ACID SULFATE SOIL DESKTOP ASSESSMENT
BAYONET HEAD OUTLINE DEVELOPMENT PLAN AREA
ALBANY

Prepared for:

Health Development Company and CAMABB
PO Box 381
COTTESLOE WA 6911

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Written/Submitted by:	Written/Submitted by:	Reviewed/Approved by:
Jeremy Spencer Environmental Scientist	Dr Susie Brown Manager - Great Southern	Dr Greg Milner Principal Contaminated Sites

Coffey Environments Pty Ltd ABN 45 090 522 759
Suite 3, 236 Naturaliste Terrace Dunsborough WA 6281 Australia
PO Box 694 Dunsborough WA 6281 Australia
T (+61) (8) 9756 7869 F (+61) (8) 9756 8878 www.coffey.com/environments
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6 November 2007

Health Development Company and CAMABB
PO Box 381
COTTESLOE WA 6911

Attention: Brian Newman

Dear Brian

RE: Acid Sulfate Soil Desktop Assessment

As a part of the Environmental Reports being performed by Coffey Environments within the Bayonet Head outline development plan area, Albany, an acid sulfate soil preliminary investigation was conducted. The results of this investigation are provided in the report accompanying this letter.

If you wish to discuss this report further please feel free to give me a call on 9892 6400.

For and on behalf of Coffey Environments Pty Ltd

Jeremy Spencer
Environmental Scientist

RECORD OF DISTRIBUTION

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ABBREVIATIONS

AASS	Actual Acid Sulfate Soil
AHD	Australian Height Datum
ASS	Acid Sulfate Soil
ASSMP	Acid Sulfate Soil Management Plan
ER	Environmental Review
GSWA	Geological Survey of Western Australia
PASS	Potential Acid Sulfate Soil
PER	Public Environmental Review
WAPC	Western Australian Planning Commission

EXECUTIVE SUMMARY

Coffey Environments Pty Ltd was commissioned by the Health Development Company (HDC) and CAMABB to complete a preliminary acid sulfate soils assessment, comprising a desktop study, as part of an Environmental Review and Public Environmental Review for sites within the Bayonet Head outline development plan area in Albany.

The objective of this investigation is to identify indicators of ASS on the site, and to assess if the proposed works associated with the proposed development trigger the requirement for further soil sampling and/or an Acid Sulfate Soil Management Plan (ASSMP).

Preliminary investigations involved a review of published ASS risk maps, environmental geology maps, and a site visit. The results of the investigation have concluded that there is little or no known risk of ASS across much of the Bayonet Head outline development plan area however there is an area of moderate to high risk in the northern portion but this area is not associated with the lots subject to the ER and PER.

1 INTRODUCTION

1.1 Background

The Health Development Company (HDC) and CAMABB have engaged Coffey Environments to complete a preliminary acid sulfate soils assessment, comprising a desktop study as a part of the environmental review and public environmental review for lots 1, 476 and 1000, which are a part of the Bayonet Head outline development plan area (the site). The location of the site is Bayonet Head which lies approximately 6km to the north east of the Albany town centre and approximately 400km south of Perth (Figure 1).

Acid Sulfate Soils (ASS) are wetland soils and unconsolidated sediments that contain iron sulfides which can form sulfuric acid when exposed to atmospheric oxygen in the presence of water. ASS form in protected low-energy environments such as barrier estuaries and coastal lakes and commonly occur in low-lying coastal lands such as Holocene marine muds and sands. When disturbed, these soils are prone to produce acidity and consequently mobilise iron, aluminium, manganese and other heavy metals into the environment. The release of these reaction products can be detrimental to biota, human health and built infrastructure.

The objective of this investigation is to review the likely presence of ASS on the site, and to assess if future development works may trigger a requirement for further soil sampling and an Acid Sulfate Soil Management Plan (ASSMP). The scope of works is outlined further below.

