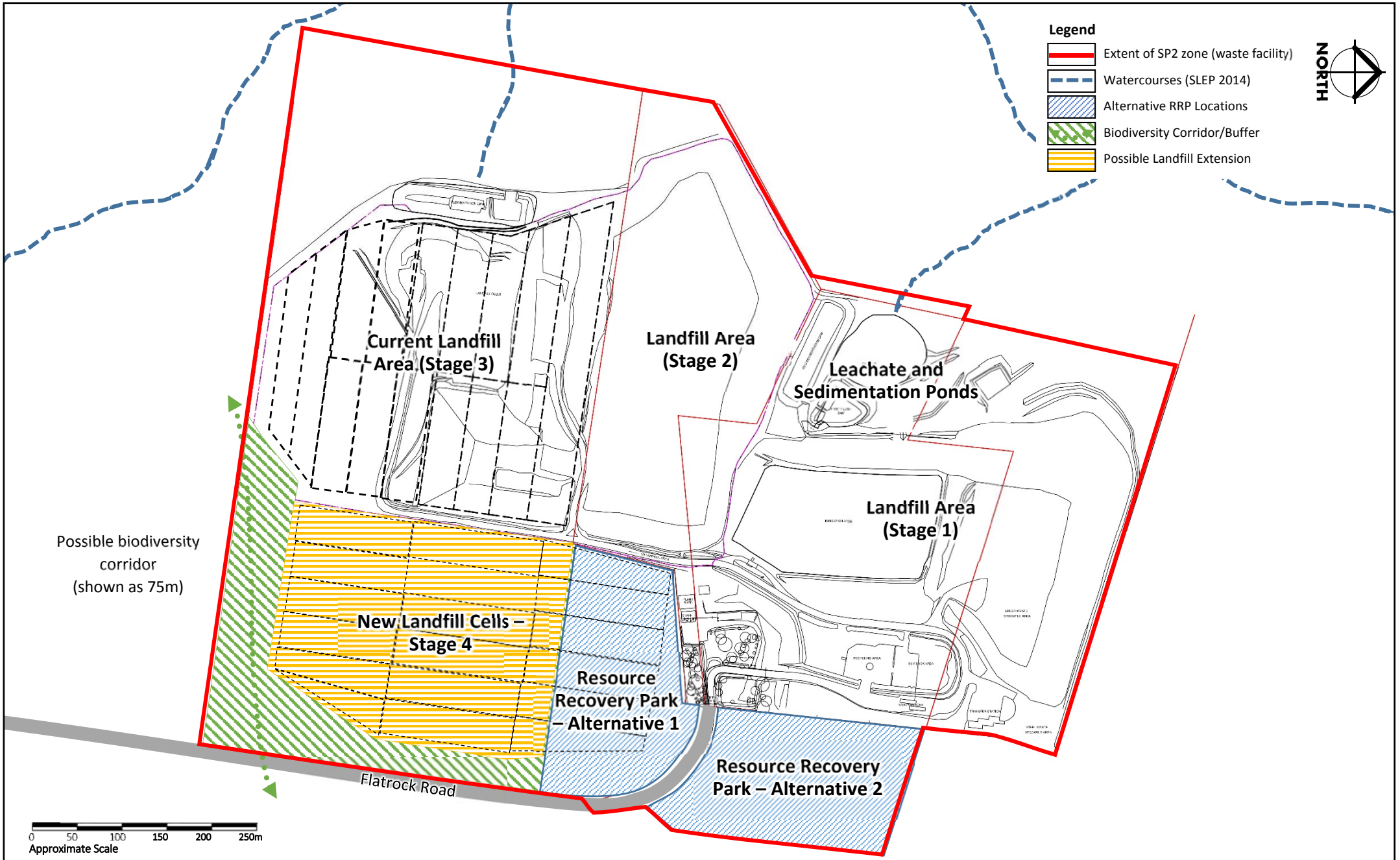
Figure 14



localé consulting	Project:	Desktop Landfill Site Identification Study
	Client:	Shoalhaven City Council
	Scale:	As shown
	Revision:	0

Drawing: **Existing West Nowra Landfill Site and Proposed Resource Recovery Park Plan**

Figure 15



localé consulting	Project: Desktop Landfill Site Identification Study	Drawing: **Existing West Nowra Landfill Site Proposed Extension Plan**
	Client: Shoalhaven City Council	
	Scale: As shown	**Figure 16**
	Revision: 0	

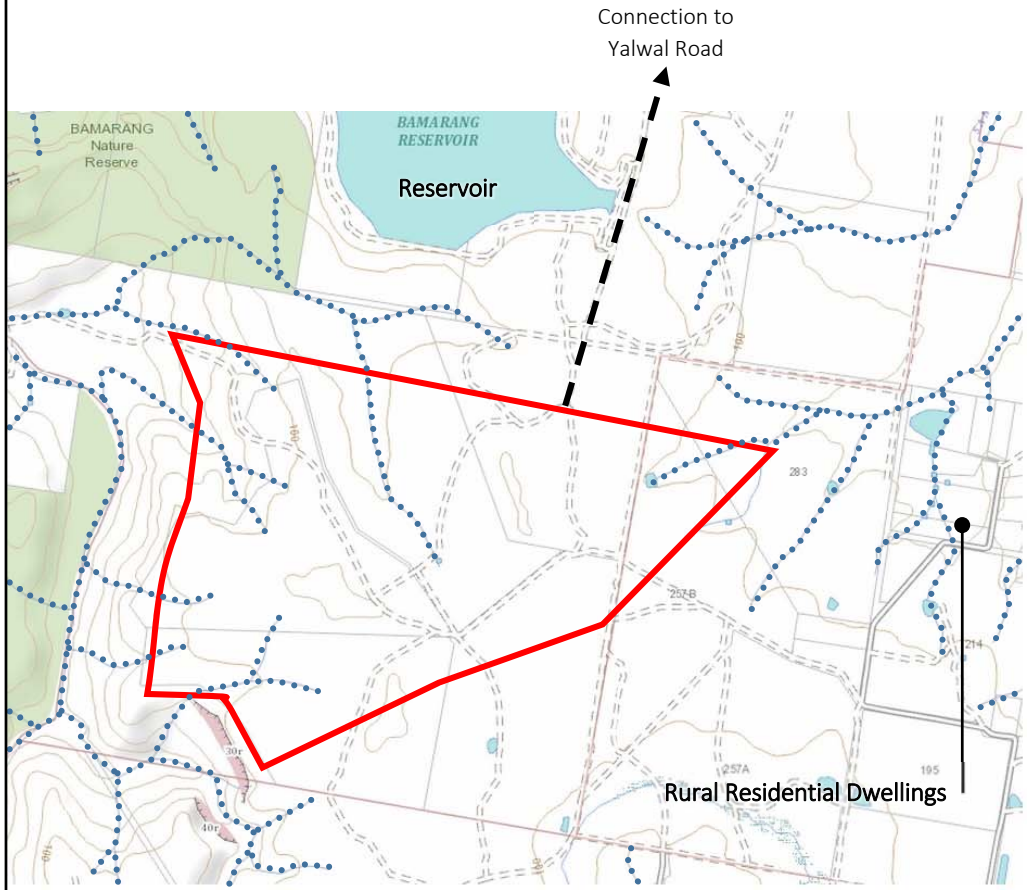
Appendix B

Site Plans for Comparative Site Analysis (Stage 3)

