

**DUST AND ASBESTOS  
MANAGEMENT PLAN  
CYGNIA COVE, WATERFORD**

Prepared for:

Trustees of the Christian Brothers in Western  
Australian Incorporated  
c/- Richard Noble & Company  
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Report Date: 5 November 2009  
Project Ref: 2006/225, V9

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5 November 2009

Trustees of the Christian Brothers in Western Australian Incorporated  
c/- Richard Noble & Company  
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189 Hay Street  
SUBIACO WA 6008

**Attention: Alex Gregg**

Dear Alex

**RE: DUST AND ASBESTOS MANAGEMENT PLAN - CYGNIA COVE, WATERFORD**

The attached Asbestos and Dust Management Plan for Cygnia Cove, Waterford is intended to satisfy the first component of Condition 8 of Ministerial Statement 692 (*Prepare Asbestos Management Plan*) and the proponent commitment to prepare a dust management plan. This report has been issued as Version 9.

If you have any further queries, please contact myself or Paul Zuvela on 9355 7100.

For and on behalf of Coffey Environments Pty Ltd



Pamela Lee  
Environmental Scientist

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1		TCB-2006-007-DUST_001_rk_V7	V7	3 July 2009	Coffey Environments Pty Ltd	ND
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## ABBREVIATIONS

<b>µg/m<sup>3</sup></b>	microgram per cubic meter
<b>µm</b>	micrometre
<b>ACM</b>	asbestos containing material
<b>Al</b>	aluminium
<b>ANZECC</b>	Australian and New Zealand Environment Conservation Council
<b>ARMCANZ</b>	Agriculture and Resource Management Council of Australia and New Zealand
<b>AS</b>	Australian Standard
<b>As</b>	arsenic
<b>ASCC</b>	Australian Safety and Compensation Council
<b>ATA</b>	ATA Environmental
<b>C<sub>15-28</sub></b>	Hydrocarbon chainlength fraction
<b>Cd</b>	cadmium
<b>cm</b>	centimetre
<b>COPC</b>	Contaminants of Potential Concern
<b>Cr</b>	chromium
<b>CSM</b>	Conceptual Site Model
<b>CTP</b>	Coffey Test Pit
<b>Cu</b>	copper
<b>DAMP</b>	Dust and Asbestos Management Plan
<b>DEC</b>	Department of Environment and Conservation
<b>DEP</b>	Department of Environmental Protection
<b>DoE</b>	Department of Environment

## ABBREVIATIONS

<b>DoH</b>	Department of Health
<b>Dup</b>	Duplicate
<b>EHD</b>	Environmental Health Directorate
<b>EIL</b>	Ecological Investigation Level
<b>EPA</b>	Environmental Protection Authority
<b>ha</b>	hectare
<b>Hg</b>	mercury
<b>HIL</b>	Health Investigation Level
<b>hr</b>	hour
<b>kg</b>	kilogram
<b>km</b>	kilometre
<b>L</b>	litre
<b>LEV</b>	Local Exhaust Ventilation
<b>m</b>	metre
<b>m<sup>2</sup></b>	square metre(s)
<b>m<sup>3</sup></b>	cubic metre(s)
<b>mAHD</b>	metre(s) Australian Height Datum
<b>mbgs</b>	metre(s) below ground surface
<b>mg</b>	milligram
<b>mg/kg</b>	milligram(s) per kilogram
<b>mg/m<sup>3</sup></b>	milligram(s) per cubic metre
<b>mL</b>	millilitre

