

Preliminary Site Investigation (PSI)

Eastbourne Reserve,
Geraldton, WA

CW1018900_Report01.1



Prepared for
City of Greater Geraldton

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Preliminary Site Investigation (PSI)

Eastbourne Reserve, Geraldton, WA

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List of Abbreviations and Units

Technical Terms

ACM	Asbestos Containing Material
AHD	Australian Height Datum
AMG	Australian Map Grid
AS	Australian Standard
ASS	Acid Sulfate Soil
BGL	Below Ground Level
CSM	Conceptual Site Model
DWER	Department of Water and Environmental and Regulation
DQI	Data Quality Indicator
DQO	Data Quality Objective
FA	Fibrous Asbestos
HIL	Health Investigation Level
HSL	Health Screening Level
LOR	Limit of Reporting
MGA	Map Grid of Australia
N/A	Not Applicable
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	National Environmental Protection Measure
PSI	Preliminary Site Investigation
QA	Quality Assurance
QC	Quality Control
RPD	Relative Percentage Difference
SAQP	Sampling and Analysis Quality Plan

Units

Ha	Hectares
mblg	Metres Below Ground Level

Preliminary Site Investigation (PSI)

Eastbourne Reserve, Geraldton, WA

1 Introduction

1.1 Background

Cardno (WA) Pty Ltd (Cardno) was engaged by the City of Greater Geraldton (the 'City' or 'Client') to undertake a Preliminary Site Investigation (PSI or the Assessment) at Eastbourne Reserve, Geraldton, WA (Lot 2872 on Deposited Plan 216566) ("the site"). The site is situated approximately 5.8 km north of Geraldton town centre and covers an area of 3.4 hectares (ha). The site location is presented on Figure 1, Appendix A.

It is understood that the City has been approached by a community group that has expressed interest in undertaking some work at the site and the City needs to understand if there are any contamination issues prior to progressing with discussions.

This PSI has been carried out in accordance with the scope and limitations presented in Cardno's proposal of 6 December 2017 (Our Ref: CW41707027_ENV_Proposal01.2). The PSI commenced following approval of the proposed works by the Client.

1.2 Purpose & Objectives

The specific objectives of the Assessment, subject to the limitations stated in Section 1.5, are to:

- > Identify site and surround landholding characteristics and current conditions.
- > Assess the potential for current and past activities to impact the environment, health and safety conditions, or result in liability upon review of all reasonably available desk-based information.
- > Assess potential source-pathway-receptor linkages at the site (from all potential sources identified in the PSI).
- > Prepare a report including a basic site condition assessment based on site inspection and interview.
- > In the event that significant contamination and/or risk is found, provide recommendations for further investigation, assessment, management and/or remediation as necessary.

1.3 Scope of Assessment

The following scope of works was undertaken as part of the PSI:

1.3.1 Desktop Review

- > A review of background information and data through government agency database searches requests and other publically available information sources, including:
 - Site identification details, including street address, certificate of title (CoT) and co-ordinates of the site boundary (easting's and northing's);
 - A review of historical aerial photographs and site plans to ascertain historical land use and determine the timeline of historical development;
 - A search of the Department of Water and Environmental Regulation (DWER) Contaminated Sites Database (online and basic summary search only);

- > Department of Water (DoW) and Water Information Network (WIN) database and summary records as applicable (data pertaining to the water table);
- > Review of information pertaining to the environmental setting of the site, including (but not limited to):
 - Geological, hydrogeological and hydrological setting, including surface and groundwater drainage conditions;
 - Site land forms, topography and morphology, including the location and description of any known imported fill;
 - Acid Sulfate Soils (ASS) risk mapping and desktop investigation;
 - Relevant environmental values of the site and its surrounds [Environmental Sensitive Area (ESAs)];
 - Determine the environmental value of the site and surrounding environment, including the location, use and installation data of all registered groundwater bores within a 500m radius of the site.
- > Review of information pertaining to potential contamination sources at the site, including:
 - Evidence of chemical storage and potential for leaks, spills and discharges; and
- > Review of information pertaining to the social and cultural setting of the site, including (not limited to):
 - Aboriginal heritage; and
 - European heritage.

1.3.2 Site Inspection

A detailed site inspection was conducted with the aid of information obtained from the desktop investigation and the Cardno site inspection checklist. The site inspection was completed with a view to identifying potential sources of contamination or visible evidence of contamination and areas of environmental significance. The work included the following:

- > Preparation of a Job Safety Assessment / Health Environment Safety Plan (HESP).
- > Recording the site conditions and relevant observations with notes and photographs.
- > Noting of soil types, including evidence of disturbance.
- > Looking for evidence of groundwater and surface water occurrence, groundwater seepage, surface water bodies, and water movement (drainage ditches).
- > Identifying potential areas of concern e.g. disturbed or affected vegetation, visual indications of spills/soil contamination, obvious odours, corrosion of infrastructure.
- > Identifying site infrastructure and equipment with potential to cause contamination (such as fuel storage infrastructure).
- > Looking for nearby (less than 200 m) potentially contaminating sites.

1.3.3 PSI Report

Preparation of a succinct report (this report) outlining the scope of work, results obtained and any findings in relation to the specific objectives of the assessment and development of a preliminary Conceptual Site Model (CSM) and recommendations for further assessment and/or management (as required).

1.4 Standard of Assessment

This PSI has been prepared in general accordance with the applicable industry standards and guidelines to the extent relevant to a PSI of this type. The investigation, assessment, management and remediation of potentially contaminated sites in Western Australia is directed by the *Contaminated Sites Act 2003* (CS Act), aided by associated industry standards and guidelines. The DWER is responsible for

the enforcement of the CS Act. Key industry standards and guidelines applicable to this PSI include (but are not limited to) the following:

- > Department of Environment and Regulation (DER) (2014) *Assessment and Management of Contaminated Sites*.
- > National Environment Protection Council (NEPC) (1999) *National Environment Protection (Assessment of Site Contamination) Measure*, as amended (registered on 15 May 2013). This is referred to from here on as “the NEPM” or “NEPM (2013)”.
- > Department of Health (DoH), 2009, *Guidelines for the Assessment, Management and Remediation of Asbestos Contaminated Sites in Western Australia*.
- > *Code of Practice for the Management and Control of Asbestos in Workplaces* [NOHSC: 2018 (2005)].

1.5 Limitations

The agreed scope of this assessment has been limited for the current purposes of the Client. The assessment may not identify contamination occurring in all areas of the site. Conclusions and recommendations presented in this report are derived from available desk-based information, anecdotal evidence, the site inspection undertaken on 11 December 2017. This assessment report is not any of the following:

- > A Mandatory Audit Report as defined under the *Contaminated Sites Act 2003*.
- > A Detailed Site Investigation (DSI).
- > An Asbestos Site Management Plan (SMP) or an Asbestos Materials Register (AMR).
- > A total assessment to assess suitability of the entire parcel of land at the Site for one or more of the beneficial uses of land.

Furthermore, this PSI may not be sufficient for a Contaminated Sites Auditor to be able to conclude a Contaminated Sites Audit.

An overview of site environmental assessments is included in Appendix E.

2 Site Description & Setting

2.1 Site Definition and Description

The Site is located at Eastbourne Reserve, Geraldton, WA (Lot 2872 on Deposited Plan 216566), Table 2-1 summarises the key details defining the site. The location of the site is shown on Figure 1, Appendix A.

Table 2-1: Site Identification Details

Site Identification Details	
Site Area	3.4 ha
Title Details	Lot 2872 on Deposited Plan 216566
Site Address	No Address (Bounded by Bosely St, Barker Rd, Eastbourne Rd and Chapman Rd)
Municipality	City of Greater Geraldton-
Current Site Owner	City of Greater Geraldton
Planning Zone	Reserve 19556 under the City of Greater Geraldton Local Planning Scheme No.1
Land Use	Public Open Space (POS)

A summary of the approximate site boundaries as determined by Cardno is presented in Table 2-2.

