JBA Planners Pty Ltd

Preliminary Site Investigation and Preliminary Acid Sulfate Soils Assessment: Sydney Polo Club Planning Proposal, Richmond Lowlands, NSW

ENVIRONMENTAL

WATER

WASTEWATER

GEOTECHNICAL

CIVIL

PROJECT MANAGEMENT

P1605208JR02V01
April 2016

Limitations Statement

The sole purpose of this report and the associated services performed by Martens & Associates Pty Ltd is to provide a Preliminary Site Investigation and Preliminary Acid Sulfate Soils Assessment at the subject site in accordance with the scope of services set out in the contract / quotation between Martens & Associates Pty Ltd and JBA Planners Pty Ltd (hereafter known as the Client). That scope of works and services were defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

Martens & Associates Pty Ltd derived the data in this report primarily from a number of sources which included correspondence regarding the proposal, examination of records in the public domain, interviews with individuals with information about the site or the project, and field explorations conducted on the dates indicated. The passage of time, manifestation of latent conditions or impacts of future events may require further examination / exploration of the site and subsequent data analyses, together with a re-evaluation of the findings, observations and conclusions expressed in this report.

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All enquiries regarding this project are to be directed to the Project Manager.

Contents

1 Overview

1.1 Introduction

Martens & Associates Pty Ltd has prepared this Preliminary Site Investigation (PSI) which includes a preliminary acid sulfate soils (ASS) assessment for JBA Planners Pty Ltd ('the Client') to support a planning proposal for amendment to the Hawkesbury City Council (HCC) LEP (HELP 2012) to include additional permitted uses on the Sydney Polo Club and surrounding lands (23 lots) ('the site') in the Richmond Lowlands. Refer to site general layout plan (PS02 – A050, Attachment A) and list of lot and DP information (Figure 2, Attachment B).

1.2 Objectives

1.2.1 Preliminary Site Investigation

Investigation objectives include:

- Identification of historic and current potentially contaminating site activities.
- Evaluation of potential areas of environmental concern (AEC) and associated contaminants of primary concern (COPC).
- Provide comment on suitability of site for proposed permitted uses and provide recommendations for a detailed site investigation (DSI) including possible intrusive soil investigations if required to inform the planning proposal.

1.2.2 Preliminary Acid Sulfate Soils Assessment

The objectives of the ASS assessment include:

- Provide details of acid sulfate soil condition of the site and assess their significance for proposed additional land uses.

1.3 Project Scope

Scope of works includes:

- Walkover inspection to review current land uses, potential contaminating activities and neighbouring land uses.
- Review available Hawkesbury City Council (HCC) site development consents.

- Review of 7 historic aerial photographs to assess past site and surrounding land use patterns.
- Review NSW OEH (formerly NSW EPA) notices under the Contaminated Land Management Act (1997).
- Preliminary analysis of potential areas of environmental concern (AEC) as identified in site background reviews and MA experience in the local area.
- Prepare a PSI in general accordance with the relevant sections of ASC NEPM (1999, amended 2013), NSW OEH (2011) and DEC (2006). This report shall satisfy requirements for a 'Stage 1' assessment in accordance with Managing Land Contamination – Planning Guidelines SEPP 55 – Remediation of Land 1998.
- Assess the risk of actual or potential ASS (PASS) being present at the site, via geomorphic observations and review of acid risk mapping.
- Prepare a preliminary ASS assessment in accordance with the guidelines and standards of ASSMAC (1998).

1.4 Proposed Development

We understand that these assessments are to support a planning proposal for the site to allow for additional permitted uses within the RU2 zoned lands. The proposed future permitted uses are:

- Advertisement.
- Advertising structures.
- Car park.
- Food and drink premises.
- Eco-tourist facilities.
- Function centres.
- Industrial retail outlet.
- Light industry.
- Kiosk.
- Market.

- Medical centre.
- Recreation facility (major).
- Recreation facility (outdoor).
- Sewage reticulation system.
- Sewage system.
- Sewage treatment plant.
- Shop.
- Veterinary hospital.
- Water supply system.

1.5 Abbreviations

ACM - Asbestos containing material

AEC – Area of environmental concern

ASC NEPM – Assessment of Site Contamination - National Environmental Protection Measure (1999 amended 2013).

ASS – Acid sulfate soil

ASSMAC – Acid Sulfate Soils Management Advisory Committee

AST – Above ground storage tank

BTEX – Benzene, toluene, ethyl benzene, xylene

COPC – Contaminants of primary concern

DA – Development application

DP – Deposited plan

DEC – NSW Department of Environment and Conservation

DSI – Detailed site investigation

EPA – NSW Environmental Protection Authority

HCC – Hawkesbury City Council

HLEP 2012 – Hawkesbury City Council Local Environment Plan 2012

HM – Heavy metals

LGA – Local government area

MA – Martens & Associates Pty Ltd

mAHD – Metres, Australian Height Datum

mbgl – Metres below ground level

OCP – Organochloride pesticides

OEH – NSW Office of Environment and Heritage

OPP – Organophosphate pesticides

PACM – Potential asbestos containing material

PAH – Polycyclic aromatic hydrocarbons

PASS – Potential acid sulfate soil

PSI – Preliminary site investigation

SAC – Site acceptance criteria

TRH – Total recoverable hydrocarbons

2 Site Description

2.1 Site Location and Existing Land Use

Site information is summarised in Table 1. Site location and general surrounds are provided in PS02-A050 (Attachment A).

Table 1: Site background information.