## ABBREVIATIONS

<b>mm</b>	millimetre
<b>MoT</b>	Memorial on Title
<b>NA</b>	not applicable
<b>NATA</b>	National Association of Testing Authorities
<b>NEPC</b>	National Environment Protection Council
<b>NEPM</b>	National Environmental Protection Measure
<b>NES</b>	National Exposure Standard
<b>NH<sub>3</sub>-N</b>	Ammonia
<b>NHMRC</b>	National Health and Medical Research Council
<b>Ni</b>	nickel
<b>NOHSC</b>	National Occupational Health and Safety Commission
<b>NO<sub>x</sub>-N</b>	Nitrogen
<b>OC</b>	Organochlorine (Pesticide)
<b>OHS&amp;E</b>	Occupational Health Safety & Environment
<b>Pb</b>	lead
<b>PER</b>	Public Environmental Review
<b>PM</b>	Particulate Matter
<b>PM<sub>10</sub></b>	Particulate thoracic fraction <10 µm
<b>POS</b>	public open space
<b>PPE</b>	personal protective equipment
<b>SMP</b>	Site Management Plan
<b>SMS</b>	Short Message Service

## ABBREVIATIONS

<b>TEOM</b>	Tapered Element Oscillating Microbalance
<b>TP</b>	Test Pit
<b>TPH</b>	Total Petroleum Hydrocarbon
<b>TSP</b>	Total Suspended Particulates
<b>TWA</b>	Time Weighted Average
<b>w/w</b>	by weight
<b>WA</b>	Western Australia
<b>WALIS</b>	Western Australian Land Information System
<b>Zn</b>	zinc

## 1 INTRODUCTION

### 1.1 Site Description

Cygnia Cove, formerly known as the East Clontarf development site is located south of Manning Road in the suburb of Waterford, as shown in Figure 1.

The site is located approximately 8km south-east of the Perth Central Business District, encompassing an area of approximately 20ha. The coordinates of the centre of the site are approximately 395,730mE and 6,457,300mN.

Clontarf Bay on the Canning River forms the southern boundary of the site, and approximately 30% of the site currently comprises a Resource Enhancement category wetland which trends east-west along the northern central portion of the site. The wetland drains to Clontarf Bay along a narrow drainage line situated near the western edge of the site.

Curtin University is located to the north-west of the site, with Clontarf Aboriginal College to the west, and residential housing both to the north and east (Figure 2).

The topography of the site has historically been modified and the original size of the wetland has been reduced. During the 1940's, pine plantations and market gardens were present at the site. Drainage channels were also created and maintained to assist in reducing ground water levels. It is understood that uncontrolled fill was imported to the site prior to 1968 in order to elevate the area occupied by the Christian Brothers' Clontarf Orphanage playing fields, in the southern portion of the site.

### 1.2 Purpose

Condition 8 of the Ministerial Statement (Appendix A) requires the preparation of an Asbestos Management Plan, whilst the proponent has committed to the development of a Construction Environmental Management Plan which includes within it, Dust Management procedures.

This report presents strategies to ensure that nuisance and contaminated dust, including asbestos fibres, are controlled during the remediation, bulk earthworks and construction phases at the Cygnia Cove development site, comprising Lot 9001, Lot 829 and Lot 83 Manning Road, Waterford.

### 1.3 Previous Investigations

ATA Environmental (ATA) has previously investigated soil and groundwater contamination at the site, as described in the following reports:

- *Environmental Assessment, East Clontarf, Manning* (ATA, 2001). ATA Environmental Report 2000/179. Prepared for Trustees of the Christian Brothers, January 2001.
- *Preliminary Assessment - Asbestos Contamination, East Clontarf, Manning* (ATA, 2002a). ATA Environmental Report 2002/47. Prepared for Trustees of the Christian Brothers, May 2002.
- *Remediation Report, Asbestos Contamination, Clontarf Aboriginal College, Manning* (ATA, 2002b). ATA Environmental Report 2002/122. Prepared for Trustees of the Christian Brothers, September 2002.