1.2 Scope of Works

In order to meet the objectives listed above, the scope of works included the undertaking of an acid sulfate soils desktop study with reference to the DEC's *Draft Identification of Acid Sulfate Soils* (2006) and the preparation of a report on the findings from this investigation including:

- Desktop Assessment in consultation with DEC (2006) incorporating information from the following sources:
    - ASS risk maps published by WAPC (2003);
    - General soil maps;
    - Environmental geology maps;
    - Aerial photographs; and
    - Other local investigations.

2 DESKTOP ASSESSMENT

2.1 Background

The presence of ASS has been a recognised issue of concern in Western Australia since 2003. The Department of Environment and Conservation (DEC) and the Western Australian Planning Commission (WAPC) have released guidance notes on ASS, covering the requirement for assessing sites and the management of sites where ASS are identified.

ASS investigations are commonly required as part of the conditions of subdivision and development, or as a requirement for a dewatering license application. Proponents of developments that involve the disturbance of soil or the change of groundwater levels in areas susceptible to ASS are required to conduct desktop and field based investigations. The objective of these investigations is to determine the extent and magnitude of ASS at the site. Adequate investigations are required prior to soil disturbance to determine the potential risks and to allow for the formulation of appropriate management strategies.

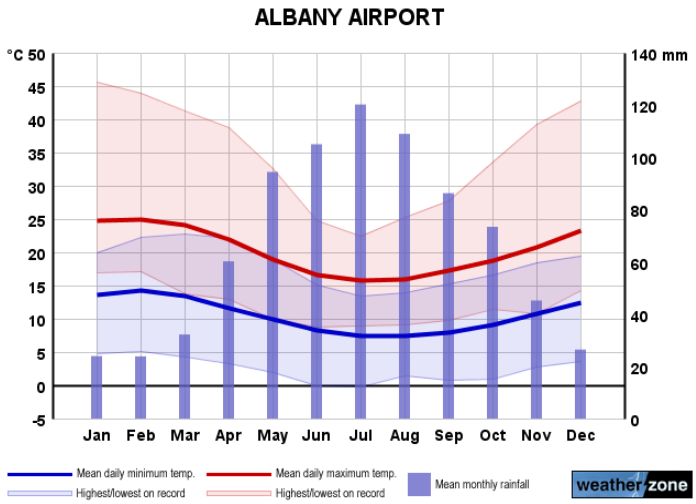
2.2 Location

The site is located at Bayonet Head, approximately 6km north east of the Albany town centre approximately 400km to the south of Perth (Figure 1) in the Great Southern region of Western Australia. The Lower King Road runs along the western edge of the area which adjoins the existing Bayonet Head development to the south. The entire area is approximately 430ha and includes lots 1, 476 and 1000 which are subject to environmental review and public environmental review.

2.3 Climate

The Great Southern region experiences a Mediterranean climate with warm to hot dry summers, and mild wet winters. High-pressure cells dominate climatic patterns during summer, and the passage of cold fronts and associated low-pressure cells dominate during winter. Strong sea breezes dominate during late November to early March.

At the Albany airport, approximately 10km to the north of the site, the mean yearly maximum temperature of approximately 23^{o}C generally occurs in January and a mean yearly minimum temperature of approximately 8.1^{o}C occurs during July (Bureau of Meteorology, 2007). The mean annual rainfall for the Albany area derived from long term records is approximately 930mm (Bureau of Meteorology, 2007). Rainfall events are irregular and characterised by a winter maximum, which coincides with an annual temperature low.



2.4 Soil Mapping

The DEC is the lead state agency in identifying and managing acid sulfate soils and has carried out mapping of areas with a high acid sulfate soil risk in areas under high pressure from development. The DEC has compiled ASS risk maps for several regions, and these maps have been incorporated into the WAPC Planning Bulletin 64 (WAPC, 2003). The WAPC Planning Bulletin 64 identifies the majority of the site as having "no known risk of ASS occurring within 3m of natural soil surface (or deeper)", with a low lying area of estuarine/alluvial floodplain that correlates to area of "high to moderate risk of ASS occurring within 3m of natural soil surface" (WAPC, 2003). The ASS risk mapping for the site is shown in Figure 2.