Table 2-2: Site Coordinates

Site Boundary	Easting (mE)	Northing (mS)
North-East	266,187	6,820,345
North-West	267,848	6,820,355
South-East	268,195	6,820,248
South-West	267,849	6,820,244

Note: Map Grid Area (MGA) 94, Zone 50

2.2 Surrounding Land Uses

The surrounding land uses are outlined in Table 2-3.

Table 2-3: Surrounding Land Uses

Direction	Zoning	Land Use or Activity
North	Residential	Residential
West	Commercial/residential	Vacant/Holiday park
East	Residential	Residential
South	Residential	Residential

2.3 Environmental Setting

Key details defining the site are summarised in Table 2-4.

Table 2-4: Key Site Details

Setting	Description
Topography	A review of the WA Atlas online database (accessed 9 January 2018) indicates that the site is flat with an elevation of approximately 13 metres Australian Height Datum (mAHD).
Geology	<p>Regional Geology</p> <p>This geology is described by the Geological Survey of Western Australia (GSWA) (Geraldton – Houtman Abrolhos, Sheet SH50-1 and Part of Sheet 49-4 1:250,000)</p> <p>The geology of the Site is reported to comprise dune and beach sands overlying coastal limestone</p> <ul style="list-style-type: none"> • Dune and beach sands: white calcareous and quartzose sands. • COASTAL LIMESTONE: and overlying podsolised sand – aeolianite and leached quartz sands.
Acid Sulfate Soil	The Acid Sulfate Soil (ASS) risk mapping for the Geraldton area indicates that the study area exists in an area containing no risk of ASS within 3 m of the natural soil surface.
Hydrology	<p>There are no natural surface water features present on the site. A stormwater retention is located within the central western portion of the site. It is understood that during periods of rainfall storm water is directed via the local stormwater drainage network to the retention area (for infiltration and evaporation) prior to re-entering the stormwater system.</p> <p>Rainfall that falls onto the site is generally expected to directly infiltrate the ground surface and migrate vertically towards groundwater, evaporate at the site surface, and/or be taken up by vegetation (root uptake).</p>
Hydrogeology	<ul style="list-style-type: none"> • Groundwater Occurrence – Unconfined Aquifer located in calcareous sand / marine sand (subjected to tidal influence close to the beach). • Depth to Groundwater - Approximately <3.0 meters Below Ground Level (mBGL). • Groundwater Flow Direction & Receiving Water Body – West towards the Indian Ocean. • Protected Groundwater Use Zones – none identified with the immediate vicinity of the site. Closest protected zone [i.e. Protected Drinking Water Source Area (PDWSA)] '<i>Wicherina Catchment Area</i>' is approximately 30 km to the east. • Groundwater Use -A search of the DoW groundwater data base reported 4 registered groundwater bores within a 0.5km radius of the site. The following purposes were listed: <ul style="list-style-type: none"> ○ Domestic/Household -2 bores ○ Garden Irrigation - 1 bores ○ Unknown – 1 bores <p>The closest registered groundwater bore is approximately 100m to the west listed for Domestic/Household purposes.</p> <ul style="list-style-type: none"> • Beneficial Uses – The following beneficial uses may apply to the groundwater beneath the site (beneficial use in italics is considered to be unlikely due to the known surrounding land-uses) <ul style="list-style-type: none"> ○ Maintenance of ecosystems. ○ Irrigation. ○ <i>Stock watering.</i> ○ Domestic non-potable / recreation.
Flora and Fauna	A preliminary search for priority and threatened flora and fauna was performed for a 1 km radius from the centre of the site using the online NatureMap database (Naturemap, 2017). A total of 137 (flora and fauna) species were identified as possibly being located within a 1 km radius from the centre of the site. Of these, 4 species are considered to be Naturalised, 2 specie is Priority 2 conservation, 1 specie is Priority 3 conservation, 1 specie is Priority 4 conservation and 2 specie is Protected under international agreement. The NatureMap report is provided as Appendix B.
Environmental Sensitive Areas	<p>The DWER maintains a dataset of Environmentally Sensitive Areas (ESA). ESAs are areas of land deemed to support conservation, heritage or ecological value, or an area protected through existing State Policy and includes the following:</p> <ul style="list-style-type: none"> > Declared World Heritage Property > An area that is registered on the Register of National Estate

Setting	Description
	<ul style="list-style-type: none">> Within 50 m of a defined wetland> The area covered by vegetation within 50 m of flora declared as Rare under the <i>Wildlife Conservation Act 1950</i>> An area covered by a Threatened Ecological Community The site is not located within an Environmentally Sensitive Area.
Wetlands	A review of the WA Atlas online database indicates that there are no wetlands within the boundary of the Site or located within 1 km of the Site.

3 Site History & Potential for Contamination

3.1 Historical Aerial Photograph Review

A review of selected aerial photography for the site and surrounds between 1952 (earliest available) to 2016 (latest available) is provided within Appendix C and observations are summarised in Table 3-1.

Table 3-1: Historic Aerial Photograph Summary

Date	Key Developments
Plate 1 October 1952	<p>Site Specific: The site appears to be predominately vacant (cleared). Evidence of market garden activities is visible in the western portion of the site, whilst a small dwelling/infrastructure is present in the eastern portion of the site.</p> <p>Site Surrounds: The immediate surrounds are mainly undeveloped vacant land. Isolated dwelling/infrastructure are present along with market garden activities.</p>
Plate 2 February 2000	<p>Site Specific: The site appears to be predominately vacant (cleared) park lands with a scattering of trees. Site boundary is clearly visible defined by roads.</p> <p>Site Surrounds: <ul style="list-style-type: none"> Surrounding land has been redeveloped for residential purposes </p>
Plate 3 March 2003	<p>Site Specific: <ul style="list-style-type: none"> The site appears unchanged, with exception to some infrastructure in the south-western corner of the site. </p> <p>Site Surrounds: <ul style="list-style-type: none"> The surrounds appear unchanged. </p>
Plate 4 July 2010	<p>Site Specific: <ul style="list-style-type: none"> The site appears unchanged. Infrastructure in the south-western corner of the site has been removed. </p> <p>Site Surrounds: <ul style="list-style-type: none"> The surrounds appear unchanged, with exception to some localised redevelopment. </p>
Plate 5 December 2016	<p>Site Specific: <ul style="list-style-type: none"> The site appears unchanged. </p> <p>Site Surrounds: <ul style="list-style-type: none"> The surrounds appear unchanged, with exception to some localised redevelopment. </p>

3.2 Cultural Heritage

3.2.1 Aboriginal Heritage

An online search of the Department of Aboriginal Affairs (DAA) (via Nation Map) Aboriginal Heritage was undertaken. The search identified that the site is not located in a registered area, however the following sites were identified within 1km of the site:

- > Site ID 5961, Chapman River Mouth 'Skeletal Material /Burial' (Registered).
- > Site ID 4390, North Bank 'Artefacts/Scatter' (Lodged).
- > Site ID 27321 Aboriginal Lands Trust (ALT) – Reserve 'Swan Drive/Chapman River'.

3.2.2 European Heritage

The presence of historical or current European Heritage sites was investigated using Heritage Council WA State Register (via National Map) Database.

The search did not identify any registered sites at the site. The closest registered site is Nazareth House (state registered place, No. 1055) located approximately 500m south of the site.

3.3 Government Freedom of Information Searches

3.3.1 DWER Contaminated Sites Database

The State Government, through the DWER, has the overall responsibility for developing, administering and enforcing the CS Act and its associated procedures. Part of this responsibility includes maintenance of the Contaminated Sites Database. The Contaminated Sites Database holds information on known contaminated sites that have been classified by the DWER as:

- > Contaminated – remediation required.
- > Contaminated – restricted use.
- > Remediated for restricted use.

A search of the DWER Contaminated Sites Database (accessed 9 January 2018) did not indicate that the site has been assigned any of the above classifications. There are no sites located within 5 km of the site that have been assigned the above classifications.