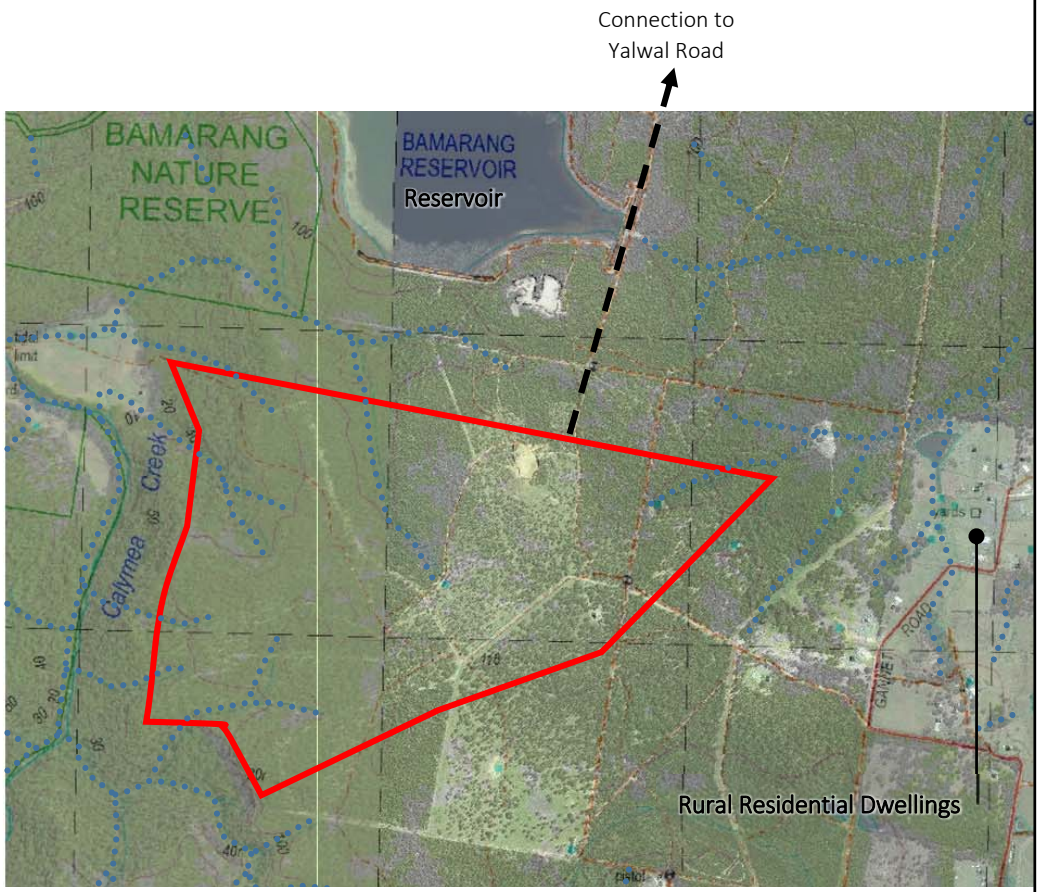
Legend

- Approximate site extent
- Assumed access point
- Mapped watercourse

NORTH



Topographic Base Plan



Topographic Aerial Plan

0 200 400 600 800m
Approximate Scale

Base image source: NSW Spatial Information Exchange

localé consulting

Project:	Desktop Landfill Site Identification Study
Client:	Shoalhaven City Council
Scale:	As shown
Revision:	0

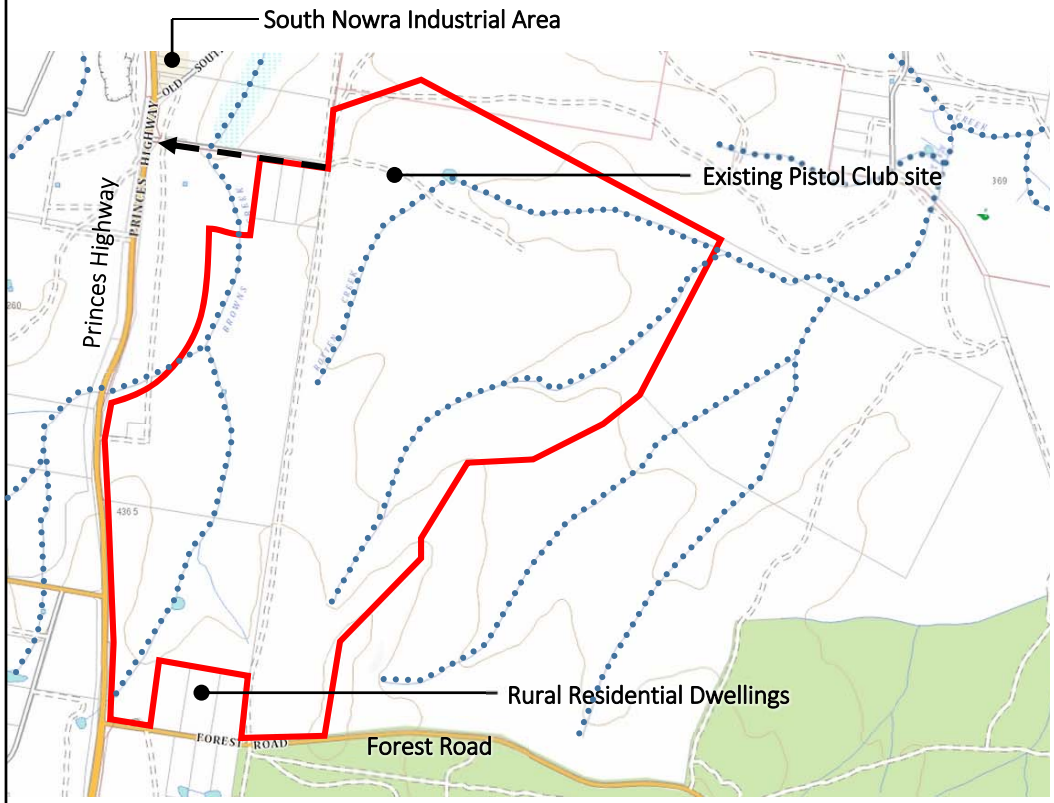
Drawing: **Site Plan**

Site Plan 1 - Bamarang

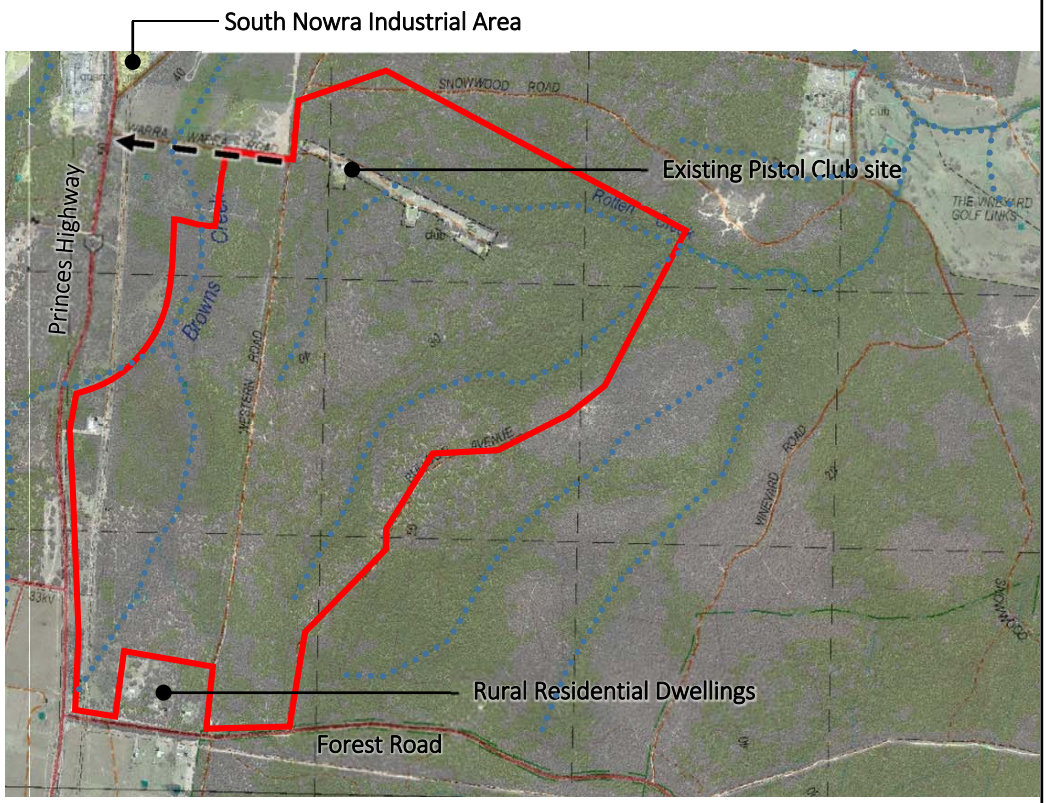
Legend

- Approximate site extent
- Assumed access point
- Mapped watercourse

NORTH



Topographic Base Plan



Topographic Aerial Plan

0 200 400 600 800m
Approximate Scale

Base image source: NSW Spatial Information Exchange

localé consulting

Project:	Desktop Landfill Site Identification Study
Client:	Shoalhaven City Council
Scale:	As shown
Revision:	0