The site lies at an elevation of between 30mAHD and 50mAHD and is described as being comprised of gently undulating lateritic upland and coluvial slopes with an area of esturine/alluvial floodplain in the north (GSWA, 1989). In general the southern half slopes from the west to the east and the northern half sees the general topography slope from the south to the north.

Geological mapping for the region by the Geological Survey of Western Australia (GSWA) indicates the site comprises of Holocene and Tertiary material represented by the following soil units:

- Sand – White to pale grey, fine to medium and occasionally coarse, angular to sub-angular quartz, little fines, moderately sorted.
- Sand - Pale grey, fine to coarse, angular to sub-rounded quartz, loose moderately sorted with occasional pebbles of laterite.
- Gravel – Strong brown, coarse, sub-rounded, ferruginous, pisolithic with variable amounts of sand and silt in the matrix.
- Laterite – massive, friable to strongly indurated, vesicular, some sand content, developed on siltstone.

There is a strong relationship between the white to pale grey sands that are located in the estuarine/alluvial floodplain, and the location of the moderate to high risk ASS.

3 THE ACID TEST

WAPC Planning Bulletin 64 (WAPC, 2003) contains an "Acid Test", used to determine the ASS risk for the site. This test is used to determine if an acid sulfate soil investigation is required in any particular instance.

Each step of the test is discussed below in the context of the subject site.

3.1 Step 1

The first step in the WAPC 'Acid Test' process is to determine:

Is there evidence of a significant risk of disturbing acid sulfate soils at this location?

Test 1: Is the land depicted in Figures 1-10 of the Planning Bulletin as having a 'high risk of Actual Acid Sulfate Soil (AASS) & Potential Acid Sulfate Soil (PASS) <3m from surface'?

Test 2: Is the land located in an area, whether depicted in Figures 1-10 or not, where site characteristics and local knowledge lead you to form the view that there is a significant risk of disturbing acid sulfate soils at this location?

The WAPC Planning Bulletin 64 (WAPC, 2003) identifies the majority of the site as having "no known risk of ASS occurring within 3m of natural soil surface (or deeper)". There is a low lying area of estuarine/alluvial floodplain that correlates to area of "high to moderate risk of ASS occurring within 3m of natural soil surface" (Figure 2) but this area is outside the areas subject to the ER and PER. In addition to this a site visit revealed no significant indications of ASS. Due to the area of moderate to high ASS risk it may be a requirement to conduct a further review should this area be disturbed. For this reason step 2 of the acid test has been considered.

3.2 Step 2

Are any of the following works proposed, or likely to be carried out, on the land?

Test 1: Are any dewatering works proposed to be undertaken?

Test 2: Is the surface elevation $\leq$ 5m AHD and is excavation of $\geq$ 100m3 of soil (i.e. 10 standard dump truck loads) proposed?

Test 3: Is the surface elevation > 5m AHD and is excavation of $\geq$ 100m3 of soil (i.e. 10 standard dump truck loads) with an excavation depth of $\geq$ 2m proposed?

If YES to any of these go to Step 3.

If NO to all of these no further investigation is required.

This ASS assessment is being prepared for inclusion in ER and PER documents. At this stage the nature of development and detail concerning physical works is yet to be determined. Should future planning only involve development works within the lots subject to the ER and PER then no further ASS investigations will be required. However, should future planning include works to be carried out on the area of estuarine/alluvial floodplain it is likely that the nature of works to prepare the site for development will require the excavation of greater than 100m^3 of soil. Additionally it is likely that the installation of services will require excavation to depths that may require dewatering. Accordingly, it is considered likely that Steps 3 and 4 of the Acid Test will be required should this area of moderate to

high risk be disturbed. The additional assessment as a part of steps 3 and 4 of the acid test would comprise Preliminary and Detailed Site Assessments for ASS in accordance with DEC guidelines.