3.3.2 DWER Contaminated Sites Register

In addition to the Contaminated Sites Database, the DWER maintains the Contaminated Sites Register, which holds information regarding sites that have been reported to the DWER and classified as:

- > Report not substantiated.
- > Possibly contaminated – investigation required.
- > Not contaminated – unrestricted use.
- > Decontaminated.

Cardno submitted a freedom of information request (FOI) to the DWER regarding the site. As of 10/1/2018 no response has been received.

4 Site Inspection

Cardno undertook an inspection of the site and surrounds on 11 December 2017. Observations at the time of the site inspection are summarised in the following section.

4.1 Site Observations

The site is currently a vacant reserve, situated between Bosley Street and Eastbourne Rd, there are no permanent above ground structure on-site. The site observations at the time of the site inspection are summarised in Table 4-1 below. Observations are also present on Figure 4 (Appendix A).

Table 4-1: Site Observations

Item	Observations & Descriptions
Surface coverings	Sand and grasses cover majority of the site, with a number of established native trees and bushes.
Site slope & drainage features	The site slopes from West to the East with a stormwater retention depression within the central western portion of the site. It is understood that during periods of rainfall storm water is directed via the local stormwater drainage network to the retention area (for infiltration and evaporation) prior to re-entering the stormwater system.
Nearby water bodies	Indian Ocean to the west.
Buildings	None observed.
Manufacturing or chemical processes & infrastructure	None observed.
Surface soil	Surface soils are typically SAND, some areas of gravel.
Surface soil stability	Surface soils appeared stable.
Site cut & filling	No evidence of significant filling was observed. Evidence of minor gravel fill was observed in isolated areas throughout the site. Minor amounts of stockpiled soil (approximately 15 m ³) were observed at the site, which appeared to be a composite of gravel and sand with some anthropogenic material (i.e. brick, cement and metal) consistent with building rubble [including suspect Asbestos Containing Material (ACM) cement fragments].
Fuel storage tanks	None observed.
Dangerous goods	None observed.
Solid waste deposition	None observed.
Liquid waste disposal features	None observed.
Evidence of previous site contamination investigations	None observed.
Evidence of land contamination (staining or odours)	None observed.
Evidence of suspect asbestos or ACM	Suspect ACM fragments were observed in isolated area of the site, predominately in areas where gravel fill was observed. Suspect ACM was also identified at the surface of stockpiled soil observed at the site. ACM was noted to be in fragmented form of sound condition.
Potentially contaminating sites (<500 m from the site)	None observed.

Item	Observations & Descriptions
Groundwater bores	None observed.

4.1.1 ACM Laboratory Analysis (confirmatory)

Two suspect ACM fragments were collected as part of the site inspection and were submitted to Emission Assessments for confirmatory analysis (absence/presence). Laboratory results are summarised in Table 4-2, laboratory certificates of analysis are provided in Appendix D.

Table 4-2: Laboratory Analysis Summary

Asbestos Type Detected	Sample Ref (Cardno)	Sample Ref (Lab)	Sample Dimensions (mm)	Sample Weight (g)	Physical Structure
Chrysotile	ACM 1	L27020	100x50x40	23	Asbestos Cement Product
Chrysotile	ACM 2 (Stockpile)	L27021	40x35x40	9	Asbestos Cement Product

5 Preliminary Conceptual Site Model

Based on the site history review and site inspection, a preliminary Conceptual Site Model (CSM) was developed. These have been summarised in the following sections.

In accordance with NEPM guidelines (NEPM 2013), an assessment must be made identifying the likely presence or absence of the following elements:

- > **Source** - a substance that is capable of causing an unacceptable risk to human and/or environmental health;
- > **Pathway** - a mode or route by which the substance/source can migrate to a receptor; and
- > **Receptor** - someone and/or something that could be adversely affected by the substance/source.

Where one of these elements is absent, there cannot be an unacceptable risk to human and/or environmental value, and therefore cannot be considered *contaminated* under the Contaminated Sites Act. Where all of these elements are present, a complete or potentially complete pathway for contamination exists and there is a potential risk to human and/or environmental health that will require further investigation and possible management and/or management. The magnitude of the risk is primarily a function of the concentration of the source, toxicity, chemical mobility, sensitivity of the receptor and the nature of the migration pathway.

The CSM development process is also used to identify data gaps, uncertainty and to define the risk assessment approach. The CSM is a blue print (a working hypothesis) for the understanding of site contamination and are updated as new information is obtained.

5.1 Potential Contamination Sources

The site is currently a reserve for the purpose of Public Open Space (POS), potential contamination sources [or Area of Potential Environmental Concern (AoPEC)] identified at the site are detailed below:

- > Asbestos (i.e. ACM fragments) impacted soils within isolated areas of the site (predominately in areas of where gravel fill was identified).
- > Stockpiled fill material (unknown source, containing anthropogenic material including ACM).
- > Historic land use as a market garden (western portion of the site).

5.1.1 Contaminates of Potential Concern (CoPC)

Key contaminants of concern associated with potential sources are detailed below:

- > Metals
- > Phenols.
- > Benzene, Toluene, Ethylbenzene & Xylenes (BTEX).
- > Polycyclic Aromatic Hydrocarbon (PAH).
- > Organochlorine Pesticide/ Organophosphorus Pesticide (OCP/OPP).
- > Total petroleum hydrocarbons (TPH).
- > Asbestos (ACM fragments).

5.2 Potential Receptors

The potential receptors that may be adversely affected by contamination at the Site include:

- > **On-site visitors.**
- > **On-site construction / maintenance workers** (associated ongoing maintenance, including subsurface works).
- > **Off-site users** (public and workers at surrounding properties via dust/fibre migration).
- > **Groundwater users** (through groundwater extraction from registered bores).
- > **Modified Ecosystems** (terrestrial flora and fauna).

5.2.1 Potential Contamination Pathways

The exposure pathways that have the potential to result in a risk to receptors have been summarised in Table 5-1 below in terms of the medium in which exposure could occur.

Table 5-1: Potential Pathways and Exposure Routes

Source	Pathway	Exposure Route
Fill Material (including approximately 15 m ³ stockpile)	Direct and secondary contact	<p>Dermal contact, incidental ingestion or inhalation of surface/near-surface contaminated soils/dust (contaminated soil if present at depth has the potential to impact human receptors if exposure occurs during intrusive earthwork activities).</p> <p>Uptake by ecological receptors.</p> <p>Leaching of contaminants into groundwater followed by migration of impacts in groundwater.</p>
Asbestos	Secondary contact with contaminated material. Dust/fibre migration through air via wind or mechanical agitation.	Inhalation of asbestos fibres.
Historic land use as a Market Garden (western portion of the site)	Direct and secondary contact	<p>Dermal contact, incidental ingestion or inhalation of surface/near-surface contaminated soils/dust (contaminated soil if present at depth has the potential to impact human receptors if exposure occurs during intrusive earthwork activities).</p> <p>Uptake by ecological receptors.</p> <p>Leaching of contaminants into groundwater followed by migration of impacts in groundwater.</p>

5.2.2 Potential Linkages

The preliminary CSM is summarised in Table 5-2: and is based on the findings of the desk based research and site inspection.