Investigation address	Sydney Polo Club and surrounding lands (comprising allotments at Ridges Lane, Powells Lane, Cornwells Lane, and Old Kurrajong Road, Richmond Lowlands, NSW).
Lot and DP (Title Information)	Investigation area comprises 23 allotments (Figure 2, Attachment B).
Investigation area	Investigation area: approximately 209 ha.
Local Government Area (LGA)	Hawkesbury City Council.
Zoning	Majority of site is zoned RU2 – Rural Landscape, with a small portion of the southeastern area zoned E2 - Environmental Conservation. A small portion of the site is zoned W1 – natural waterways.
Site description	The investigation area is situated on the southern banks of the Hawksbury River, approximately 2 km north of the Richmond town centre. The site is predominantly used for agricultural (turf farm and grazing) purposes and polo activities, and includes two function centres. These uses are on lands referred to as the Sydney Polo Club. A tourist accommodation facility is located near the site's northwestern boundary. The site includes a number of existing dwellings and sheds associated with rural and rural residential uses, and several dams, an ornamental lake and a wetland. Site vegetation is predominantly pasture grasses, scattered trees and scrubs, and landscaped gardens and polo fields.
Current land use	Primarily agricultural and recreation uses.
Proposed land use	A range of agricultural, recreation, services and tourist uses.
Surrounding land uses	Generally rural lands.
Topography	The site is generally low lying, and is identified by Council as Flood Prone Land being within the estimated extent of 100 year flood. The investigation area generally grades toward a wetland located in the site's southeast, and neighbouring dams and watercourses to the south. Site elevation is between approximately 8 mAHD in the southwest corner, to 14 – 15 mAHD in the site's western area. A constructed embankment is located near the centre of the site. It rises approximately 3 – 4 m above surrounding floodplain with slopes of 20% – 60%, volume approximately 2,400 m^3.
Geology and soil landscapes	The Penrith 1:100,000 Geological Sheet 9030 identifies the site as being underlain by Quaternary Lowlands Formation, comprised of gravel, sand, silt and clay. The NSW Environment and Heritage eSPADE website identifies the site as having soils of the Freemans Reach landscape consisting of deep brown sands and

	loams, apedal to moderately structured, usually friable, and including alluvial soils, solods and dark podzolic soils. Site inspections by Martens found top soils (sandy loam to 200 mm) overlay silty clay to 3.0 mbgl and then silty sands.
Environmental receptors	The majority of the investigation area drains toward a dam near the eastern boundary, and a wetland in the site's southeast. Some of the western portion of the site drains to another onsite dam, or dams or wetlands on neighbouring properties to the south. Areas of the dam/wetland in the southeast (zoned E2) are identified on Council's Wetlands Map. The wetland area and small pockets in the western portion of the site are identified on Council's Terrestrial Biodiversity Map as containing "significant vegetation".
Human receptors	Existing and future residents. Future facility (i.e. function centre) visitors and polo players. Future site workers / builders.

2.2 Hydrogeology

Review of NSW Department of Primary Industries - Office of Water's database indicated thirteen groundwater bores located onsite or within 500 m of the site (Table 2). Groundwater bore locations are shown in Figure 2 (Attachment B).

Table 2: Available hydrogeological information.

Groundwater Bore Identification	Direction and Distance	Depth To Groundwater (mbgl)	Intended Use	Water Bearing Zone Substrate
GW013468	South (420m)	4.2	Irrigation stock	Unconsolidated
GW032013	South (420m)	3.6	Irrigation	Unconsolidated
GW068247	Located onsite (NE corner)	48.5	Domestic stock	Grey sandstone
GW100707	Southwest (450m)	7.0	Recreation (groundwater)	Sand
GW100756	North (425m)	8.0	Irrigation stock	Coarse sand
GW102733	Southwest (460m)	13.0	Domestic stock	Sand and gravel
GW103250	Southwest (100m)	9.00	Domestic stock, Recreation (Groundwater)	Gravel and sand
GW103531	Southwest (310m)	13.0	Domestic stock, Irrigation	Sand and gravel
GW104648	North (430m)	10.6	Domestic stock, Irrigation	Brown sand
GW106645	South (425m)	ND[1]	Irrigation	ND[1]
GW110213	South (90m)	9.0	Stock	Sand and gravel

Groundwater Bore Identification	Direction and Distance	Depth To Groundwater (mbgl)	Intended Use	Water Bearing Zone Substrate
GW110214	South (120m)	8.00	Stock	Sand and gravel
GW110557	Located onsite (SW portion of site)	10.0	Domestic stock	Gravel, medium

Notes

[1] No data available.

Table 2 indicates groundwater in the vicinity is mostly used for stock, irrigation, or recreation, and is from than 3.6 m to 48.5 m below ground level (mbgl). Site investigations near the fill mound found no evidence of water to 5.5 mbgl. Depending on intended use of the site, further investigation may be required to fully characterise site hydrogeology.

2.3 Walkover Site Inspection

Results of site walkover inspection from March 16, 2016 are summarised below, with plates of selected views in Figure 4, Attachment B:

- Rural dwelling and sheds across the site, associated with agricultural activities including grazing, horse agistment, turf farms, and polo facilities.
- A wetland in the site's southeast.
- Stock yards on Triangle Lane (opposite Powells Lane).
- Number of small fenced paddocks and associated shelter sheds for horses.
- Numerous polo fields with associated infrastructure including fenced paddocks, shelters for horses (both open shelters and stables), sheds for equipment and feed storage, horse washing areas, and visitor facilities.
- Sydney Polo Club built facilities in the northeastern portion of the site include:
    - Function centre.
    - Maintenance shed with concrete floor is in the northwest of the built facilities and stores hay bales, vehicles, machinery, tools, equipment, and other items including containers of fuel and other unknown content.

    - Two metal above ground storage tanks (ASTs) labelled 'Diesel' and 'Unleaded' north of the maintenance shed. Tanks are with a concrete bund in good condition, with some staining.

    - A third metal AST on unbunded concrete pad is located east of the tanks above. It likely also used for storage of fuel.

    - Three metal feed silos are located north of the maintenance shed.

- Stockpiles of vegetation, timber, metal, bricks, soil, sand, and gravel are located as a "waste" area northeast of maintenance building.

- Water pump is located in the site's northeast, adjacent to the Hawkesbury River.

- Visitor toilet facilities and horse stables.

- Ornamental lake is located south of main built facilities near site's eastern boundary.

- An area to the south of the ornamental lake is used for car parking during events.