4 SUMMARY AND CONCLUSIONS

The preliminary ASS assessment of the Bayonet Head outline development plan area reveals that the majority of the site has “no known risk of ASS occurring within 3m of natural soil surface (or deeper)”. There is a low lying area of estuarine/alluvial floodplain that correlates to an area of “high to moderate risk of ASS occurring within 3m of natural soil surface” (figure 2). In addition to this a site visit revealed no significant indications of ASS. As the nature of development works has yet to be determined it is not possible to complete the WAPC “acid test” for the entire site however it is concluded that the preparation of an Acid Sulfate Soil Management Plan (ASSMP) is not required for lots 1, 476 and 1000, which are the subject of a PER and ER.

The portion of the site mapped at high to moderate risk is only approximately 20%. However it should be noted that areas identified as having significant risk of ASS, where dewatering or extensive earthworks are proposed, require further assessment prior to development. For a site this size, DEC guidelines recommend 2 sample locations per hectare, with samples collected at 0.25m intervals from surface to at least 1m below the proposed depth of disturbance.

In order to appropriately target the necessary future investigations, it would be beneficial to identify areas of the site that will remain undisturbed, and to determine the likely maximum depth of disturbance across the site. Full acid sulfate soils investigations for large areas incur significant costs in order to collect and analyse samples, as required by DEC guidelines. Furthermore, implementation of ASS management plans is costly due to requirements for soil treatment and verification, and extensive groundwater and surface water monitoring. These costs can be reduced up front through development planning to minimise soil and groundwater disturbance, such as using fill to raise site levels, and designing with an aim to eliminate the need for dewatering during construction.

5 REFERENCES

Bureau of Meteorology (2006). Bureau of Meteorology website: http://www.bom.gov.au

DEC (2006). *Department of Environment Draft Identification and Investigation of Acid Sulfate Soils - Acid Sulfate Soils Guideline Series.* May 2006.

GSWA (1989), Gozzard J R, *Geological Survey of Western Australia Environmental Geology Series [1 : 100 000] : Part Sheets 2427, 2428 II, 2527 II & 2528 III*. Geological Survey of Western Australia. Perth, WA.

WAPC (2003), *Planning Bulleting No. 64: Acid Sulfate Soils*. Western Australian Planning Commission, Perth.