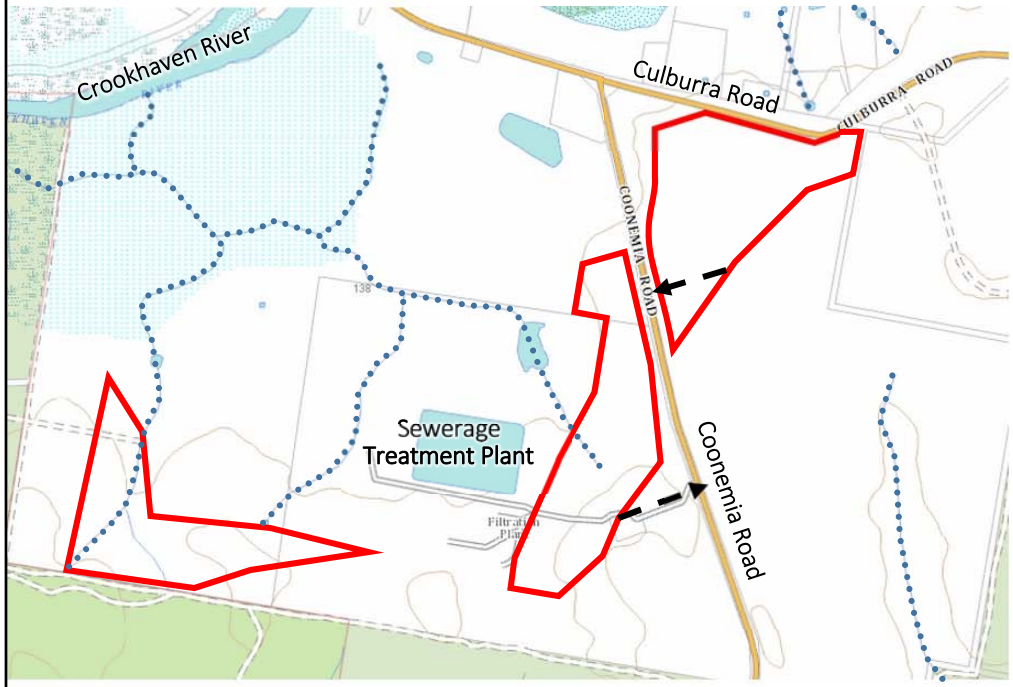
Drawing: **Site Plan**

Site Plan 2 – South Nowra

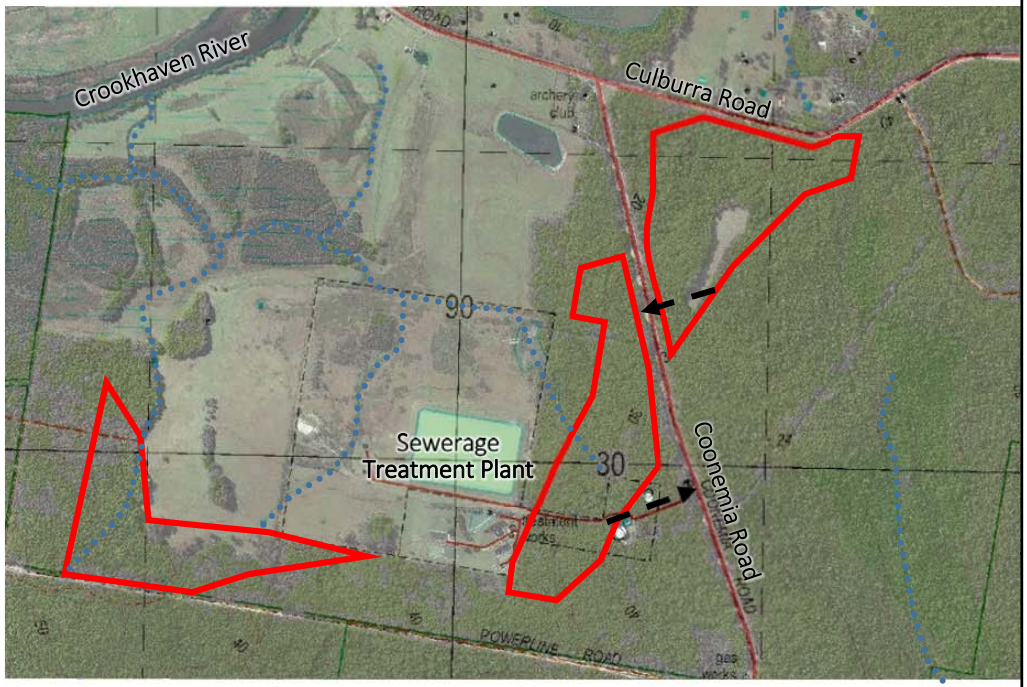
Legend

- Approximate site extent
- Assumed access point
- Mapped watercourse

NORTH



Topographic Base Plan



Topographic Aerial Plan

0 200 400 600 800m
Approximate Scale

Base image source: NSW Spatial Information Exchange

localé consulting

Project:	Desktop Landfill Site Identification Study
Client:	Shoalhaven City Council
Scale:	As shown
Revision:	0