- A large fill embankment is located near the southwestern boundary of the Sydney Polo Club property, Client advises fill sourced from levelling of adjacent polo field. Embankment volume approximately 2,400 m^3.

- Sunnybrook Barn is located near the northern boundary, and is used for functions.

- Turf farm located in northeastern portion of site, adjacent to Hawkesbury River.

- Dam constructed as part of quarry rehabilitation is located near the site's northwestern boundary, currently located adjacent to polo fields.

- Cabins used as rural tourist accommodation are located near the site's northwestern boundary.

- Stockpiles of vegetation and timber consistent with active rural uses located across the site.

3 Site Background Assessment

3.1 Historical Site Records Review

Development application and building plan records kept by Hawkesbury City Council have been requested, but were not received prior to report finalisation. A list of existing development consents was provided by JBA Urban Design Services and was reviewed, it indicates consents have been granted for construction of rural sheds on various properties over the years, and construction and use of three cabins as a 'rural tourist facility' on Lot B DP 89077 in 2006. Consent was granted in 2015 for the use of the Polo Barn and Sunnybrook Barn for holding functions. According to JBA (2015), these "use" consents will operate until December 2016.

3.2 NSW OEH Records

No notices for the site or nearby surrounding areas were listed under the Contaminated Land Management Act (1997) or the Environmentally Hazardous Chemicals Act (1985). No site within the suburb of Richmond is identified on the list of NSW contaminated sites notified to the EPA.

3.3 Historical Aerial Photograph Analysis

Historical aerial photographs from 1955, 1961, 1975, 1986, 1998, 2007 and 2016 were reviewed to investigate historic site land uses (Table 3). Copies of aerial photographs are provided in Attachment C. Photos indicate that the site has been used for rural purposes since at least 1955.

Table 3: Historic aerial photograph observations 1955 – current.

Year	Description	Surrounding Land Use
1955	The majority of the subject site is used for agricultural (grazing and market garden) purposes. Dwellings and sheds are visible adjacent to the southern banks of the Hawkesbury River, and to the south of a wetland in site's southeast. Several dams are visible in the southeastern area. Orchards are located near the northwestern boundary, adjacent to the Hawkesbury River. Market gardens are visible scattered across the majority of the site. Horse paddocks and stables (shelters) are visible in the northeastern area. Internal and main road infrastructure constructed.	Surrounding rural land uses. Orchards on the northern side of the Hawkesbury River, and market gardens east and west of site. Dams and wetland areas visible to southwest.

Year	Description	Surrounding Land Use
1961	Removal of some horse paddocks and stables (shelters) in centre north. Wetland footprint is reduced and more closely reflects current E2 zoning. Orchards near northwestern boundary no longer visible and replaced with market gardens.	Minor surrounding rural development. Reduced orchards to northwest and increased orchards to east. Increased market gardens to southeast and east of wetland to eastern boundary. Otherwise little change from 1955 photo.
1975	Reduction in market gardens on site, property likely used for grazing purposes. Wetland footprint larger, similar to 1955. Dwellings and sheds removed for quarry operations which are visible in northwest of site, adjacent to Hawkesbury River, second smaller quarry operation at current Sunnybrook barn location. Quarry operations infrastructure in both areas include sheds and equipment, stockpiles, and quarry dams.	Minor surrounding rural development, including construction of horse paddocks and sheds to southwest for polo activities. Additional orchards to west. Orchards to northeast, and market gardens to north (both north of river) no longer visible, and further reductions of market gardens in the surrounding area.
1986	Minor dwelling and/or shed development. Further reductions of market gardens onsite, appears to be managed pastureland. Quarry operations area appears to be expanded to the southwest, additional quarry dams constructed, and additional stockpiles visible. Second minor quarry operations to northwest are no longer visible, with dam filled in and land appears to be converted back to agricultural land.	Minor surrounding rural works, including farm dams. Further reductions of market gardens in the surrounding areas, appears to be managed pastureland.
1998	Minor dwelling and/or shed development. Area for quarry operations reduced, with all except north dam filled and returned to rural uses. Removal of dwelling and/or sheds, construction of Sydney Polo Club built facilities in northeast of site. Horse paddocks and stables in northeastern area redeveloped.	Minor surrounding rural development. Further development of polo fields to southwest. Further removal of orchards to east. Otherwise little change from 1986 photo.
2007 (Google Earth Maps)	Development of polo fields. Tourist accommodation (cabins) visible near northwestern boundary. Former quarry site returned to rural uses, polo fields to south. No remaining market gardens onsite. Evidence of historic filling.	Minor surrounding rural development. Further redevelopment of market gardens in the surrounding area, majority of areas likely used for agricultural (grazing) purposes and polo activities.
2016 (Nearmap)	Further landscaping and planting/growth of trees around polo fields and construction of ornamental lake near northeastern boundary. Fill mound visible. Polo fields with associated infrastructure. Turf farm in northern portion of site, adjacent to Hawkesbury River.	New market garden to north of Hawkesbury River, otherwise little change from 2007 photo.

4 Areas of Environmental Concern/Contaminants of Primary Concern

Our assessment of site AECs and COPCs (Table 5) is made on the basis of available site history, aerial photograph interpretation and site walkovers. .

Table 4: Areas of environmental concern and contaminants of primary concern.