6 DISCLAIMER

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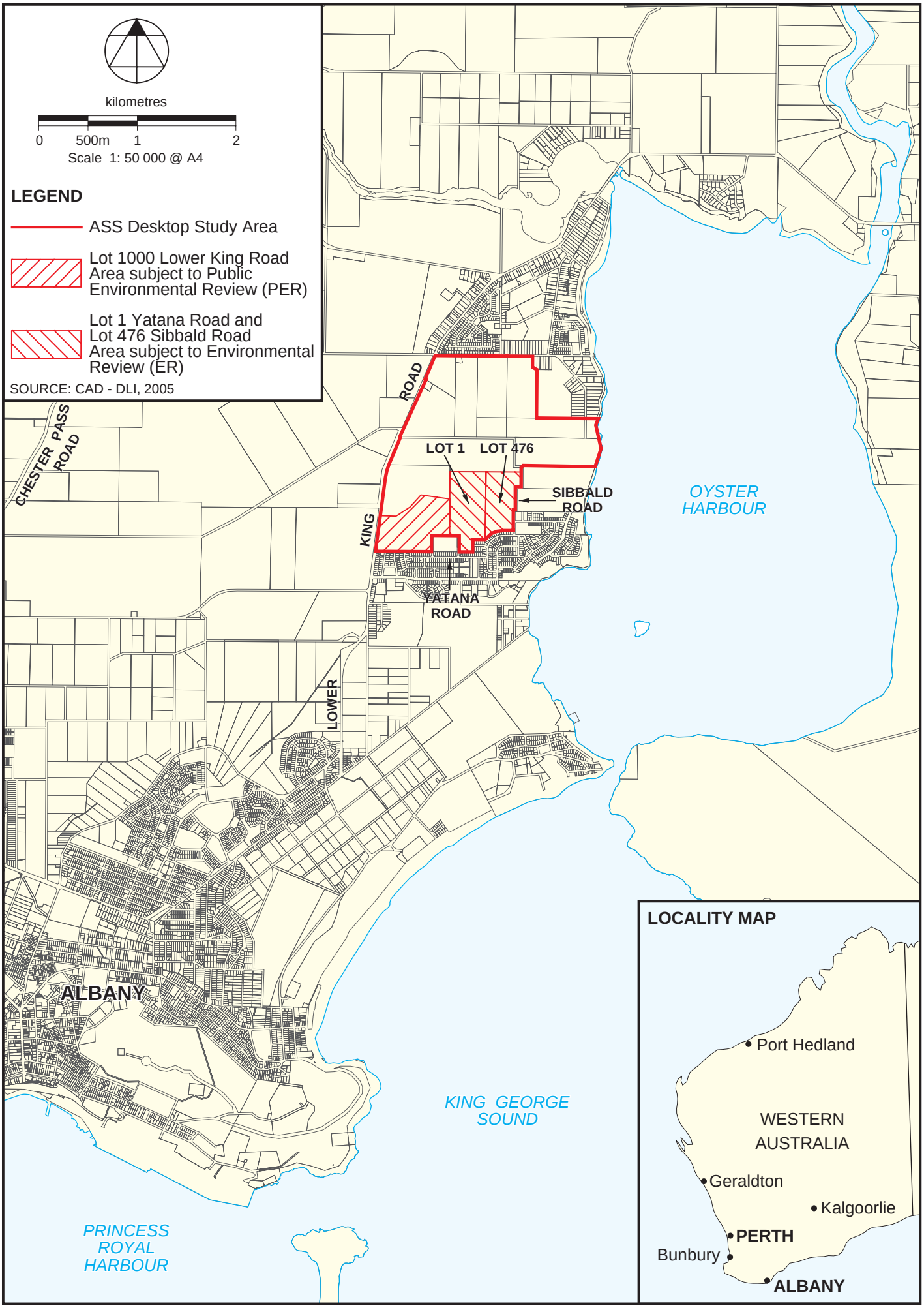
Figures