- *Detailed Soil/Groundwater Contamination and Preliminary Acid Sulphate Soils Investigation, Sampling and Analysis Program* (ATA, 2002c). ATA Environmental Report 2002/147. Prepared for Trustees of the Christian Brothers, December 2002.
- *Preliminary Acid Sulphate Soils Investigation, East Clontarf, Manning* (ATA, 2003a). ATA Environmental Report 2003/115. Prepared for Trustees of the Christian Brothers, August 2003.
- *Detailed Soil and Groundwater Investigation, East Clontarf, Waterford* (ATA, 2003b). ATA Environmental Report 2002/144. Prepared for Trustees of the Christian Brothers, December 2003.

The results of a detailed soil investigation for the site (ATA, 2003b) are reviewed in this report and used to formulate management strategies appropriate to the proposed development works at the site. A Site Summary form is provided as Appendix B, together with copies of the current Certificates of Title for Lot 9001 (Deposited Plan 44883, Volume 2598 Folio 42); Lot 829 (on Diagram 88770, Volume 2048 Folio 180); and Lot 83 on Plan 2461, Volume 2048 Folio 181.

The soil and groundwater contamination investigation sampling and analysis plan (ATA, 2002c) was reviewed by the Department of Environment (DoE) (then DEP, Department of Environmental Protection) in February 2003, as included in the detailed soil and groundwater investigation report (ATA, 2003b). Based on DoE (now Department of Environment and Conservation (DEC)) comments and site observations, some amendments were made to the sampling and analysis plan during the implementation of the soil and groundwater contamination investigation, as outlined in ATA (2003b).

The site was formally assessed under the *Environmental Protection Act 1986*, and a Public Environmental Review (PER) document for the proposed development was prepared and released for public comment in June 2004. Information regarding soil contamination derived from site investigations was included in Section 3.10 the PER. Reports associated with the formal assessment process include the following:

- Clontarf Residential Subdivision, Manning, Public Environmental Review Environmental Scoping Document Assessment No. 1467 (ATA, 2003c). ATA Environmental Report 2003/39. Prepared for Trustees of the Christian Brothers, July 2003.
- Clontarf Residential Subdivision, Waterford, Public Environmental Review (EPA Assessment No. 1467) (ATA, 2004a). ATA Environmental Report 2003/91, Version 5. Prepared for Trustees of the Christian Brothers, June 2004.
- Clontarf Residential Subdivision, Waterford, Responses to Submissions (EPA Assessment No. 1467) (ATA, 2004b). ATA Environmental Report 2004/182. Prepared for Trustees of the Christian Brothers, October 2004.
- Clontarf Residential Subdivision, Waterford, Ministerial Statement No. 692, Section 45C Referral (ATA, 2006a). ATA Environmental Report 2006/82. Prepared for Trustees of the Christian Brothers, April 2006.

Commitments were made by the proponent in the PER document to remediate contaminated soil at the site such that the site would be compatible with the proposed future land uses, and to do so in a manner that would not adversely impact on environmental or human health. The Environmental Protection Authority (EPA) released Bulletin 1156 containing its report and recommendations on 6 December 2004 (EPA, 2004). The East Clontarf Residential Development proposal, now known as Cygna Cove, was approved by the Minister for the Environment in Ministerial Statement No. 692 in October 2005, subject to the fulfilment of conditions.

## 1.4 Proposed Site Works

It is proposed to develop the site for residential use with public open space (POS), with the core of the wetland retained as shown in Figure 3. The subdivision plan shown in Figure 3 has been modified slightly to that assessed in the PER. The revised subdivision plan has been approved by the EPA as a part of Section 45C Referral.

Remedial works will be required prior to development in order to remove geotechnically unsuitable material (uncontrolled fill) which locally exceeds the DEC's Ecological Investigation Levels (EIL) guidelines for metals and contains some asbestos sheeting.

## 1.5 Objective and Scope of Works

The purpose of this document is to outline measures to prevent the release of asbestos fibres whilst handling and relocating contaminated material during the remediation phase, and in the long term after development. A crucial component of this plan is to ensure that nuisance and contaminated dust, including asbestos fibres, is controlled during the remediation, bulk earthworks and construction phases of the development.