AEC [1]	Potential for Contamination	COPC	Contamination Likelihood
A – Dwellings (and former dwellings)	Pesticides and heavy metals may have been used under dwellings for pest control. Dwelling construction may include ACM and/or lead based paints.	HM, OCP/OPP and asbestos	Medium - high
B – Sheds, former sheds and other structures – (used for a range of purposes associated with agricultural practices and polo facilities)	Sheds (and former sheds) may currently (or have previously) stored fuel, oils, asbestos sheeting (PACM), pesticides and/or been treated with heavy metals and pesticides (pest control). Shed construction may include ACM and/or lead based paints.	HM, TRH, BTEX, PAH, OCP/OPP and asbestos	Medium
Containers and drums of unknown content	Sheds may have stored containers and drums of unknown content, potentially contaminating chemicals may have spilled or leaked onto underlying soil.	HM, TRH, BTEX, PAH and OCP/OPP	Medium (main sheds have concrete floors)
C – Former market garden, orchard use; and current turf farm	Application of agricultural chemicals, use of pesticides and heavy metals for pest control.	HM and OCP/OPP	Medium
D – Former quarry operations areas	Potential fuel and lubricant leakage from equipment and during refuelling/maintenance operations, and potentially imported materials for rehabilitation.	HM, TRH, BTEX and PAH	Low
E – ASTs	Hydrocarbon contamination may have occurred, with contaminants spilling or leaking into underlying soil.	TRH, BTEX, and PAH	Low (bunded) High (unbunded)
F - Site filling (localised areas)	Fill material of unknown origin and quality associated with quarry rehabilitation and other site activities.	HM, TRH, BTEX, PAH, OCP/OPP and asbestos	Low (likely site won)

AEC [1]	Potential for Contamination	COPC	Contamination Likelihood
G - Stockpiles	Contaminants from unknown contents of stockpiles and general refuse may have spilled or leaked onto underlying soil.	HM, TRH, BTEX, PAH and OCP/OPP and asbestos	Very low (green waste) Low (waste on concrete slabs) Medium (other stockpiles)
H - Dams	Contaminants from quarry operations or agricultural practices may have washed into and accumulated in dams.	HM and OCP/OPP	Low - medium
I – Grazing (entire site)	Very minor risk associated with potential past agricultural chemical uses. Includes remaining stock "shelters" being timber frame and metal roofed open structures and stock yards.	HM and OCP/OPP	Very low

5 Preliminary Acid Sulfate Soils Assessment

5.1 ASS Risk Map Classification

According to HLEP (2012) - Acid Sulfate Soils Map (Figure 3, Attachment B), the investigation site is classified as Class 4 and Class 5. Generally, the areas adjacent to the Hawkesbury River, the northwestern and majority of the central areas are Class 5, while the southern portions of the site are Class 4.

Based on Table 2.1 of the ASSMAC (1998) guidelines, the following works must not be carried out at the site without Council consent:

For Class 4:

- Works beyond 2 metres below natural ground surface.
- Works by which the watertable is likely to be lowered beyond 2 metres below natural ground surface.

For Class 5:

- Works within 500 meters of adjacent Class 1, 2, 3 or 4 land, which are likely to lower the water table below 1 mAHD on adjacent Class 1, 2, 3 or 4 land.

5.2 Geomorphic Characteristics

The likelihood of ASS occurrence at a site is a function of various geomorphic parameters (ASSMAC, 1998). Such parameters and their presence at the study areas are listed in Table 5.

Table 5: Presence/absence of geomorphic site features indicative of ASS.

Geomorphic Feature	Present on site?
Holocene sediments	Yes
Soil horizons less than 5 mAHD	No
Marine / estuarine sediments or tidal lakes	No
Coastal wetland; backwater swamps; waterlogged or scaled areas; interdune swales or coastal sand dunes	Yes
Dominant vegetation is mangroves, reeds, rushes and other swamp or marine tolerant species	No
Geologies containing sulphide bearing material	Unlikely
Deep older (Pleistocene) estuarine sediments	At depth

Some of the geomorphic features listed in Table 2 are present or possibly present within the study areas. Therefore, actual or potential ASS could be present. Combined with Council's ASS mapping it is likely that PASS or ASS are present on the site, most likely at depth.

The planning proposal seeks to make permissible various uses which may result in excavation to greater than 2 m (foundations). Such development would need to consider impacts of and on acid sulfate soils. The likely presence of PASS/ASS onsite can be readily managed by future development proposals and is not an impediment to the change to the HELP 2012 as proposed.

6 Conclusions and Recommendations

6.1 Conclusions

The results of the site history and walkover inspection indicates that the site has been used for rural purposes since at least 1955 and has the following potential contamination sources:

- Past dwelling construction and maintenance have the potential to have introduced contaminants in the form of asbestos (as a construction material), pesticides (pest control) and heavy metals (paints, pest control).

- Sheds and former sheds may currently or previously have stored fuel, oils or other chemicals, leading to hydrocarbon and other contamination. Lead based paints or PACM (fibrous cement sheeting containing asbestos) may have been used during construction. The sheds may have been treated with pesticides and heavy metals for pest control.

- Aerial photographs indicate much of the site may have been used for intensive agricultural uses including market gardens, orchards or turf farm. Pesticides and heavy metals may have been used for pest control (OCP/OPP, heavy metals).

- Former quarry operations may have introduced localised contamination of hydrocarbons or heavy metals to the site soils and potentially other contaminants if filling from offsite sources was part of remediation.

- Several ASTs observed containing known (diesel and unleaded) and unknown content may have introduced contaminants to the soil. Bunding of two of the three ASTs mitigates this risk significantly.

- Localised areas of site fill. Potential for contaminants if fill sourced from offsite (unlikely).

- Waste stockpiles may have introduced heavy metals, hydrocarbons, OCP/OPP and asbestos where stockpiled waste other than organics.

- Farm dams may have accumulated contaminants from surrounding land uses.

Overall, the site has a number of identified contamination risks. Other than minor localised AECs (ASTs, dwellings and sheds), the risks associated with land use is generally low or medium. The planning proposal does not seek to make permissible any sensitive land uses such as residential, schools or child care facilities. The identified risk of contamination is considered to be acceptably low to permit the changes to the site permissible uses as proposed by the HLEP 2012 amendment. Subsequent applications for development should fully assess localised contamination and address any identified issues. Where contamination is identified it is likely to be of a type and extent that can be readily remediated to allow any of the proposed additional permissible uses to proceed.

The assessed site ASS conditions are considered to be compatible with proposed additional permissible site uses. Site ASS conditions can be readily managed in conjunction with future DAs for developments to be made permissible on the site.