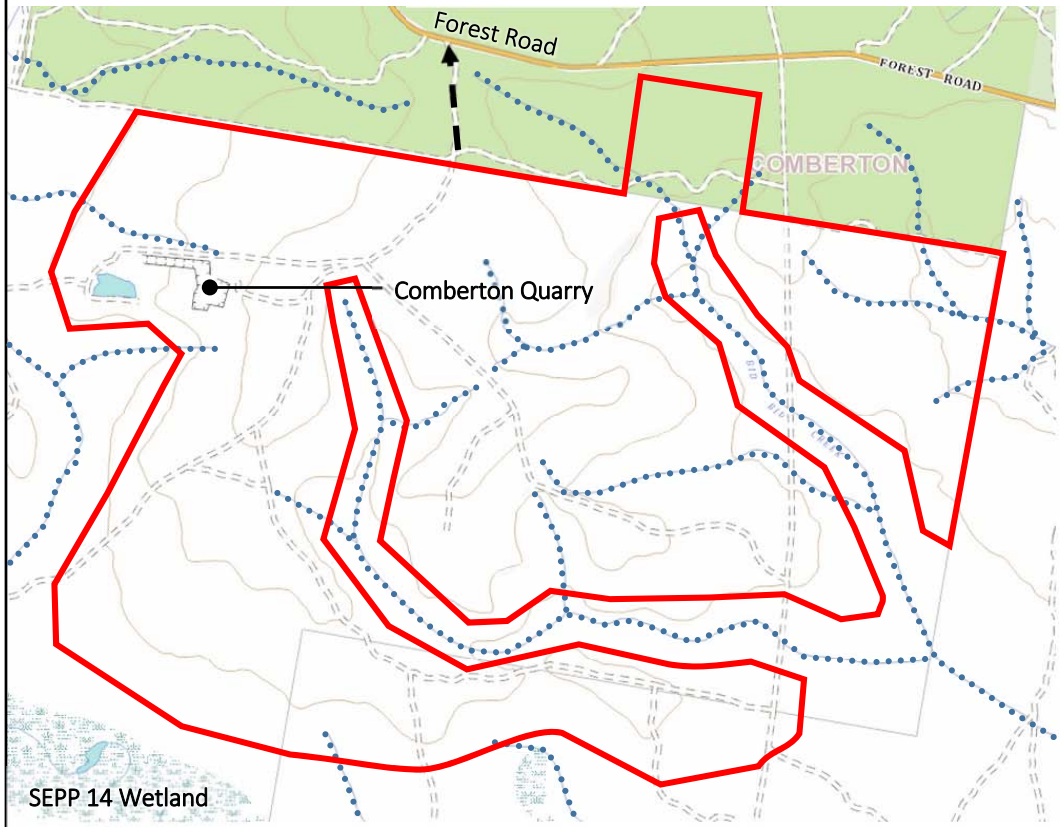
Drawing: **Site Plan**

Site Plan 3 – Coonemia Road

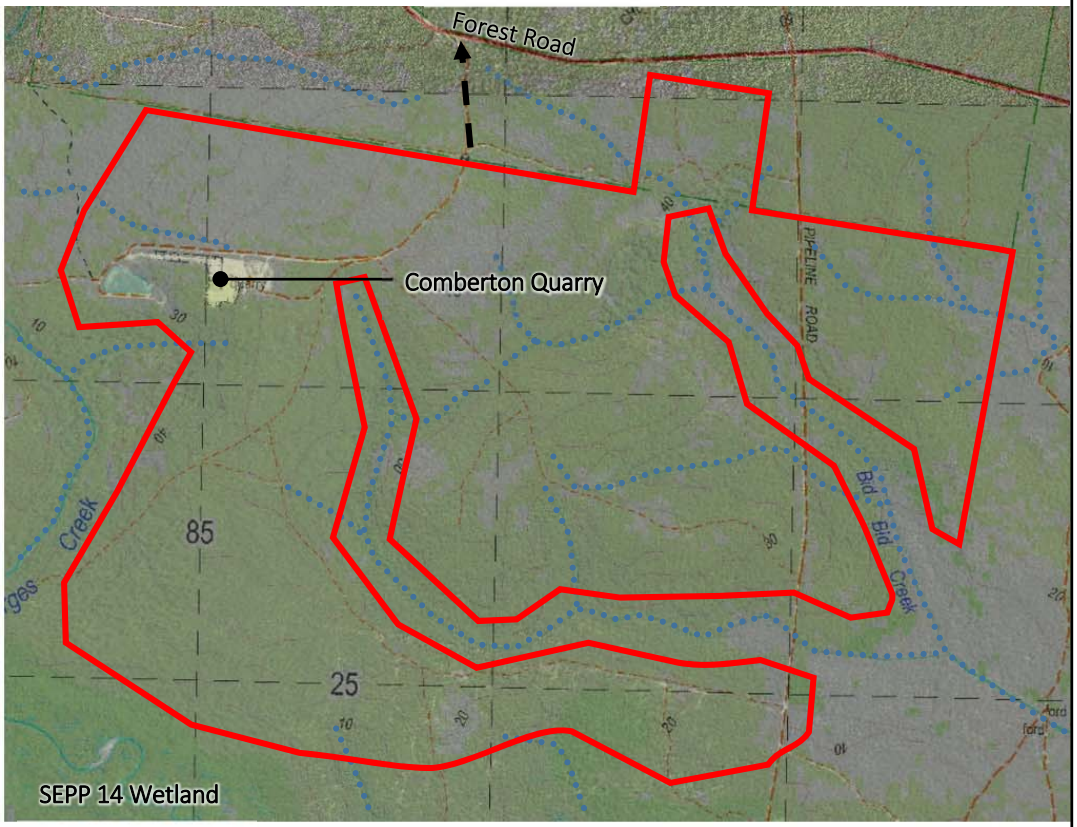
Legend

- Approximate site extent
- Assumed access point
- Mapped watercourse

NORTH



Topographic Base Plan



Topographic Aerial Plan

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Approximate Scale

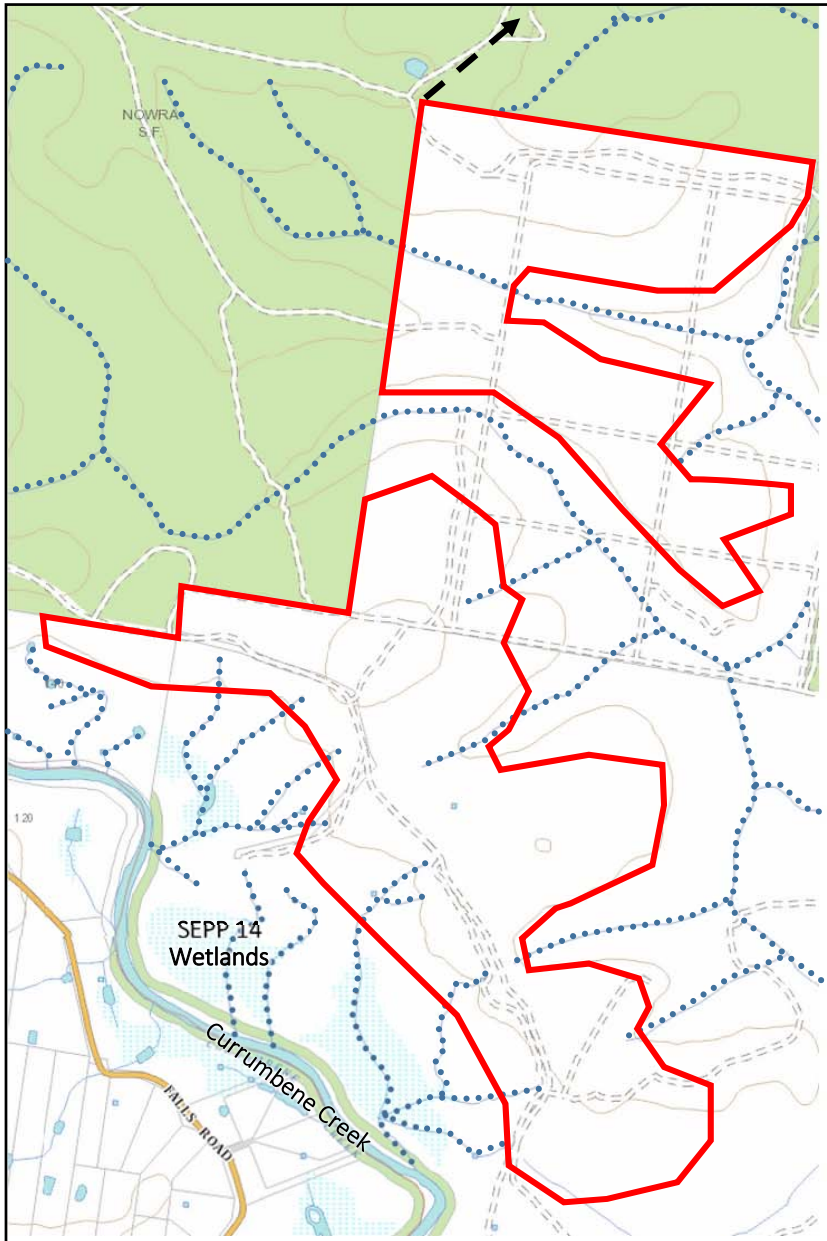
Base image source: NSW Spatial Information Exchange

localé consulting

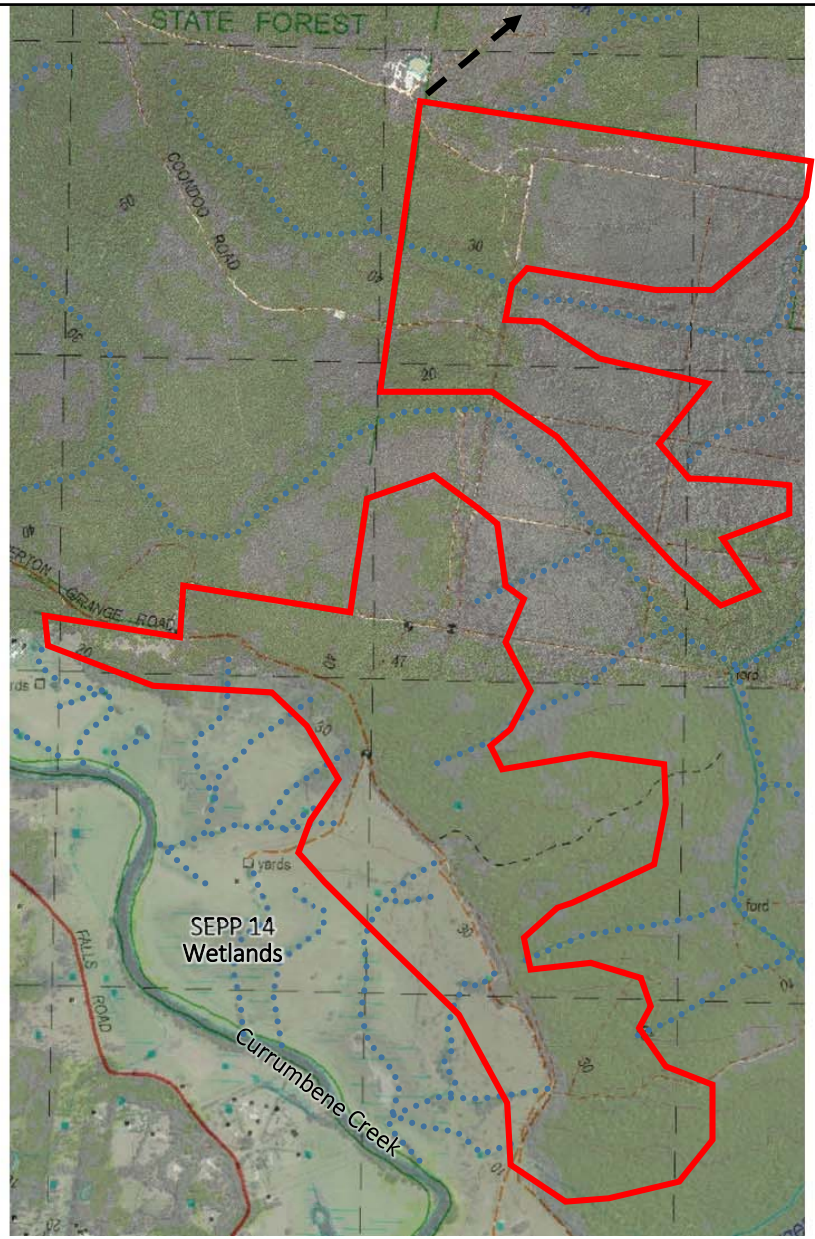
Project:	Desktop Landfill Site Identification Study
Client:	Shoalhaven City Council
Scale:	As shown
Revision:	0