Table 5-2: Preliminary Conceptual Site Model 'Potential Linkages'

Source	Preferential Pathway	Exposure Routes	Receptors	Likelihood of Pollutant Linkage	Discussion
Fill Material (including stockpile)	Direct and secondary contact	<p>Dermal contact, incidental ingestion or inhalation of surface/near-surface contaminated soils/dust (contaminated soil if present at depth has the potential to impact human receptors if exposure occurs during intrusive earthwork activities).</p> <p>Uptake by ecological receptors.</p> <p>Leaching of contaminants into groundwater followed by migration of impacts in groundwater.</p>	<p>Onsite visitors (including intrusive workers)</p> <p>Future site users</p>	Yes	Unknown origin and characteristics of fill material (including approximately 15m ³ stockpile).
Asbestos (ACM Fragments)	Secondary contact with contaminated material. Dust/fibre migration through air via wind or mechanical agitation.	Inhalation of asbestos fibres	<p>Onsite visitors (including intrusive workers)</p> <p>Future site users</p> <p>Offsite users</p>	Yes	ACM observed at surface and within surface soil. There is a current exposure pathway to receptors (i.e. health risk to site users), which requires management to mitigate risks to potential receptors.
Historic land use as a Market Garden (western portion of the site)	Direct and secondary contact	<p>Dermal contact, incidental ingestion or inhalation of surface/near-surface contaminated soils/dust (contaminated soil if present at depth has the potential to impact human receptors if exposure occurs during intrusive earthwork activities).</p> <p>Uptake by ecological receptors.</p> <p>Leaching of contaminants into groundwater followed by migration of impacts in groundwater.</p>	<p>Onsite visitors (including intrusive workers)</p> <p>Future site users.</p> <p>Groundwater users.</p>	Yes (low)	A historical potential contamination land use (i.e. market garden activities) exists, which requires further assessment to assess level of risk (if any).

6 Conclusions and Recommendations

6.1 Purpose & Objectives

Cardno has undertaken a Preliminary Site Investigation (PSI) to assess the likelihood that contamination may be present at the site as a result of historical and/or current land use at Eastbourne Reserve, Geraldton.

It is understood that the City has been approached by a community group that has expressed interest in undertaking some work at the site and the City needs to understand if there are any contamination issues prior to progressing with discussions.

The specific objectives of the assessment are to:

- > Identify site and surround landholding characteristics and current conditions.
- > Assess the potential for current and past activities to impact the environment, health and safety conditions, or result in liability upon review of all reasonably available desk-based information.
- > Assess potential source-pathway-receptor linkages at the site (from all potential sources identified in the PSI).
- > Prepare a report including a basic site condition assessment based on site inspection and interview.
- > In the event that significant contamination and/or risk is found, provide recommendations for further investigation, assessment, management and/or remediation as necessary.

6.2 Summary of Conclusions

Based on desktop investigation, field observation and laboratory analysis (ACM confirmatory analysis), the following conclusions have been drawn from this assessment:

- > The site is currently a reserve (*Reserve 19556* under the City of Greater Geraldton Local Planning Scheme No.1) currently used for the purpose of Public Open Space. No aboveground infrastructure is present at the site.
- > There are no natural surface water features present on the site. A surface water retention area is located within the central western portion of the site. It is understood that during periods of rainfall stormwater is directed via the local stormwater drainage network to the retention area (for infiltration and evaporation) prior to re-entering the stormwater system. The closest natural surface water feature is the Indian Ocean, (marine environment) approximately 300 m to the west of the site.
- > The geology of the site is reported to comprise dune and beach sands overlying coastal limestone. Field observations reported surface soils are typically SAND with some areas of gravel. The upper aquifer at the site is expected to occur within Quaternary Sand and Limestone [Superficial Aquifer (unconfined)] between 3 m and 4 mBGL.
- > A Groundwater Bore Database search identified 4 groundwater bores are present within 0.5km of the site and are registered for domestic/household (2 bores), garden irrigation (1 bores) and unknown use (1 bore).
- > A review of historical aerial images (earliest available 1952) indicated that the site appears to be predominately vacant open space to present date (December 2017) with little historic land use. Evidence of market garden activities in the western portion of the site along with

a small dwelling/infrastructure is present in the eastern portion of the site in the 1952 aerial photography. It is noted that a lack aerial images between 1952 to 2000 limits the historic land use assessment.

- > A site inspection indicated the site is a reserve/ public open space, adjacent land use is mostly standard residential with limited commercial land use (i.e. shopping centre). Sand and grasses cover majority of the site, with a number of established native trees and bushes.
- > Suspect ACM fragments were observed on surface soil in isolated areas across the site. Two samples of suspect ACM fragment were collected from site surface, analysed and confirmed as containing asbestos (i.e. chrysotile asbestos). Where suspect ACM was encountered, it was noted to be in bonded, fragmented form and of sound condition.
- > No evidence of significant filling was observed. Evidence of minor gravel fill was observed in isolated areas throughout the site. Minor amounts of stockpiled fill material (approximately 15 m³) were observed at the site, which appeared to be a composite of gravel and sand with some anthropogenic material consistent with building rubble [including ACM].

The desktop and site inspection identified a number of Areas of Potential Environmental Concern (AoPEC), including the following:

- > Asbestos (i.e. ACM fragments) impacted soils within isolated areas of the site (predominately in areas of where gravel fill was observed).
- > Fill material / stockpile (unknown source, containing anthropogenic material including ACM).
- > Historic land use as a Market Garden (western portion of the site).

Following review of AoPEC and potential receptors (on- and off-site) a number of potential linkages (i.e. source – pathway – receptor) were present primarily associated with the potential for:

- > Exposure to ACM and potential contaminated soil/stockpiled fill material.

6.3 Recommendations

Based on the findings of the PSI, Cardno offers the following recommendations:

- > Given the presence of ACM at surface and within surface soil, there is a current exposure pathway to receptors (i.e. health risk to site users). It is recommended that further assessment and targeted ACM surface remediation (removal of visible ACM fragments) is undertaken to characterise the nature and extent of ACM impact and mitigate the risk of human exposure¹.

Further assessment works should be undertaken in reference to Department of Health (DoH) (2009) '*Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*'.

- > Undertake a stockpile classification assessment (i.e. sampling and analysis) to determine fill material characteristics (suitability for reuse and/or classification status for offsite disposal). Assessment should be undertaken in reference to DER (2014) '*Assessment and Management of Contaminated Site's*' and DEC (2009) '*Landfill Waste Classification and Waste Definitions 1996 (As amended December 2009)*' guidelines.
- > Given the presence of historic market garden activities (DWER listed potential contaminating land use) in the western portion of the site, further assessment should be

¹ Top 10cm of soil should be made free of visible asbestos or ACM (DoH, 2009).

considered. This is likely to include additional desktop assessment and a targeted intrusive investigation (i.e. soil sampling).

7 References

Legislation and Guidelines

1. *Contaminated Sites Act, 2003*, Western Australia.
2. Department of Environment and Regulation (DER) (2014), *Assessment and Management of Contaminated Sites*.
3. Department of Health (DoH), 2009, *Guidelines for the Assessment, Management and Remediation of Asbestos Contaminated Sites in Western Australia*.
4. Department of Indigenous Affairs, 2015, *Aboriginal Heritage Inquiry System*. (<http://maps.dia.wa.gov.au/AHIS2/>)
5. Department of Mines and Petroleum (DMP), 2015, *Geological Map* (<http://warims.dmp.wa.gov.au/GeoView/Viewer.html?Viewer=GeoVIEW>)
6. Department of Environment Regulation (DER) 2014. 'Assessment and management of contaminated sites – Contaminated sites guidelines'.
7. Geological Survey of Western Australia (1971) Geraldton – Houtman Abrolhos. Sheet SH 50-1 and Part of Sheet SH 49-4. Perth: GSWA.
8. Heritage Council 2015, *State Heritage Register* (<http://inherit.stateheritage.wa.gov.au/public>).
9. Landgate, 2014, *WA Atlas Online Database*, (<https://www2.landgate.wa.gov.au/bmvf/app/waatlas/#>).
10. National Environmental Protection (Assessment of Site Contamination) Measure (NEPM, 1999 as amended 2013).