6.2 Recommendations

6.2.1 Contamination

Where further development is proposed, a detailed site investigation (DSI) including intrusive soil sampling is recommended within the subject area to address any AECs identified in this report. Testing is required to address AECs and associated COPCs which may present a risk to the proposed use.

Any future DSI is to be developed in accordance with NSW EPA (1995) *Sampling Design Guidelines* and a risk based assessment. Assessment shall address each AEC (A-H) relevant to the intended use and assess COPC identified (Table 5). Results of the site testing shall be assessed against site acceptance criteria (SAC) developed with reference to ASC NEPM (1999, amended 2013).

6.2.2 Acid Sulfate Soils

Where future development proposals will require excavation to greater than 2 m (Class 4 land) or will likely result in groundwater lowering below 1 mAHD (Class 5 land), future ASS assessment and management plans shall be required.

7 Limitations Statement

The preliminary site investigation and preliminary acid sulfate soils assessment was undertaken in line with current industry standards for a planning proposal.

It is important, however, to note that no land contamination study can be considered to be a complete and exhaustive characterisation of a site nor can it be guaranteed that any assessment shall identify and characterise all areas of potential contamination or all past potentially contaminating land-uses. This is particularly the case on sites where full access is not possible due to the presence of structures (dwellings and/or sheds), where extensive past agricultural uses have occurred and where significant filling has been completed without documentation. Therefore, this report should not be read as a guarantee that no contamination shall be found on the site. Should material be exposed in future which appears to be contaminated or inconsistent with natural site soils, additional testing may be required to determine the implications for the site.

Alluvial environments are particularly variable due to their depositional history. As such, rapid changes in material type and acid producing potential can occur over short lateral distances.

Martens & Associates Pty Ltd has undertaken this preliminary assessment for the purposes of assessing potential site contamination and acid sulfate soil characteristics to address requirements of a proposal to allow additional HELP 2012 permissible uses. No reliance on this report should be made for any other investigation or proposal. Martens & Associates accepts no responsibility, and provides no guarantee regarding the characteristics of areas of the site not specifically studied in this investigation.

8 References

Ahern et al (1998) *Acid Sulfate Soils Assessment Guidelines*. Published by the Acid Sulfate Soil Management Advisory Committee, Wollongbar, NSW.

ASC NEPM (1999, amended 2013) *National Environmental Protection Measure, 1999 (site contamination measure).*

Google Maps (2007).

Hawkesbury City Council – DA/BA/CC records (2016).

JBA Urban Planning Consultants Pty Ltd (September, 2015) *Draft Amendment to Hawkesbury LEP 2012: Planning Proposal, For Basscave, Richmond Lowlands. 15143.*

Nearmap (2016).

NSW DEC (2006) *2nd Ed. Contaminated Sites: Guidelines for the NSW Site Auditor Scheme*.

NSW Department of Environment & Heritage (eSPADE, NSW soil and land information), www.environment.nsw.gov.au.

NSW Department of Lands – Map sales. Aerial photographs (1955, 1961, 1975, 1986, 1998).

NSW Department of Mineral Resources, (1991) *Penrith 1:100,000 Geological Sheet 9030*.

NSW DPI Office of Water Groundwater database, accessed February 17, 2016, http://allwaterdata.water.nsw.gov.au/water.stm.

NSW EPA (1995) *Sampling Design Guidelines.*

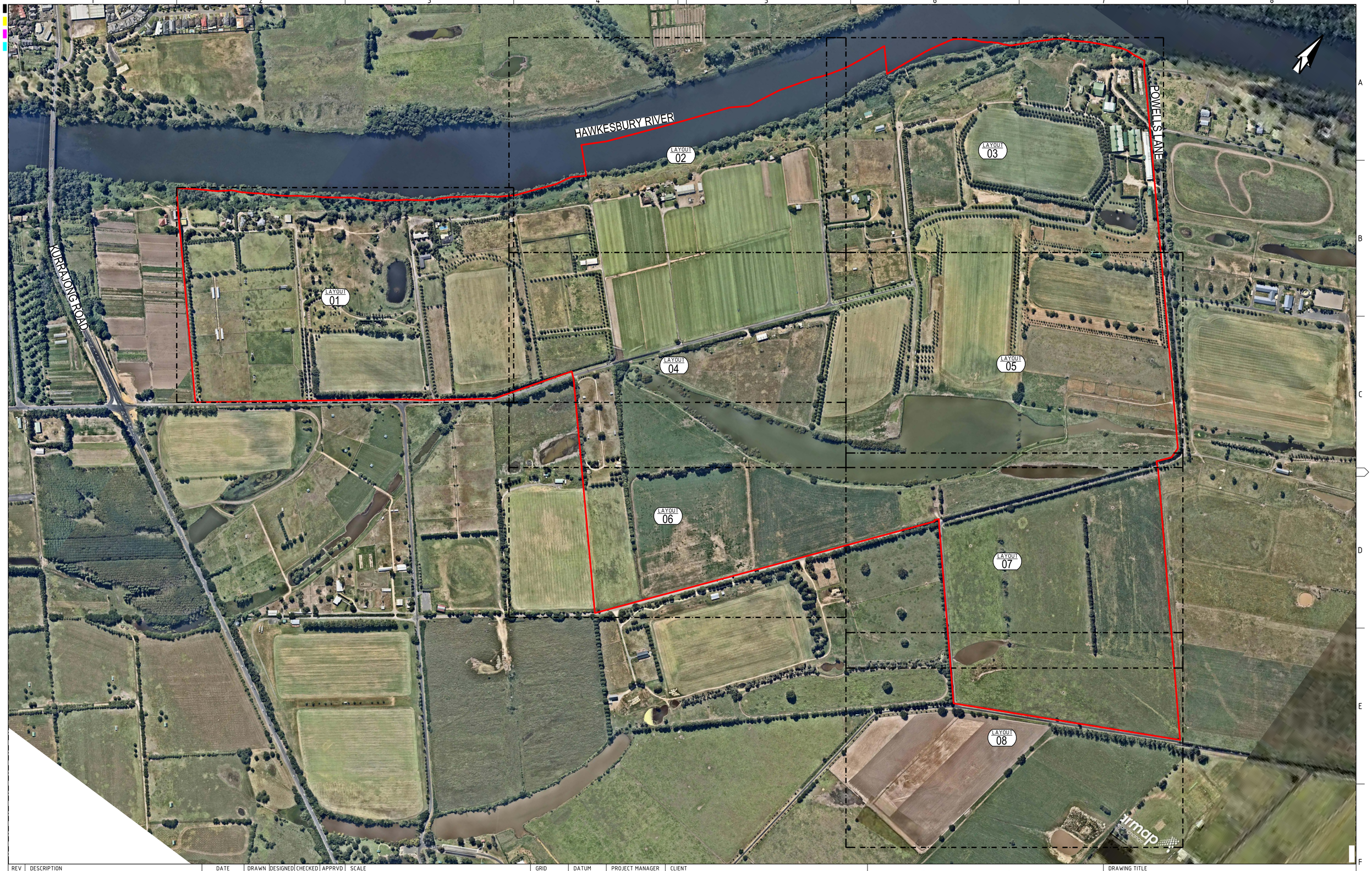
NSW OEH (2011) *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites, 2nd Edition.*