Drawing: **Site Plan**

Site Plan 4 - Comberton Quarry



Topographic Base Plan



Topographic Aerial Plan

Legend

- Approximate site extent
- Assumed access point
- Mapped watercourse

NORTH

0 200 400 600 800m
Approximate Scale

Base image source: NSW Spatial Information Exchange

localé consulting

Project:	Desktop Landfill Site Identification Study
Client:	Shoalhaven City Council
Scale:	As shown
Revision:	0

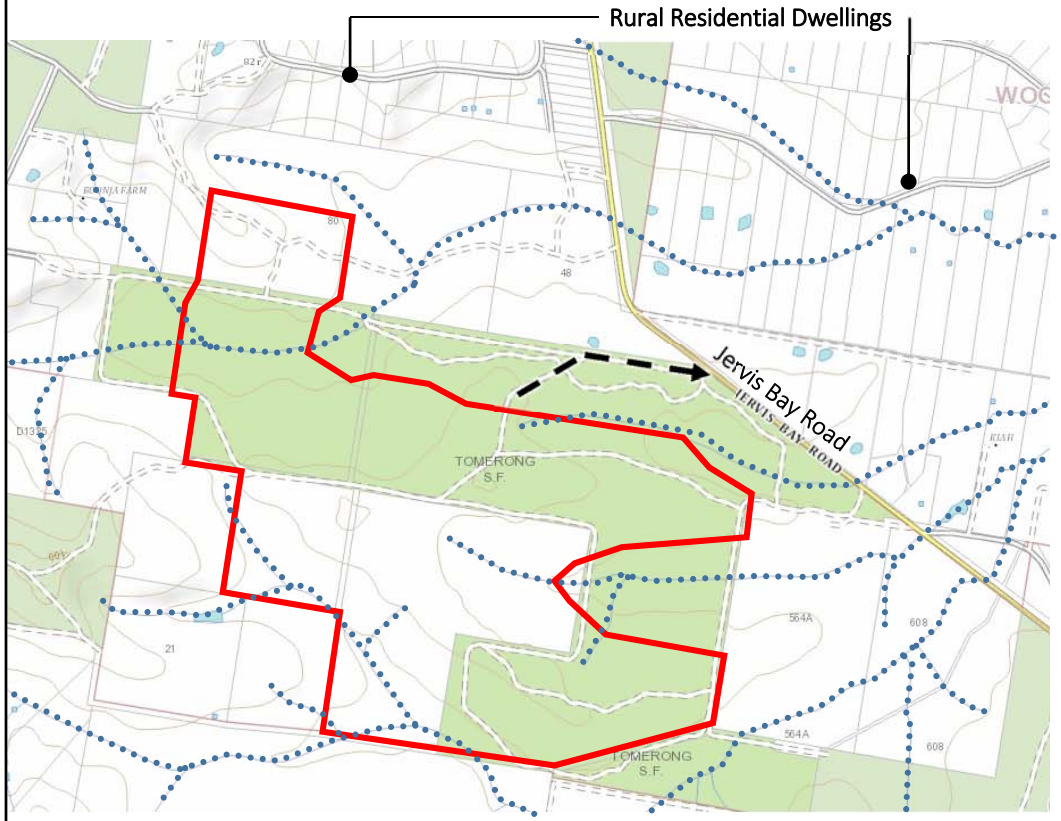
Drawing: **Site Plan**

Site Plan 5 - Comberton Grange

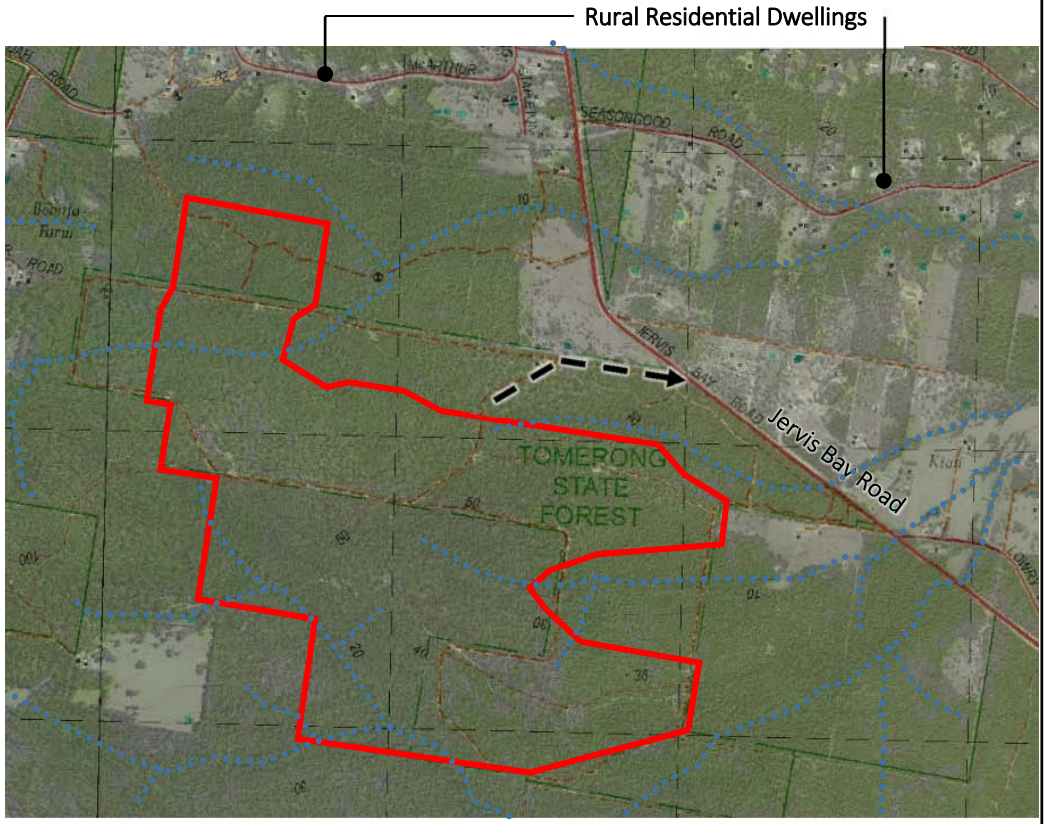
Legend

- Approximate site extent
- Assumed access point
- Mapped watercourse

NORTH



Topographic Base Plan



Topographic Aerial Plan

0 200 400 600 800m
Approximate Scale

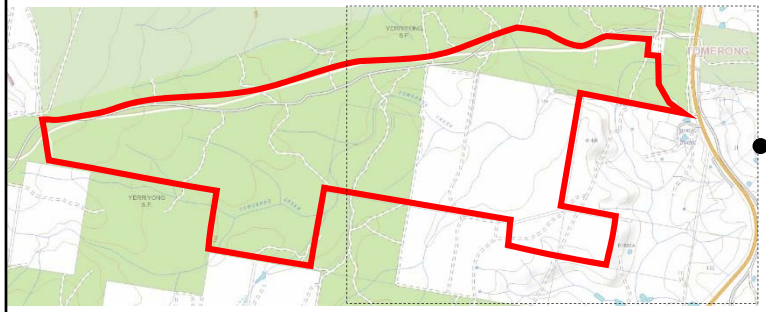
Base image source: NSW Spatial Information Exchange

localé consulting

Project:	Desktop Landfill Site Identification Study
Client:	Shoalhaven City Council
Scale:	As shown
Revision:	0