Appendix A

4 Pages

Figures

Figure 1: Site Location

Figure 2: Geology

Figure 3: DoW Registered Groundwater Bores

Figure 4: Site Layout



Site Location

PRELIMINARY SITE INVESTIGATIONS (PSI)
CITY OF GREATER GERALDTON
FIGURE 1



1:2,000 Scale at A3

0 30 60 120
Metres

Legend

- Study Area
- Cadastre (MDS, 2015)

Cardno

Map Produced by Cardno Geosciences and Environment Perth
Date: 2018-01-09
Coordinate System: GDA 1994 MGA Zone 50
Project: CW 1018900
Map: CW1018900-GS-001-Figure1_Site_Layout.mxd 01
Aerial Imagery Supplied by Nearmap November, 2017



Coastal Dunes

Geology Description (Geoscience Australia, 2014)
 Tamala Limestone: Unconsolidated to strongly lithified calcarenite with calcrete/kankar soils; aeolian. Locally quartzose, feldspathic, or heavy-mineral-bearing.
 Coastal Dunes: Beach sand, sand dunes, coastal dunes, beaches, and beach ridges; calcareous and siliceous, locally shelly and/or cemented (beach rock); locally reworked

Legend

- Study Area
- Surface Geology (Geoscience Australia, 2014)**
- Tamala Limestone
- Coastal Dunes



Geology
 PRELIMINARY SITE INVESTIGATIONS (PSI)
 CITY OF GREATER GERALDTON
 FIGURE 2

Cardno
 Map Produced by Cardno Geosciences and Environment Perth
 Date: 2018-01-09
 Coordinate System: GDA 1994 MGA Zone 50
 Project: CW1018900
 Map: CW1018900-GS-001-Figure3_Geology.mxd 01
 Aerial Imagery Supplied by Nearmap November, 2017)



Legend

- Study Area
- 500m Buffer
- + Groundwater Bores (DWER, 2016)

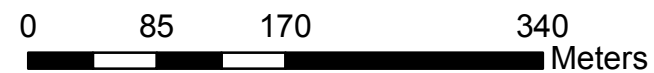
DoW Registered Groundwater Bores

PRELIMINARY SITE INVESTIGATIONS (PSI)
CITY OF GREATER GERALDTON

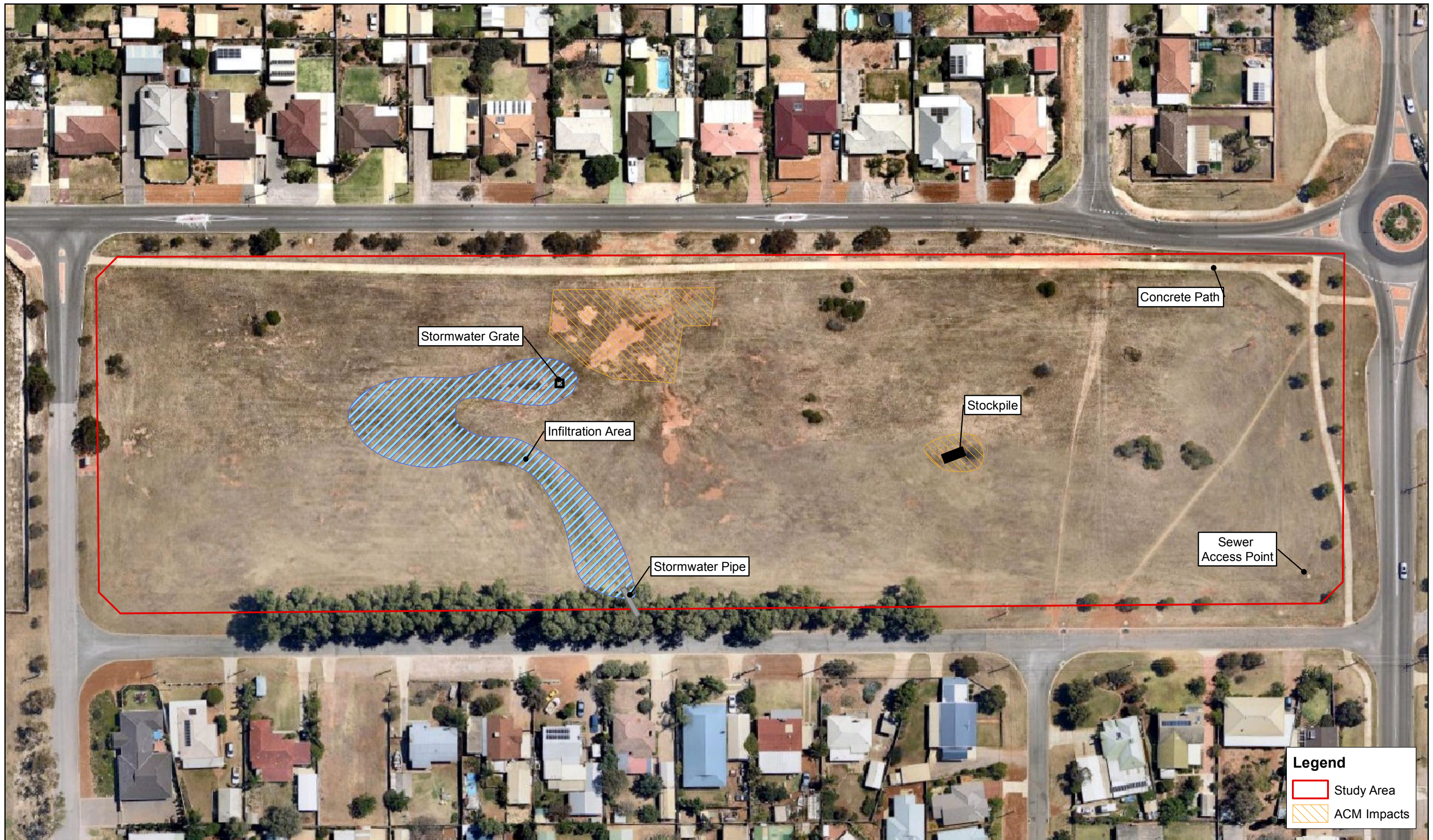
FIGURE 3



1:5,000 Scale at A3



Map Produced by Cardno Geosciences and Environment Perth
Date: 2018-01-09
Coordinate System: GDA 1994 MGA Zone 50
Project: CW1018900
Map: CW1018900-GS-001-Figure2_Topography_Groundwater.mxd 01
Aerial Imagery Supplied by Nearnmap November, 2017)



Site Layout

PRELIMINARY SITE INVESTIGATIONS (PSI)
CITY OF GREATER GERALDTON
FIGURE 4



1:1,000 Scale at A3
0 15 30 60
Metres

Legend

- Study Area
- ACM Impacts

Cardno

Map Produced by Cardno Geosciences and Environment Perth
Date: 2018-01-09
Coordinate System: GDA 1994 MGA Zone 50
Project: CW 1018900
Map: CW1018900-GS-001-Figure4_Site_Layout.mxd 01
Aerial Imagery Supplied by Nearmap November, 2017

Appendix B

3 Pages

Certificate of Title and Desk based Research

WESTERN



AUSTRALIA

REGISTER NUMBER 2872/DP216566	
DUPLICATE EDITION N/A	DATE DUPLICATE ISSUED N/A

RECORD OF QUALIFIED CERTIFICATE
OF
CROWN LAND TITLE
UNDER THE TRANSFER OF LAND ACT 1893
AND THE LAND ADMINISTRATION ACT 1997
NO DUPLICATE CREATED

VOLUME **LR3010** FOLIO **704**

The undermentioned land is Crown land in the name of the STATE OF WESTERN AUSTRALIA, subject to the interests and Status Orders shown in the first schedule which are in turn subject to the limitations, interests, encumbrances and notifications shown in the second schedule.



REGISTRAR OF TITLES

LAND DESCRIPTION:

LOT 2872 ON DEPOSITED PLAN 216566

**STATUS ORDER AND PRIMARY INTEREST HOLDER:
(FIRST SCHEDULE)**

STATUS ORDER/INTEREST: RESERVE UNDER MANAGEMENT ORDER

PRIMARY INTEREST HOLDER: CITY OF GERALDTON-GREENOUGH

**LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)**

1. RESERVE 19556 FOR THE PURPOSE OF RECREATION
MANAGEMENT ORDER. CONTAINS CONDITIONS TO BE OBSERVED.

- Warning:
- (1) A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
Lot as described in the land description may be a lot or location.
 - (2) The land and interests etc. shown hereon may be affected by interests etc. that can be, but are not, shown on the register.
 - (3) The interests etc. shown hereon may have a different priority than shown.