NSW SIX – *Spatial Information Exchange – Land & Property Information. https://six.nsw.gov.au/wps/portal/*

SEPP 55 Remediation of Land.

SIX Viewer, LPI (2016).

9 Attachment A – Site Plan



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SCALE
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A1 (A3) 1:4,000 (1:8,000)

GRID	DATUM	PROJECT MANAGER
		AN

CLIENT
BDM Construction Pty Ltd

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PROJECT NAME/PLANSET TITLE
PSI/AEC
P1605208JR02V01
Sydney Polo Club and Surrounding Lands
Richmond Lowlands, NSW

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DRAWING TITLE
GENERAL LAYOUT PLAN
(SOURCE: NEARMAP 2016)

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P1605208	PS02	R01	PS02-A050	A

DRAWING ID: P1605208-PS02-R01-A050

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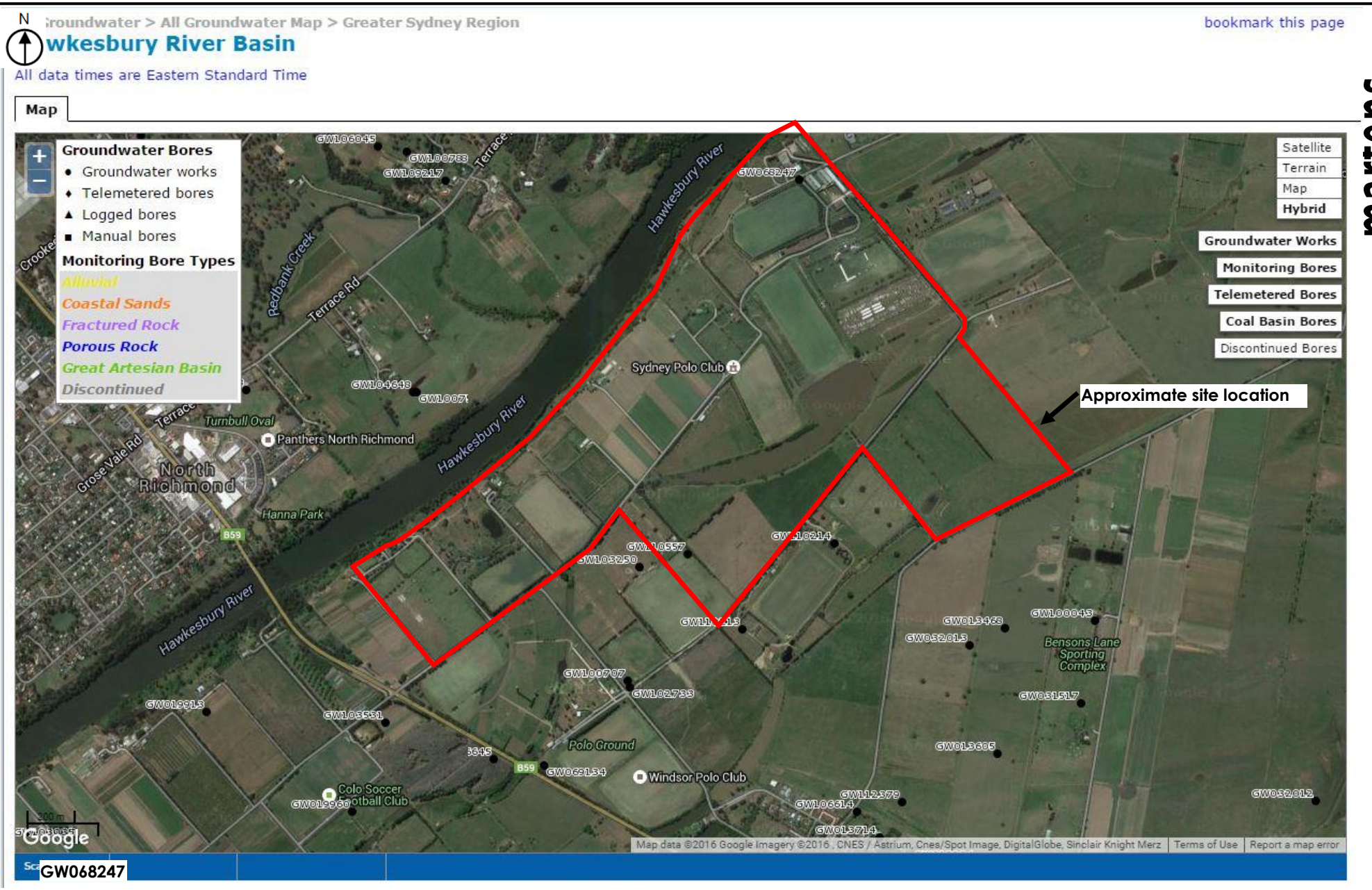
10 Attachment B – Figures