This Dust and Asbestos Management Plan (DAMP) specifically addresses the following:

- Description of the earthworks proposed for areas where asbestos has been identified;
- Methodology for ensuring the removal and appropriate disposal of impacted soils;
- Measures and practices to minimise the generation of dust;
- Suggested air quality monitoring equipment and monitoring sites;
- Monitoring for fine particulates;
- Monitoring for airborne asbestos fibres;
- Monitoring for nuisance dust;
- Confirmatory monitoring for heavy metal particulates contained within the dust;
- Identification of regulatory guidelines and compliance criteria; and
- Nomination of action levels and contingency measures in the event that air quality approaches or is likely to exceed the adopted compliance criteria.

Section 2 of this document outlines the site investigations and summary of issues pertinent to asbestos and dust. Section 3 presents a conceptual model of the site outlining the potential contaminants of concern, sources, exposure pathways and identified receptors. Section 4 presents a review of the various remediation options and details the rationale for the selected strategy. Section 5 details the proposed asbestos and dust management strategies, and monitoring is outlined in Section 6. Contingency responses are outlined in Section 7 whilst Section 8 details the reporting requirements and which parties are responsible for implementation of the proposed management plans.

## 2 SITE INVESTIGATIONS AND SUMMARY OF ISSUES

The following information is summarised from material presented in the following reports:

- East Clontarf, Manning Report on Geotechnical Studies (Coffey, 2000).
- Environmental Assessment East Clontarf, Manning [DRAFT] (ATA, 2001).
- Preliminary Assessment - Asbestos Contamination, East Clontarf (ATA, 2002a).
- Remediation Report - Asbestos Contamination, Clontarf Aboriginal College, Manning (ATA, 2002b).
- Detailed Soil/Groundwater Contamination and Preliminary Acid Sulphate Soils Investigation - Sampling and Analysis Program (ATA, 2002c).
- Detailed Soil and Groundwater Investigation - East Clontarf, Waterford (ATA, 2003b).

In 2001 a preliminary assessment for asbestos contamination at the site (ATA, 2002a) identified the presence of asbestos fibres within a concrete matrix at the base of an access track on the western margin of the site (Figure 4). Subsequently, an Asbestos Remediation Plan (ATA, 2002b) was implemented to remove the contaminated soil. A small area of the access track (Figure 4) that is covered with bitumen hardstand could not be remediated due to the presence of underground services. Provided that the soil was not disturbed, it was considered that no health or environmental threat existed given that the asbestos is contained by the bitumen (ATA, 2002b). This hardstand area does not form part of the current area of investigation (Figure 4).

In July 2002, the Department of Environmental Protection (DEP) provided comment on the initial Environmental Assessment that was submitted in May 2002 (ATA, 2001) requesting that additional investigations be conducted to better define the characteristics of fill material used to construct the playing fields and the soils associated with the market garden area. Accordingly, a detailed sampling and analysis program was developed and implemented to address the DEP's concerns (ATA, 2002c; ATA, 2003b).

The soil and groundwater contamination investigation sampling and analysis plan (ATA, 2002c) was reviewed by the former DEP in February 2003, and included in the detailed soil and groundwater investigation report (ATA, 2003b). Based on DEP comments and site observations, some amendments were made to the sampling and analysis plan during the implementation of the soil and groundwater contamination investigation, as outlined in ATA (2003b).

### 2.1 Site Geology and Hydrology

The site slopes down towards the Canning River, with a maximum elevation of approximately 9mAHD near Manning Road, 2-3mAHD through wetland areas, and 1mAHD along the foreshore.

The natural surface geology over the majority of the site (excluding the wetland) is mapped by Jordan (1986) as comprising Unit S<sub>8</sub>, Bassendean Sand. Unit S<sub>8</sub> is described as fine to medium-grained sub-rounded quartz sand which is very light grey at surface and yellow at depth (Jordan, 1986). The wetland in the north central portion of the site is mapped as comprising Unit S<sub>14</sub>, Alluvium, which is described as white to pale grey, medium- to coarse-grained quartz sand with abundant shell fragments (Jordan, 1986).