-----END OF CERTIFICATE OF CROWN LAND TITLE-----

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: DP216566
PREVIOUS TITLE: LR3010-704
PROPERTY STREET ADDRESS: NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AUTHORITY: CITY OF GREATER GERALDTON
RESPONSIBLE AGENCY: DEPARTMENT OF PLANNING, LANDS AND HERITAGE (SLSD)

NOTE 1: L019041 CORRESPONDENCE FILE 00878-1927-01RO

NatureMap Species Report

Created By Guest user on 09/01/2018

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 114° 37' 29" E, 28° 43' 27" S
Buffer 1km

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
1.	3376 <i>Acacia idiomorpha</i>			
2.	30033 <i>Acacia saligna</i> subsp. <i>lindleyi</i>			
3.	3532 <i>Acacia scirpifolia</i>			
4.	3549 <i>Acacia spathulifolia</i>			
5.	3604 <i>Acacia xanthina</i> (White-stemmed Wattle)			
6.	24261 <i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)			
7.	1208 <i>Acanthocarpus preissii</i>			
8.	20797 <i>Acanthocarpus</i> sp. <i>Ajana</i> (C.A. Gardner 8596)			
9.	25536 <i>Accipiter fasciatus</i> (Brown Goshawk)			
10.	41323 <i>Actitis hypoleucos</i> (Common Sandpiper)		IA	
11.	1721 <i>Allocasuarina campestris</i>			
12.	4905 <i>Alyogyne hakeifolia</i>			
13.	6565 <i>Alyxia buxifolia</i> (Dysentery Bush)			
14.	24315 <i>Anas rhynchotis</i> (Australasian Shoveler)			
15.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
16.	47414 <i>Anhinga novaehollandiae</i> (Australasian Darter)			
17.	3180 <i>Aphanopetalum clematideum</i>			
18.	41324 <i>Ardea modesta</i> (great egret, white egret)		IA	
19.	24319 <i>Biziura lobata</i> (Musk Duck)			
20.	11274 <i>Boronia coerulescens</i> subsp. <i>spinescens</i>			
21.	1273 <i>Borya sphaerocephala</i> (Pincushions)			
22.	3719 <i>Bossiaea spinescens</i>			
23.	42307 <i>Cacomantis pallidus</i> (Pallid Cuckoo)			
24.	29439 <i>Caesia</i> sp. <i>Wongan</i> (K.F. Kenneally 8820)			
25.	15349 <i>Caladenia flava</i> subsp. <i>maculata</i>			
26.	35856 <i>Calothamnus glaber</i>			
27.	35756 <i>Calothamnus quadrifidus</i> subsp. <i>angustifolius</i>			
28.	2796 <i>Carpobrotus modestus</i> (Inland Pigface)			
29.	258 <i>Cenchrus ciliaris</i> (Buffel Grass)	Y		
30.	43380 <i>Chelodina colliei</i> (South-western Snake-necked Turtle)			
31.	25339 <i>Chelodina steindachneri</i> (Flat-shelled Turtle)			
32.	<i>Chroicocephalus novaehollandiae</i>			
33.	24774 <i>Cladorhynchus leucocephalus</i> (Banded Stilt)			
34.	25675 <i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
35.	4561 <i>Comesperma scoparium</i> (Broom Milkwort)			
36.	40872 <i>Commersonia borealis</i>			
37.	1446 <i>Conostylis prolifera</i> (Mat Cottonheads)			
38.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
39.	25592 <i>Corvus coronoides</i> (Australian Raven)			
40.	25596 <i>Cracticus torquatus</i> (Grey Butcherbird)			
41.	<i>Craterocephalus cuneiceps</i>			
42.	16018 <i>Cryptandra arbutiflora</i> var. <i>borealis</i>			
43.	31614 <i>Cryptandra multispina</i>			
44.	4811 <i>Cryptandra spyridioides</i>			
45.	24322 <i>Cygnus atratus</i> (Black Swan)			
46.	5522 <i>Darwinia pauciflora</i>			
47.	11636 <i>Dianella revoluta</i> var. <i>divaricata</i>			
48.	18542 <i>Diplopeltis huegeli</i> subsp. <i>subintegra</i>			
49.	4748 <i>Diplopeltis petiolaris</i>			
50.	14298 <i>Drosera macrantha</i> subsp. <i>macrantha</i>			
51.	<i>Egretta novaehollandiae</i>			
52.	<i>Elanus axillaris</i>			
53.	47937 <i>Eileyornis melanops</i> (Black-fronted Dotterel)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
54.	<i>Eolophus roseicapillus</i>			
55.	24652 <i>Eopsaltria georgiana</i> (White-breasted Robin)			
56.	7185 <i>Eremophila brevifolia</i> (Spotted Eremophila)		P2	
57.	25622 <i>Falco cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
58.	25727 <i>Fulica atra</i> (Eurasian Coot)			
59.	38241 <i>Geleznovia</i> sp. <i>Binnu</i> (K.A. Shepherd & J. Wege KS 1301)		P3	
60.	3938 <i>Glycine canescens</i> (Silky Glycine)			
61.	3957 <i>Gompholobium tomentosum</i> (Hairy Yellow Pea)			
62.	24443 <i>Grallina cyanoleuca</i> (Magpie-lark)			
63.	1956 <i>Grevillea argyrophylla</i> (Silvery-leaved Grevillea)			
64.	15763 <i>Grevillea bififormis</i> subsp. <i>bififormis</i>			
65.	1973 <i>Grevillea candelabroides</i>			
66.	2032 <i>Grevillea leucopteris</i> (White Plume Grevillea)			
67.	2054 <i>Grevillea olivacea</i> (Olive Grevillea)		P4	
68.	17416 <i>Guichenotia angustifolia</i>			
69.	5011 <i>Guichenotia ledifolia</i>			
70.	5012 <i>Guichenotia macrantha</i> (Large-flowered Guichenotia)			
71.	6696 <i>Halgania sericiflora</i>			
72.	24295 <i>Haliastur sphenurus</i> (Whistling Kite)			
73.	5135 <i>Hibbertia hypericoides</i> (Yellow Buttercups)			
74.	5171 <i>Hibbertia spicata</i>			
75.	4927 <i>Hibiscus drummondii</i> (Drummond's Hibiscus)			
76.	25734 <i>Himantopus himantopus</i> (Black-winged Stilt)			
77.	24491 <i>Hirundo neoxena</i> (Welcome Swallow)			
78.	12741 <i>Hyalosperma cotula</i>			
79.	<i>Hydroprogne caspia</i>			
80.	34022 <i>Hypseleotris aurea</i> (Golden Gudgeon)		P2	
81.	<i>Hypseleotris compressa</i>			
82.	19700 <i>Isotropis cuneifolia</i> subsp. <i>cuneifolia</i>			
83.	4015 <i>Jacksonia hakeoides</i>			
84.	11289 <i>Labichea lanceolata</i> subsp. <i>lanceolata</i>			
85.	6733 <i>Lantana camara</i> (Common Lantana)	Y		
86.	25638 <i>Larus pacificus</i> (Pacific Gull)			
87.	9099 <i>Lasiopetalum angustifolium</i> (Narrow Leaved Lasiopetalum)			
88.	15428 <i>Leptosema aphyllum</i>			
89.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
90.	34736 <i>Lysinema pentapetalum</i>			
91.	24583 <i>Manorina flavigula</i> (Yellow-throated Miner)			
92.	25758 <i>Megalurus gramineus</i> (Little Grassbird)			
93.	5887 <i>Melaleuca cardiophylla</i> (Tangling Melaleuca)			
94.	5904 <i>Melaleuca depressa</i>			
95.	5936 <i>Melaleuca megacephala</i>			
96.	5958 <i>Melaleuca radula</i> (Graceful Honeymyrtle)			
97.	5959 <i>Melaleuca rhapsiophylla</i> (Swamp Paperbark)			
98.	<i>Microcarbo melanoleucos</i>			
99.	4100 <i>Mirbelia spinosa</i>			
100.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
101.	5227 <i>Opuntia stricta</i> (Common Prickly Pear)	Y		
102.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
103.	<i>Pandion cristatus</i>			
104.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
105.	24648 <i>Pelecanus conspicillatus</i> (Australian Pelican)			
106.	24667 <i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)			
107.	25699 <i>Phalacrocorax varius</i> (Pied Cormorant)			
108.	4675 <i>Phyllanthus calycinus</i> (False Boronia)			
109.	8182 <i>Podotheca angustifolia</i> (Sticky Longheads)			
110.	8184 <i>Podotheca gnaphalioides</i> (Golden Long-heads)			
111.	24681 <i>Poliocephalus poliocephalus</i> (Hoary-headed Grebe)			
112.	24683 <i>Pomatostomus superciliosus</i> (White-browed Babbler)			
113.	1671 <i>Prasophyllum elatum</i> (Tall Leek Orchid)			
114.	1674 <i>Prasophyllum giganteum</i> (Bronze Leek Orchid)			
115.	42416 <i>Pseudonaja mengdeni</i> (Western Brown Snake)			
116.	16367 <i>Pyrorchis nigricans</i> (Red beaks, Elephants ears)			
117.	41041 <i>Quoya atriplicina</i>			
118.	41063 <i>Quoya loxocarpa</i>			
119.	48096 <i>Rhipidura albiscapa</i> (Grey Fantail)			
120.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
121.	7614 <i>Scaevola globulifera</i>			
122.	6030 <i>Scholtzia ciliata</i>			
123.	25534 <i>Sericornis frontalis</i> (White-browed Scrubwren)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
124.	30948 <i>Smicromis brevirostris</i> (Weebill)			
125.	7025 <i>Solanum oldfieldii</i>			
126.	625 <i>Spinifex longifolius</i> (Beach Spinifex)			
127.	4828 <i>Spyridium globulosum</i> (Basket Bush)			
128.	25597 <i>Strepera versicolor</i> (Grey Currawong)			
129.	25590 <i>Streptopelia senegalensis</i> (Laughing Turtle-Dove)	Y		
130.	3182 <i>Stylobasium spathulatum</i> (Pebble Bush)			
131.	25705 <i>Tachybaptus novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
132.	<i>Thalasseus bergii</i>			
133.	6064 <i>Thryptomene racemulosa</i>			
134.	25549 <i>Todiramphus sanctus</i> (Sacred Kingfisher)			
135.	6073 <i>Verticordia chrysantha</i>			
136.	7389 <i>Wahlenbergia preissii</i>			
137.	25765 <i>Zosterops lateralis</i> (Grey-breasted White-eye, Silvereye)			