Drawing: **Site Plan**

Site Plan 6 - Jervis Bay Road



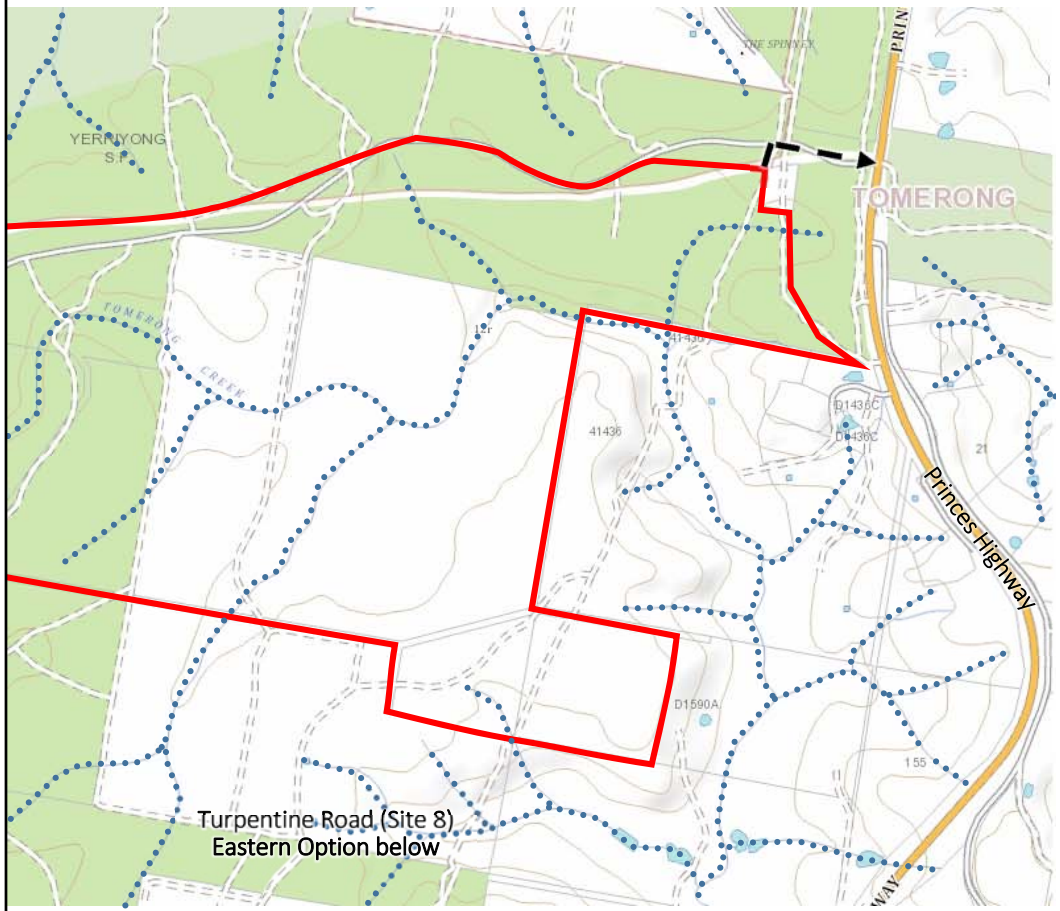
Extent of area shown on more detailed plans below

Legend

- Approximate site extent
- Assumed access point
- Mapped watercourse

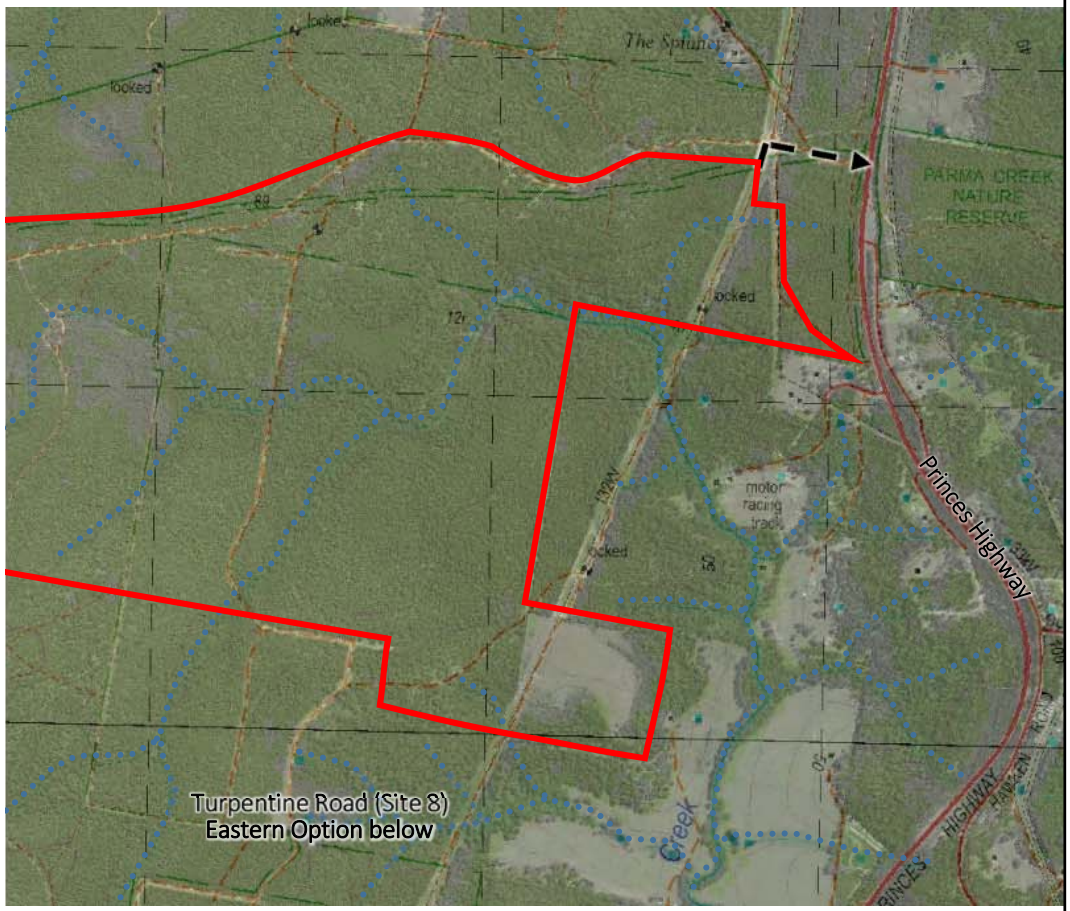
NORTH

Full Extent of Potentially Suitable Land



Topographic Base Plan (detailed plan)

Base image source: NSW Spatial Information Exchange



Topographic Aerial Plan (detailed plan)

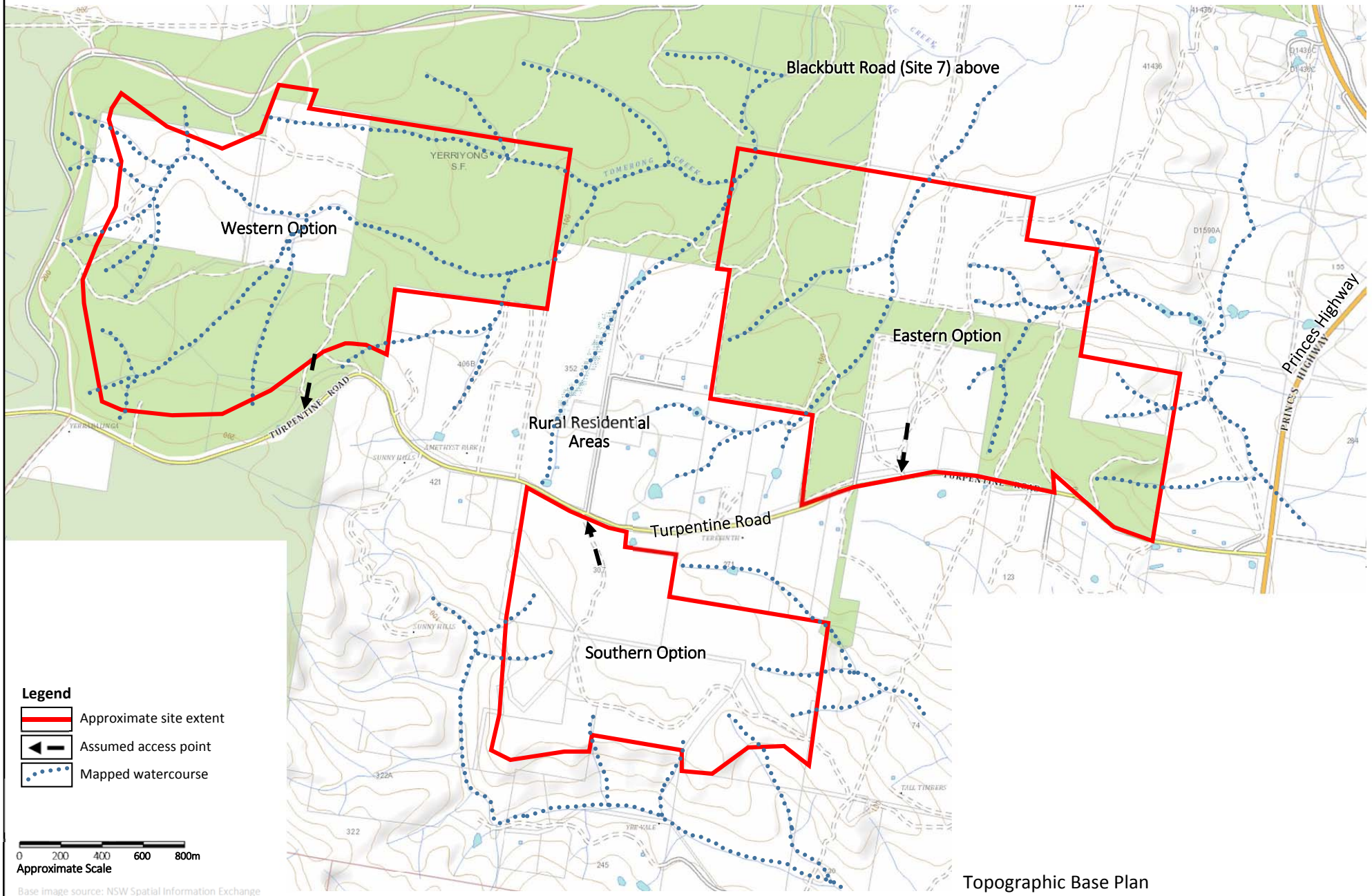
0 200 400 600 800m
Approximate Scale

localé consulting

Project:	Desktop Landfill Site Identification Study
Client:	Shoalhaven City Council
Scale:	As shown
Revision:	0