Previous investigations at the site have identified deposits of fill in several areas at the site, including several areas to the south of the wetland and two areas on the northern margin of the wetland, as shown in Figure 2 of the report *Detailed Soil and Groundwater Investigation, East Clontarf, Waterford* (ATA, 2003b). It is estimated that the uncontrolled fill covers approximately 2ha of the site and varies in thickness between 0.1m and 1.5m (ATA, 2003b).

Natural soils encountered during investigations at the site included sands consistent with the description of Bassendean Sand by Jordan (1986) over large areas of the site. Extensive areas of peat were also identified (described as sandy to clayey peat) extending beneath the current wetland, along the drainage line near the western margin of the site. Geotechnical investigations at the site were used to infer the extent of peat across the site, as shown in Figure 4 of ATA (2003a). The extent of peat on that diagram is generally consistent with areas where peat was encountered in the ASS investigation: particularly beneath the wetland and along the western drainage line. However, instead of peat adjacent to the foreshore, ATA identified clayey and silty soils matching the description of Guildford Formation (Jordan, 1986) at shallow depth beneath the Bassendean Sand unit.

## **2.2 Surface Hydrology**

The site is situated adjacent to the Canning River at Clontarf Bay, with the central area of the site occupied by a wetland. A review of the Western Australian Land Information System (WALIS) online database (<http://www.atlas.wa.gov.au>, last accessed May 2006) indicates that the wetland is designated a Resource Enhancement management category feature. ATA has conducted site-specific investigations into the extent and nature of wetlands at the site, and has come up with modified wetland boundaries and classifications which have been accepted by DEC, as shown in Figure 6 of the PER (ATA, 2004a).

## **2.3 Nature and Extent of Contamination**

As discussed in Section 1.2, a number of investigations have been undertaken at the site to assess the extent of contamination.

The following section discusses the methodology employed, analyses used and results of the aforementioned investigations specific to asbestos identification and remediation.

### **2.3.1 Preliminary Investigation - Coffey and ATA Environmental, 2000**

In December 2000, ATA Environmental undertook a preliminary soil assessment, in conjunction with the geotechnical investigations undertaken by Coffey Geosciences Pty Ltd (Coffey) at the site (ATA, 2001; Coffey, 2000). The purpose of the investigation was to identify potential soil contamination that may exist at the site due to historical land uses. Activities undertaken by ATA Environmental included the collection and subsequent analysis of judgemental soil samples from the 28 test pits excavated during Coffey's geotechnical investigations (Coffey, 2000).

There were traces of building rubble (bricks, concrete slabs and blocks) over some of the site at the time of fieldwork. Stockpiles of building rubble were located centrally in the southern portion of the site in the vicinity of Coffey's test pit CTP10 (Figure 4). In addition, asbestos cement sheeting was identified to the north-east of Coffey's test pit CTP10 and immediately west of the monitoring bores (CP1 and CP2) alignment (Figure 4).

Coffey divided the subsurface conditions in the East Clontarf site into five areas (Areas 1 to 5) based on field data together with engineering judgement. The division was based on the presence of uncontrolled fill and peaty soils overlying natural soils in the site. A brief description of these areas as they pertain to this DAMP is provided below.

Area 2A (Figure 5) is a slightly elevated section between the wetland and the river. This area contains uncontrolled fill over natural medium dense sand and clayey sand, sandy clay and clay of the Guildford Formation. The fill materials encountered in test pits CTP23 and CTP24 contained traces of plastics, brick blocks, brick fragments and steel products. A large stockpile of building rubble was noted within the vicinity of CTP23 and CTP16 at the time of fieldwork. Uncontrolled fill sand was also encountered in test pit CTP12 overlying sand and coffee rock at 1.8m depth below ground level. Backhoe bucket refusal was recorded on coffee rock at 2.2m depth below ground surface (Coffey, 2000).