Conservation Codes

- T - Rare or likely to become extinct
- X - Presumed extinct
- IA - Protected under international agreement
- S - Other specially protected fauna
- 1 - Priority 1
- 2 - Priority 2
- 3 - Priority 3
- 4 - Priority 4
- 5 - Priority 5

¹ For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Appendix C

6 Pages

Aerial Photographs (Historical) & Site Photographs



PLATE 1: Aerial Photograph 04/10/1952



PLATE 2: Aerial Photograph 02/02/2000



PLATE 3: Aerial Photograph 12/03/2003



PLATE 4: Aerial Photograph 04/07/2010



PLATE 5: Aerial Photograph 09/12/2017



PLATE 1 - Site view looking West.



PLATE 2 - Site view looking South.



PLATE 3 - Site view looking North.



PLATE 4 - Site view looking East and Stockpiled Fill Material.



PLATE 5 - Stockpiled Fill Material with ACM fragments.



PLATE 6 - Stormwater drainage line/retention area.



PLATE 7 – Stormwater infiltration area (grate with retention depression).



PLATE 8 Sewer inspection pit/lid.



PLATE 9 - ACM fragments on surface.



PLATE 10 - ACM fragments on surface.



PLATE 11 - ACM fragments on surface.



PLATE 12 - ACM fragments on surface.



PLATE 13 - ACM Fragments within soil.



PLATE 14 - Site view looking North.

Appendix D

1 Page

Laboratory Certificates



CERTIFICATE OF ANALYSIS
FIBRE IDENTIFICATION

Job No.: HL1718-382 **Date of Report:** 10/01/2018 **Samples Taken by:** Client **Samples Received:** 10/01/2018
Client: Cardno **Attention:** David James **Email:** david.james@cardno.com.au
Client Reference CW 1018900 – Geraldton

METHODOLOGY SUMMARY

Test Specification Employed e:: In-House Test Procedure *LPH-01* based on *AS 4964-2004*

Samples of material are examined to determine the presence of asbestos fibres using *AS4964 (2004)* & In-House Procedure *LPH-01* i.e. Qualitative identification of chrysotile, amosite and crocidolite in bulk samples by **Polarised Light Microscopy (PLM)** in conjunction with **Dispersion Staining (DS)**. Unequivocal identification of asbestos minerals present is made by assessing fibre properties to see whether the values are typical and consistent with published data. This provides a reasonable degree of certainty to determine whether a fibre under investigation is asbestiform or not. Careful application of the test procedure provides sufficient diagnostic clues to allow unequivocal identification of asbestos types, and so, to determine whether a sample contains asbestos or not. If sufficient diagnostic clues are absent, then positive identification of fibrous asbestos is not possible.

Sample No.	Client Ref.	Location/Description	Physical Structure	Weight/Dimensions	Analysis of Fibrous Content
L27020	ACM1		Asbestos Cement Product	23g/100x50x40mm	Chrysotile Asbestos Detected
L27021	ACM2 (Stockpile)		Asbestos Cement Product	9g/40x35x4mm	Chrysotile Asbestos Detected

Number of Samples: 2

Analyst Details	Name	Signature
Approved Identifier	Monika Bürger	
Approved Signatory	Monika Bürger	



Accreditation Number: 17108
Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian and national standards.



CERTIFICATE OF ANALYSIS ASBESTOS FIBRE IDENTIFICATION

CLIENT SUPPLIED SAMPLES

Emission Assessments is not responsible for the accuracy or competence of sampling carried by third parties. Sample location(s) and/or sample type(s) of third party samples delivered to the laboratory are given by the client at the time of delivery. Under these circumstances, Emission Assessments cannot be held responsible for the interpretation of the results shown. Emission Assessments takes responsibility of information reported only when a staff member takes the sample(s).

REPORTING OF RESULTS

'**Asbestos Detected**': Asbestos detected by **Polarised Light Microscopy (PLM)**, including **Dispersion Staining (DS)**

'**No Asbestos Detected**': No Asbestos detected by **Polarised Light Microscopy (PLM)**, including **Dispersion Staining (DS)**

'**UMF Detected**': Mineral fibres of unknown type detected by **Polarised Light Microscopy (PLM)**, including **Dispersion Staining (DS)**. Confirmation by another independent analytical technique may be necessary.

"**Hand-picked**" refers to small discrete amounts of asbestos unevenly distributed in a large body of non-asbestos material.

Limit of Detection (LOD) & Limit of Report (LOR)

Known limitations of the test procedure using **Polarised Light Microscopy (PLM)** are:

- **PLM** is a qualitative technique only;
- It does not cover identification of airborne or water-borne asbestos;
- The less encountered asbestos mineral fibres actinolite, anthophyllite and tremolite exhibit a wide range of optical properties that preclude unequivocal identification by **PLM** and **Dispersion Staining (DS)**. Thus, the method is used to positively identify the three major asbestos minerals: amosite ("brown"), chrysotile ("white") and crocidolite ("blue");
- Valid identification requires that the sample material contains a sufficient quantity of the unknown fibres in excess of the practical detection limit used (in this case, **PLM** and **Dispersion Staining**, which has a calculated practical detection limit of **0.01 - 0.1% w/w** equivalent to **0.1 - 1g/kg (AS4964-2004:App.A4)**).