Drawing: **Site Plan**

Site Plan 7 - Blackbutt Range Road



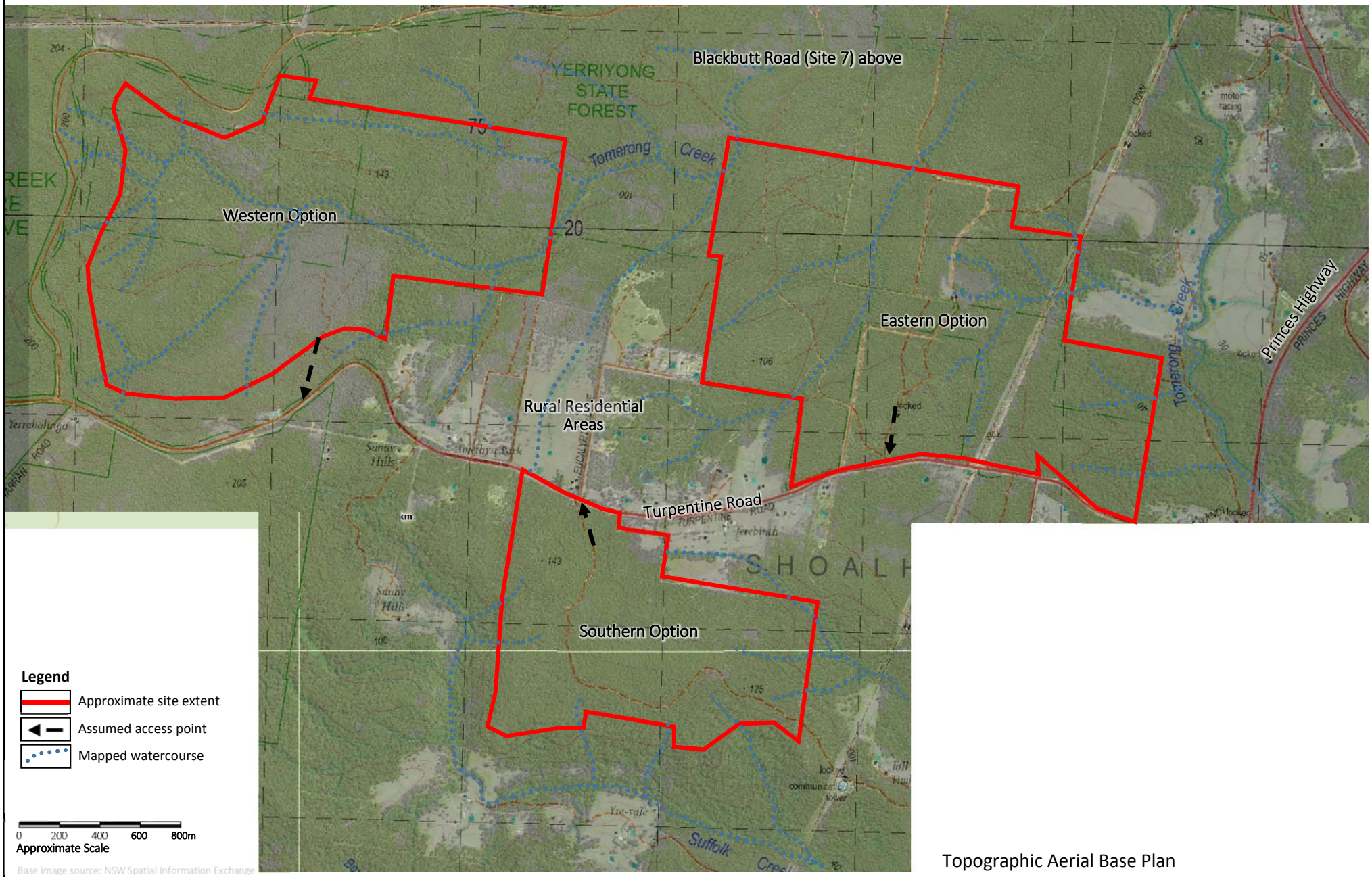
Topographic Base Plan

localé consulting

Project:	Desktop Landfill Site Identification Study
Client:	Shoalhaven City Council
Scale:	As shown
Revision:	0

Drawing: **Site Plan - Topographic**

Site Plan 8 - Turpentine Road (1 of 2)



Topographic Aerial Base Plan

localé consulting

Project:	Desktop Landfill Site Identification Study
Client:	Shoalhaven City Council
Scale:	As shown
Revision:	0

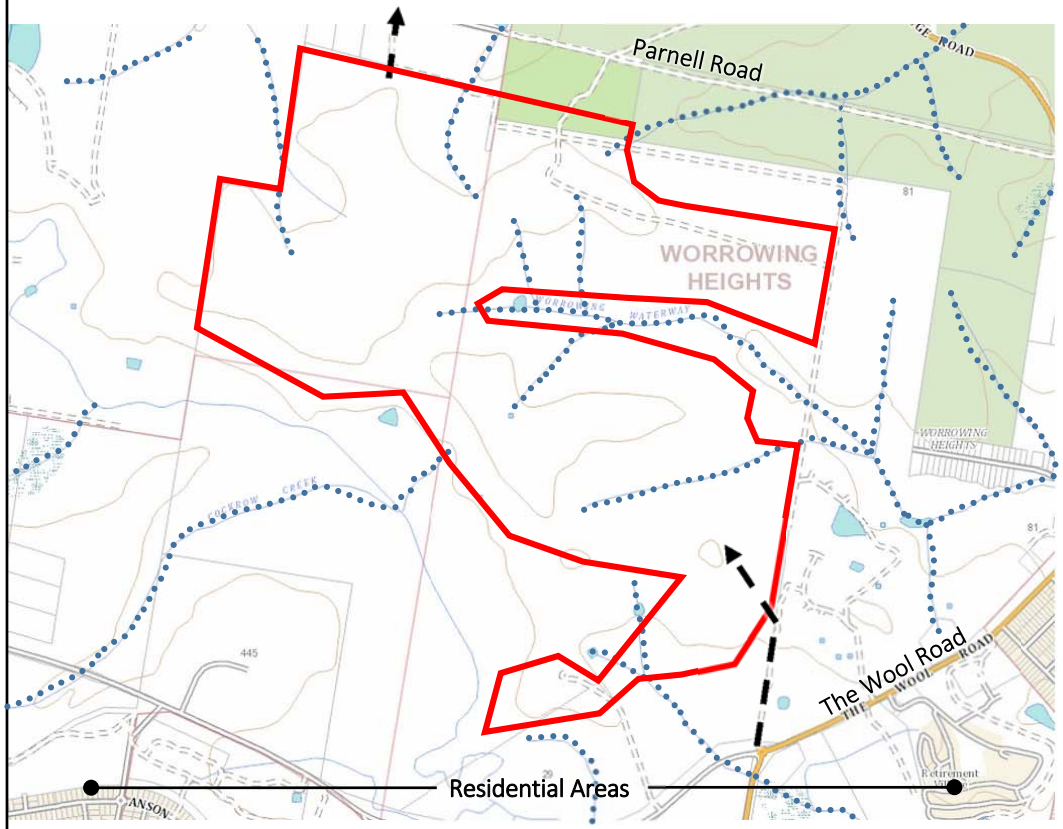
Drawing: **Site Plan – Topographic Aerial**

Site Plan 8 - Turpentine Road (2 of 2)