Areas 3A, 3B, 3C and 3D (Figure 5) are low-lying areas in or adjacent to the wetland and river foreshore reserve. These areas contain uncontrolled fill and peaty soils overlying natural soils. The natural soils were generally medium dense sand over clayey sand, sandy clay and clay of the Guildford Formation. The fill materials were generally sand, but test pits CTP3, CTP7, CTP10 and CTP25 contained traces of some brick blocks and fragments, concrete fragments, wood pieces, aluminium sheets, steel rods, plastics, steel strips, concrete slabs, concrete columns, tile bricks, concrete blocks, and steel pipes (Coffey, 2000). Asbestos cement sheets were observed in CTP10 (Coffey, 2000).

The uncontrolled fill material appeared to be relatively uniform in contents across the site and comprised predominantly dark grey sand and the following:

- a. Bricks and brick fragments;
- b. Concrete blocks, slabs and rubble;
- c. Glass bottle fragments;
- d. Ceramic tile and fragments;
- e. Incinerated wood pieces;
- f. Metal sheets, rods and piping; and
- g. Asbestos cement sheeting fragments.

#### **2.3.1.1 Soil Analytical Results**

Asbestos fibres were not detected in any of the soil samples analysed (ATA, 2001). This included samples from CTP10 in which asbestos cement sheets had been visually identified (Coffey, 2000; ATA 2001). A section of cement piping collected from the test pit CTP10 was subjected to analysis, which confirmed that chrysotile and amosite asbestos was the major constituent of the piping (ATA, 2001).

The thickness of the uncontrolled fill varies from 0.1 to 1.5m.

## **2.3.2 Detailed Soil and Groundwater Investigation ATA Environmental 2003**

### **2.3.2.1 Soil Sampling Methodology**

As discussed in Section 2 of the Sampling and Analysis Program (ATA, 2003b), sample locations were selected to target portions of the site identified as having significant risk of potential soil contamination based on a desktop review of site information and preliminary soil sampling. Portions of the site considered at risk of soil contamination comprised areas of uncontrolled fill as defined by Coffey (Areas 2A, 3B, and 3C), a former community market garden area (Area 2B), and the south-east boundary of the site, adjacent a former municipal landfill area (Figure 5). A total of 125 sample locations were selected from the identified areas of potential contamination, using the recommended sample density (DEP, 2001) based on the size of the area of concern.

Soil sampling was undertaken between 6 May 2003 and 10 May 2003. Samples were collected at 0.5m intervals to a maximum depth of 3.5m, for a total of 349 samples (including quality control samples) from 133 sample locations. Soil sample locations were designated TP1 to TP143 (with some numbers not used), and their locations are shown in Figure 5. Samples were submitted to a NATA-accredited laboratory for analysis of one or more parameters (based on the contaminants of concern) or for storage.

### **2.3.2.2 Soil Assessment Criteria**

Until recently there has been no criterion set for assessing asbestos in soil, instead the detection of asbestos fibres in an area is considered to trigger a requirement for management of the affected soil. In recent years two publications have proposed assessment criteria. The first was the EnHealth publication titled *Guidelines for the Management of Asbestos in the Non-Occupational Environment* (EnHealth, 2005) which proposed an assessment criteria of less than 0.001% w/w asbestos in soil as an appropriate standard for detection of asbestos in soil. The second is the recently published *Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia* (DoH, 2009). This document provides specific advice and recommendations on remediation and also adopts the assessment criteria proposed by EnHealth.

Both documents confirm the analytical and sampling difficulties associated with the assessment of asbestos fibres in soil which mean that there are significant uncertainties associated with methodologies of the determination of asbestos concentrations in soil. As a result while noting the recommended assessment criterion proposed, Coffey Environments will adopt as a remediation goal a criterion of zero asbestos fibres detected in validation samples. In the event that this is not achievable (considered unlikely), the alternative criterion of < 0.001% w/w asbestos in soil will be used.