Results relate only to the sample(s) submitted for testing. Test report must not be reproduced except in full.



Accreditation Number: 17108

Accredited for compliance with ISO/IEC 17025 - Testing.

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

Appendix E

3 Pages

Information About Environmental Reports

About Site Environmental Assessment Reports

1. Introduction

This document explains the Environmental Site Assessment (ESA) process and the context that applies to the use of Environmental Reports issued by Cardno Lane Piper.

2. What is an ESA?

Environmental Site Assessments (ESA) are undertaken for a range of purposes, specific to the brief issued by the client in each case. The scope may include one or a combination of any of the following:

- A factual report of the condition of a portion of the site or one aspect of an entire site.
- Assessment of the contamination levels in soil to be removed from a site – a waste classification assessment.
- Validation of the success of remediation of a site or a portion of a site.
- Provision of a professional opinion about the suitability of a site for one or more uses, in terms of its contamination status.

The scope of any ESA needs to be defined at the outset.

An ESA is not an Environmental Audit. Such audits are undertaken in accordance with the provisions of regulations enacted in various states of Australia, and are referred to as Site Audits in some jurisdictions. Statutory audits provide certification by EPA accredited auditors that a site is suitable for one or more uses. An ESA may provide similar advice but cannot be used in place of an audit if the latter is required by regulation in any instance. However in some circumstances and jurisdictions an ESA is sufficient to provide “environmental sign-off” of a site.

An ESA may be undertaken for due diligence purposes, to establish whether the site has been impacted to the extent that some beneficial uses of the site may be precluded. Due diligence audits in many cases may be completed as non-statutory Audits, although in some jurisdictions they can also be statutory audits, if defined as such at the outset.

3. The ESA Process

The Client generally initiates the ESA process by specifying a brief which identifies the specific objectives of the assessment. If not, it is the consultants' duty to so specify the ESA

In the case of an ESA to provide an opinion about the suitability of the site for use, it would be conducted in accordance with NEPM (Site Assessment). Such ESA would not commence until a thorough site history assessment (Phase 1 Assessment: to identify the potential for significant contamination at a site) is conducted. However, where the history is unclear, a broad screening of chemical parameters can be used to test environmental media. This normally includes a broad range of organic and inorganic compounds and elements, often referred to as an Environmental Screen.

(In the case of an ESA for a purpose other than to provide an opinion about the suitability of the site for use, it is not always necessary to undertake a Phase 1 assessment.)

The ESA requires sampling of soil at representative locations across the site. A NATA accredited laboratory performs the analysis of soil. It is impractical for all of the soil to be assessed. The ESA is often based on a statistical method of grid or random sampling, augmented by targeted sampling at locations known or suspected to be contaminated. Guidance on sampling strategy and density is provided in Australian Standard AS4482.1–2005. However, some considerable degree of judgement is still required in the application of any sampling and testing strategy. For example the blanket application of the “hot spot” method presented in this standard is often inappropriate given its limitations.

The field program also investigates the likelihood of contamination below the site surface. Field investigations must sample and test fill as well as the natural soils. If contamination is found then it is common for further work to be undertaken to characterise, to the extent practical, its vertical and horizontal extent. However, where fill is encountered and testing shows it to be uncontaminated, it must be realised that the heterogeneous nature of the material might mean that not all pockets of contaminated material can be detected using normal sampling regimes.

EPA guidelines for auditors, that may be relevant for an ESA, indicate the need in all cases to consider the potential for groundwater contamination in any site. This does not mean all sites need to be drilled to sample groundwater, but it is most often the case. Most hydrogeological settings and groundwater conditions are complex and vary in space and time. The condition of groundwater is investigated to identify if any beneficial use or environmental value of groundwater is precluded due to contamination.

As previously stated for soil, all groundwater at the site cannot be tested. The environmental investigations are conducted in accordance with industry standards and guidelines (e.g. EPA Vic Pub 668). This provides a level of confidence that a sufficiently comprehensive assessment of the groundwater at the site is achieved.

Where an investigation shows that groundwater is polluted, consideration should be given to assessing the risks and the need for and practicality of any clean up.

4. Environmental Assessment Report

The ESA Report details the findings of the ESA. It provides summary information on the site definition, the reasons for the assessment and other relevant facts. It reviews the scope and quality of the site investigations, laboratory testing and data analyses undertaken. These reports also present a review of the contamination status of the site, the need for any further clean up, and an opinion on the suitability of the site for a range of beneficial uses and land uses such as “residential – low density”, “commercial” etc, as appropriate.

However, as noted above, some ESA have a narrow scope such as for classification of waste soil for removal from site, and do not make conclusions on suitability of site for use.

The ESA Report generally includes copies of other documents and reports, necessary to support the assessment findings, presented as appendices. These can contain more detailed information than the body of the ESA Report. Care should be taken to also read the appended documents and the ESA report in full.

Cardno Lane Piper generally issues reports in electronic form (e-Report) on CD ROM. ESA Reports are issued in this format as Adobe Acrobat™ PDF files. However, a paper copy of the executive summary of the ESA Report is generally issued to the client, and others as required by the brief or by regulation.

5. Limitations of Environmental Assessment Report

The ESA Report is prepared in a manner that can be easily read by a lay person with a legitimate interest in the contamination status of the site, such as the site owner or occupier, EPA and Local Planning Authority. The ESA report is not intended for use by other parties or for other purposes. Anyone who uses the assessment report for purposes other than specified in the report, does so at their own risk.

The site should only be used for one or more of the beneficial uses and land uses identified in the ESA as suitable.

The conditions and qualifications may apply to the suitability of the site for use, and it is the responsibility of the Client to be cognizant of and accept these in accepting the report. Cardno Lane Piper are only responsible for the issuing of the ESA report but accepts no liability for the costs incurred in the implementation of ESA findings.

The ESA provides a “snapshot” of the site conditions at the time of the site investigation. Consequently, the report may not be valid at a later time if there has been any change to the contamination status of the site in that time. Verification of the status of the site may be required in cases where a significant time has elapsed, or site conditions have changed since the assessment and audit.

The ESA is necessarily limited by constraints such as time, cost and available information; although normal professional practice at the time has been applied with all due care to prepare the report. A necessary requirement of this process is the horizontal and vertical interpolation of data from discrete locations. However, site conditions are generally not homogenous and some discrepancies will occur between the actual and predicted results at locations not directly sampled. There is a risk that contamination may occur at the site and not be identified by a competent investigation and assessment. The approach adopted in sampling (a combination of statistically based grid and judgmental sampling) seeks to reduce, but cannot eliminate, this risk.

Where unexpected occurrences of contamination arise, subsequent to the issue of the ESA Report, Cardno Lane Piper should be permitted to make an interpretation of these facts in relation to the ESA Report findings. Consequently, the Client should inform Cardno Lane Piper and seek their opinion. Cardno Lane Piper accepts no liability for costs incurred due to such unexpected

occurrences, given the inherent uncertainties in the assessment process.

Cardno Lane Piper uses information provided by other parties as the basis for the ESA, and reliance on this information is at the discretion of Cardno Lane Piper. However, however Cardno Lane Piper cannot guarantee any of the facts, findings or conclusions presented by other parties. Cardno Lane piper will not be liable for the use of information, provided by others that is subsequently found to be intentionally misleading.

The ESA Report is not and does not purport to be anything other than a contaminated land ESA. It is not a geotechnical report and bore logs reproduced are for interpretation of the likely distribution of contamination. They are not intended for geotechnical interpretations and may not be adequate for this purpose.

The ESA Report is not intended to be a comprehensive analysis of the presence and associated risk of asbestos in buildings and services. Where asbestos in buildings and services is known or likely, the report may only caution that an appropriately qualified person be engaged to undertake demolition to avoid contamination of the site.

Cardno Lane Piper

25 February 2013