- Figure 1 – Groundwater Locations
- Figure 2 – Lot and DP Information
- Figure 3 – ASS Mapping
- Figure 4 – Plates of Existing Site



GW068247

Martens & Associates Pty Ltd ABN 85 070 240 890		**Environment | Water | Wastewater | Geotechnical | Civil | Management**	
Drawn:	CS	**Groundwater Bore Locations** **Sydney Polo Club and Surrounding Lands, Richmond Lowlands, NSW** **Source: NSW Office of Water Groundwater Database, 2016**	Drawing No: Figure 1
Approved:	AN		
Date:	22/03/2016		
Scale:	Not to Scale		Job No: P1605208

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Table 1 – Site description and ownership

Road Frontage/Access	Lot	DP	Development/Use
Owner: Basscave			
Old Kurrajong Road	1	206104	Dam ; Polo field; Farm buildings
	2	206104	Polo field; Horse yards; Horse training; Farm buildings
Powells Lane	1	70128	Grazing pasture; Wetland
	25	663770	Polo fields; Grazing pasture; Dam; Stables; Machinery shed; Function Centre Dwelling; Farm buildings
Ridges Lane	1	77207	Grazing pasture; Farm building; Wetland
	27	556434	Dwelling; Function Centre; Farm buildings; Grazing pasture; Animal yards
	1	997087	Grazing land; Farm buildings; Wetlands
	2	997087	Grazing land; Farm buildings; Wetland
Triangle Lane	3	997087	Grazing land; Farm buildings; Wetland
	1	1168610	Polo field; Farm
	2	1168610	Dwelling; Farm buildings; Equine training facilities; Polo fields
	1	997086	Grazing land; Wetland; Polo field; Farm buildings; Animal yards
	25	1100252	Grazing land; Animal training yards; Wetland
	4	1120860	Polo field
	5	1120860	Polo field; Dam
NA	1	120794	Polo fields; Farm buildings; Wetland
	A	365391	Dwelling/farm office; Shed
	1	659412	Grazing pasture
	1	972649	Grazing pasture
Owner: Muscat			
Ridges Lane	128	1151145	Turf farm; Dwelling
	129	1151145	Turf Farm; Dwelling; Farm buildings
Owner: Huston			
Old Kurrajong Road	A	89087	Dwelling; Tourist cabins; Polo fields; Horse yards; Various farm buildings
	B	89087	Dwelling; Polo fields; Horse yards; Various farm buildings