Acid Sulfate Soil Desktop Survey,
Bayonet Head, Albany



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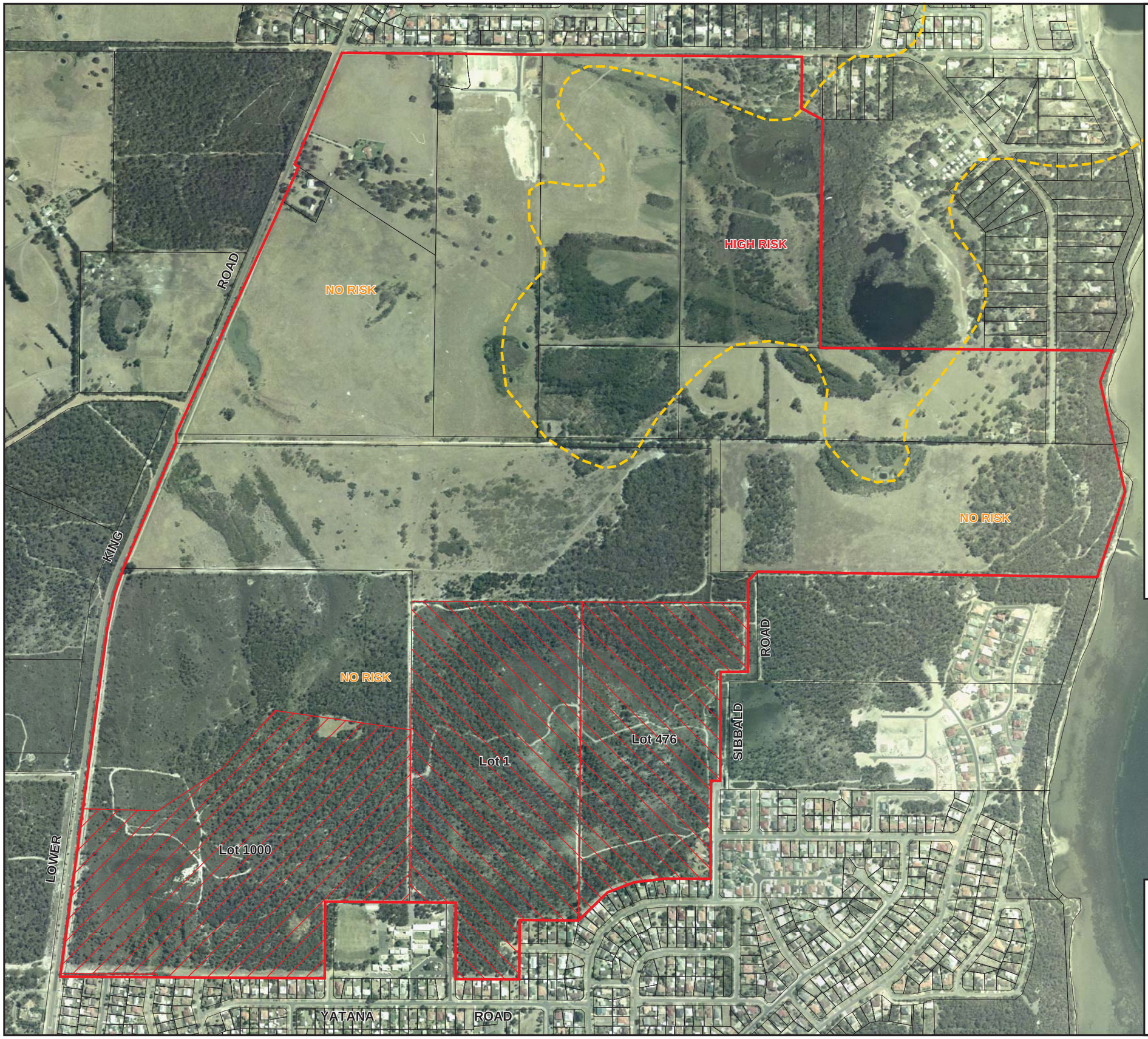
BAYONET HEAD OUTLINE DEVELOPMENT PLAN AREA
REGIONAL LOCATION
FIGURE 1

PRINTED: Tue 23 Oct 07

HDC-2006-008/ASSI/27_255f2.dgn DATUM: MGA DRAWN: 23-10-07 CHECKED: JS



metres

0 100 200 300 400

SCALE 1 : 8 000 @ A3

LEGEND

- ASS Desktop Study Area
- Lot 1000 Lower King Road Area subject to Public Environmental Review (PER)
- Lot 1 Yatana Road and Lot 476 Sibbald Road Area subject to Environmental Review (ER)
- Cadastral Boundary
- Acid Sulfate Soil Risk Mapping Boundary

ACID SULFATE SOILS RISK MAPPING

HIGH RISK High risk of actual acid sulfate soil (AASS) & potential acid sulfate soil (PASS) <3m from surface

MOD RISK Moderate to low risk of AASS and PASS occuring generally at depths of >3m (Not applicable to this figure)

NO RISK Low to no risk of AASS and PASS occuring generally at depths of >3m

SOURCE:
CAD & IMAGERY (as at 2002-2003) - Harley Survey Group, 23-10-06
ASS - WAPC Planning Bulletin No, 64, July 2004

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ACID SULFATE SOIL RISK AREA

FIGURE 2