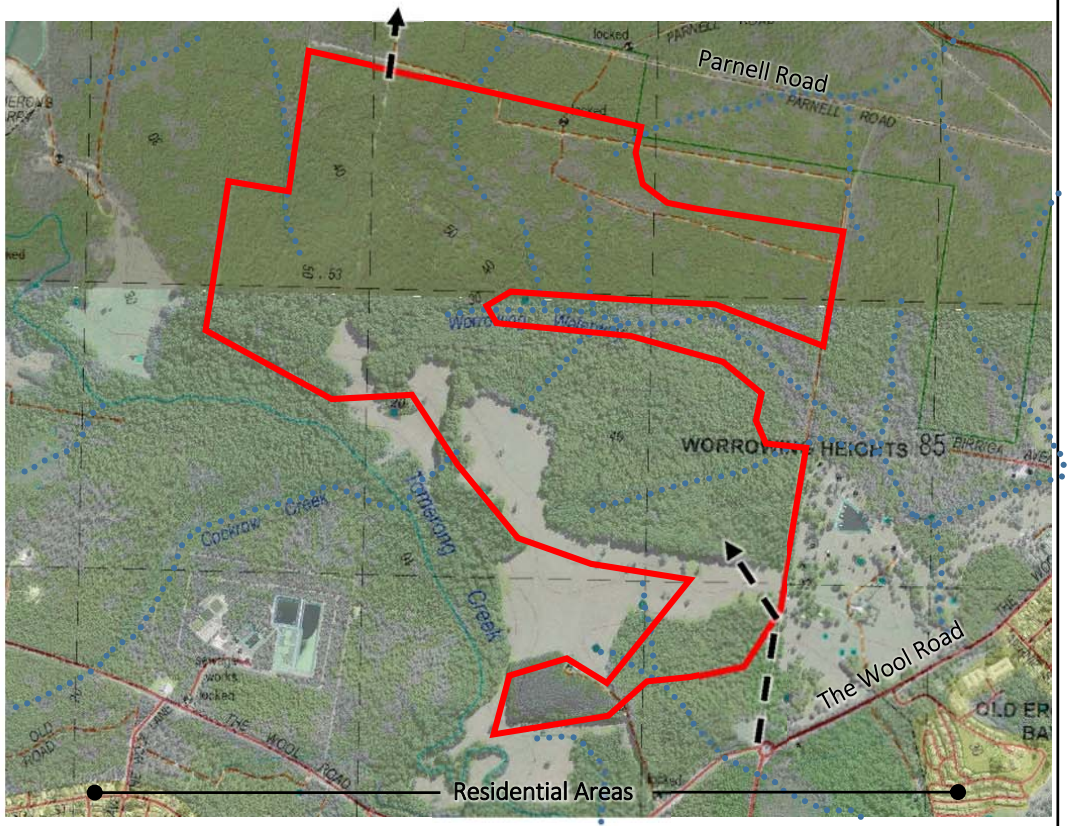
Legend

- Approximate site extent
- Assumed access point (options)
- Mapped watercourse

NORTH



Topographic Base Plan



Topographic Aerial Plan

0 200 400 600 800m
Approximate Scale

Base image source: NSW Spatial Information Exchange

localé consulting

Project:	Desktop Landfill Site Identification Study
Client:	Shoalhaven City Council
Scale:	As shown
Revision:	0

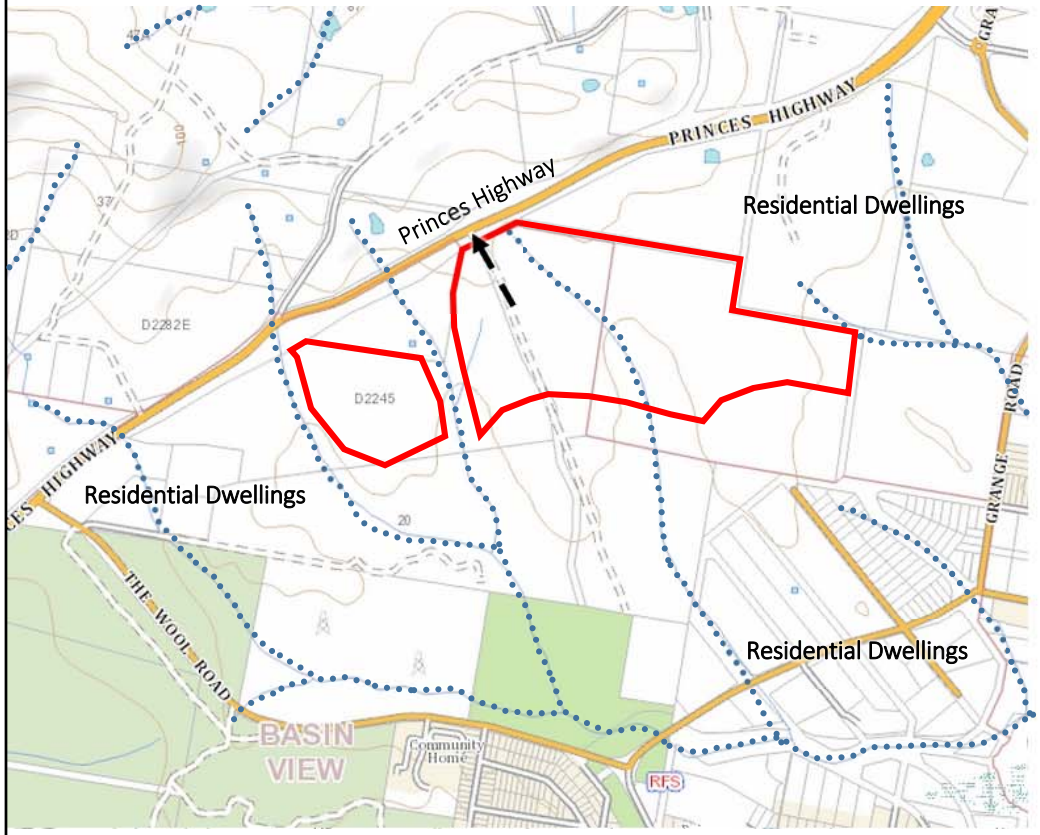
Drawing: **Site Plan**

Site Plan 9 - Bay & Basin

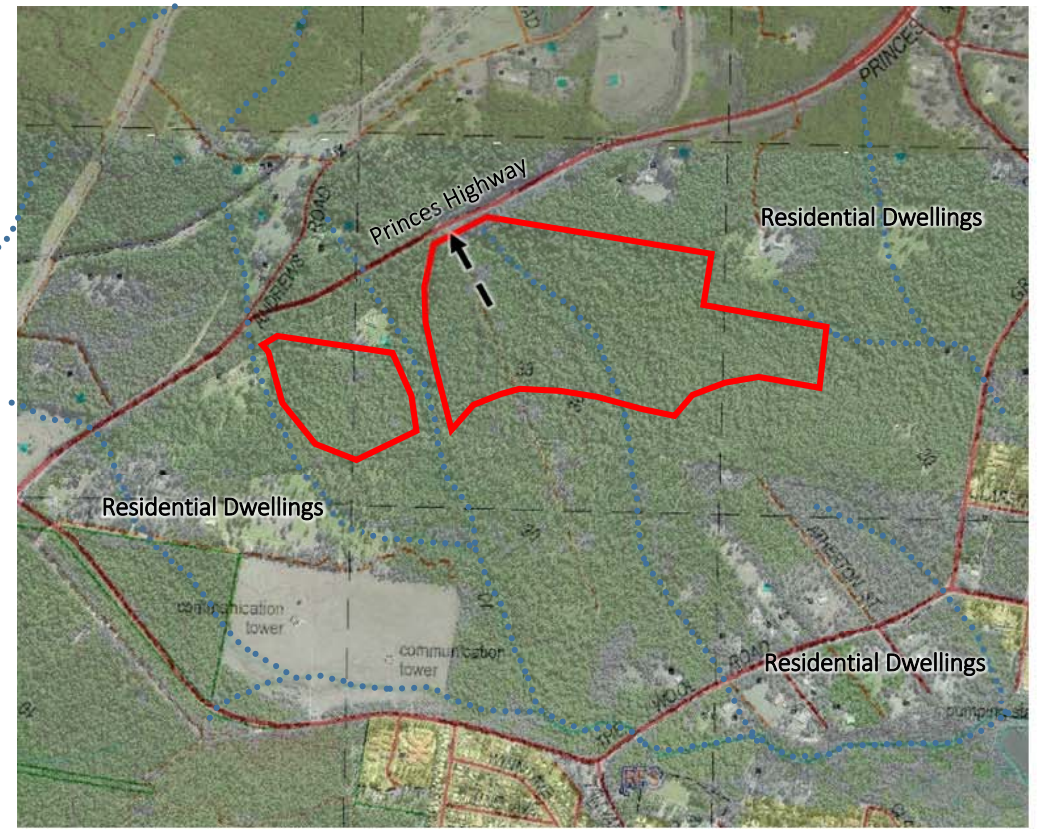
Legend

- Approximate site extent
- Assumed access point
- Mapped watercourse

NORTH



Topographic Base Plan



Topographic Aerial Plan

0 200 400 600 800m
Approximate Scale

Base image source: NSW Spatial Information Exchange

localé consulting

Project:	Desktop Landfill Site Identification Study
Client:	Shoalhaven City Council
Scale:	As shown
Revision:	0

Drawing: **Site Plan**

Site Plan 10 - Princes Highway South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