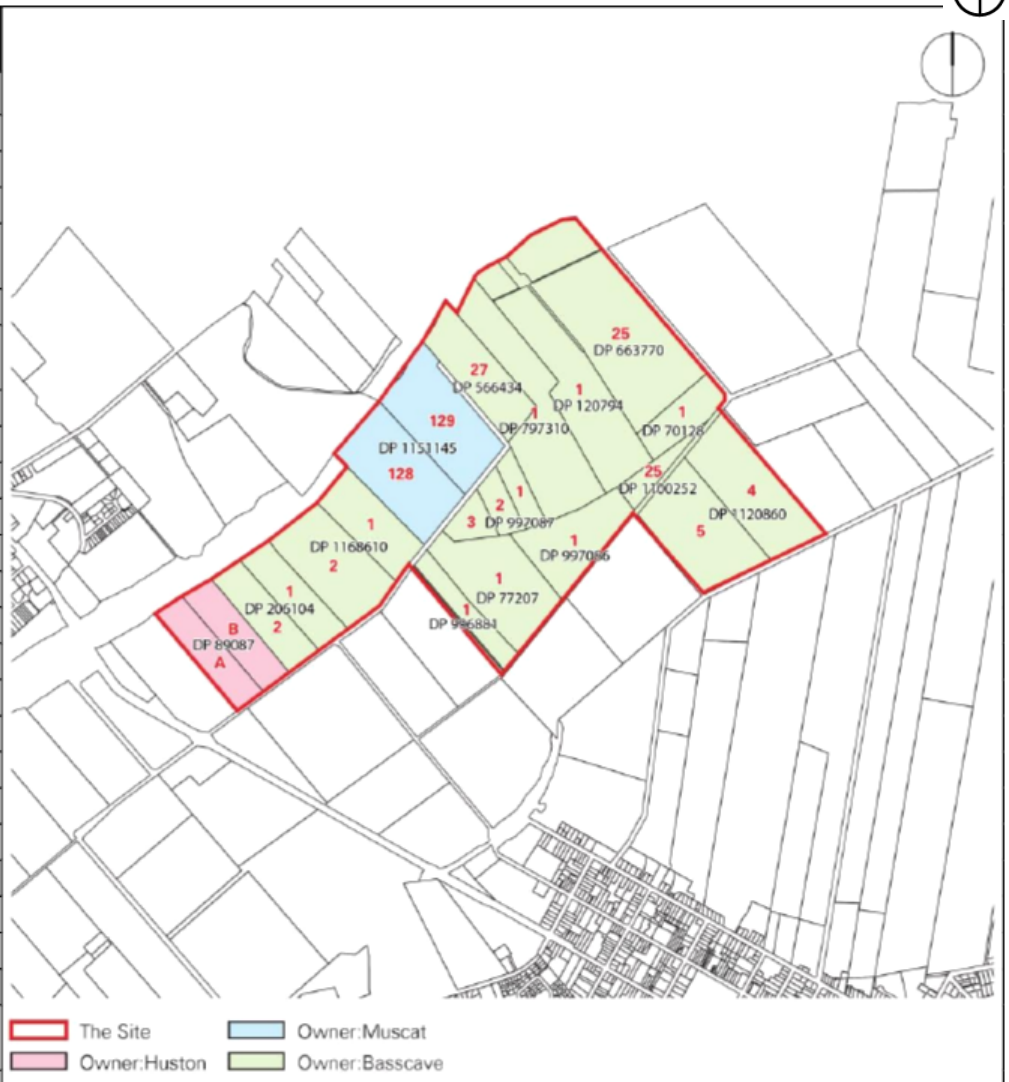

Figure 4 – Aerial photo and lot boundaries
Source: LPI Property Information

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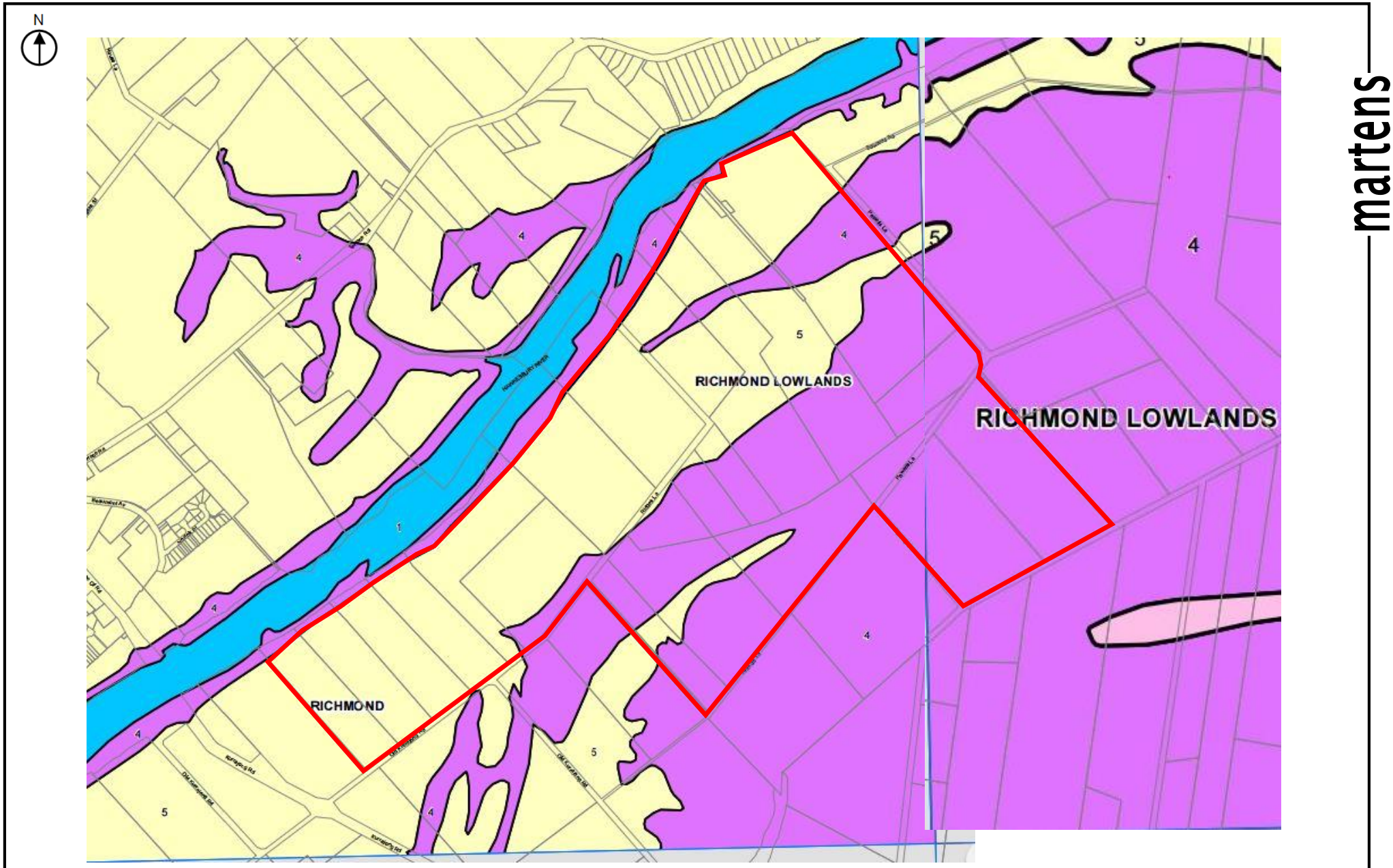
Drawn:	CS	**Lot and DP Information** **Sydney Polo Club and Surrounding Lands, Richmond Lowlands, NSW** **Source: JBA Draft Amendment to Hawkesbury LEP, 2015**	Drawing No: Figure 2
Approved:	AN		
Date:	22/03/2016		
Scale:	Not to Scale		Job No: P1605208



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Drawn:	CS	**HCC – Acid Sulfate Soils Mapping** **Sydney Polo Club and Surrounding Lands, Richmond Lowlands, NSW** **Source: HELP 2012**	Drawing No: Figure 3
Approved:	AN		
Date:	22/03/2016		
Scale:	Not to Scale		Job No: P1605208

Plate 1: Typical view of rural uses.

Plate 2: View of polo fields.

Plate 3: View of constructed mound, facing northeast.

Plate 4: Two metal ASTs and three metal feed silos north of maintenance shed.

Plate 5: Turf farm near northern boundary, view facing east.

Plate 6: Former quarry dam in northwestern portion of site, view facing south.

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Drawn:	CS	**Plates – Existing Site** **Sydney Polo Club and Surrounding Lands,** **Richmond Lowlands, NSW** **Source: Martens, 2016**	Drawing No: FIGURE 4
Approved:	AN		
Date:	22.03.2016		
Scale:	Not to Scale		Job No: P1605208

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11 Attachment C – Historical Aerial Photographs

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
A		22/03/2016	KT	CS		

SCALE
0 40 80 120 160 200 240 280 320 360 400 METRES
A1 (A3) 1:4,000 (1:8,000)

GRID | DATUM | PROJECT MANAGER: AN

CLIENT: BDM Construction Pty Ltd

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PROJECT NAME/PLANSET TITLE
PSI/AEC
P1605208JR02V01
Sydney Polo Club and Surrounding Lands
Richmond Lowlands, NSW

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DRAWING TITLE
AERIAL PHOTOGRAPHY
1955
(SOURCE: LPI)

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1605208	PS02	R01	PS02-A051	A

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