In view of the known presence of fragments of asbestos sheeting and other asbestos containing materials (ACM) on the site, an assessment goal of zero fragments of ACM as determined by a visual assessment will be adopted for assessing the successful remediation of area of the site at risk of being impacted by ACM.

Whilst the subject of soil remediation and/or removal of soils where they are contaminated by substances other than asbestos (i.e. metals/pesticides etc) is not the subject of this report, the management of dust which may contain these substances is. As such, the soil assessment criteria and analytical results relevant to these contaminants are included within this report. Further detail on soil remediation strategies is presented in the report *Site Contamination Investigation Remediation and Validation Management Plan* (Coffey Environments, 2009).

The relatively stringent Ecological Investigation Levels (EILs) presented in *Assessment Levels for Soil, Sediment and Water* (DoE, 2003) were applied to the site due to the shallow depth of the groundwater table and the proximity of the site to the Canning River.

### 2.3.2.3 Soil Analytical Results

The results of the laboratory analyses are tabulated in Appendix F of the *Detailed Soil & Groundwater Investigations* (ATA, 2003b). Comparison of the results to the EIL criteria indicates that only limited soil contamination was identified, comprising samples which exceed the criteria for metals (12 samples) or equal the criteria for organochlorine (OC) pesticides (one sample). Of 289 samples analysed for asbestos, fibres were only detected in four samples from the upper soil profile. It is considered likely that the identified asbestos fibres are derived from the weathering and disintegration of asbestos cement products which were previously identified during geotechnical investigations of the areas of uncontrolled fill. Test pit logs included in Appendix D of the *Detailed Soil and Groundwater Investigations* (ATA, 2003b), indicate that material potentially containing asbestos was visually identified at several locations across the site. These locations are identified in Figure 5.

The samples which exceed the assessment criteria are summarised in Table 1, and are identified on Figure 5.

**TABLE 1**  
**SAMPLES WITH ANALYTE CONCENTRATIONS ABOVE EILs**

Sample Location and Depth Interval		Soil Description	Contaminant	Concentration (mg/kg)	EIL (mg/kg)
TP34	0.3m	Uncontrolled Fill	Asbestos chrysotile	Detected	NA
TP39	0.5m	Sand	Asbestos chrysotile	Detected	NA
TP46	0.5m	Uncontrolled Fill	Zinc	610	200
TP48	0.2m	Uncontrolled Fill	Lead	460	300
TP55	0.5m	Uncontrolled Fill	Arsenic	22	20
TP56	0.5m	Sand	Cadmium	9.4	3
TP60	0.5m	Uncontrolled Fill	Zinc	230	200

**TABLE 1**  
**SAMPLES WITH ANALYTE CONCENTRATIONS ABOVE EILs**

Sample Location and Depth Interval	Soil Description	Contaminant	Concentration (mg/kg)	EIL (mg/kg)
TP73 0.5m	Uncontrolled Fill	Asbestos chrysotile and crocidolite	Detected	NA
		Zinc	380	200
TP75 1.0m Dup	Uncontrolled Fill	Dieldrin	0.2	0.2
TP76 0.2m	Uncontrolled Fill	Asbestos chrysotile	Detected	NA
TP90 1.5m	Mottled sandy clay	Chromium	50	50
TP113 0.5m	Mottled sandy clay	Chromium	51	50
TP120 0.5m	Uncontrolled Fill	Zinc	200	200
TP121 0.5m	Uncontrolled Fill	Zinc	620	200
TP139 1.5m	Mottled sandy clay	Chromium	50	50

The samples which exceed the action criteria generally comprise uncontrolled fill (comprising sand with obvious rubble). One sample (TP48/0.2m) contained a lead concentration of 480mg/kg which exceeds both EIL and HIL 'A' criteria. This sample was located in uncontrolled fill which will be excavated and disposed of off-site. The *Site Contamination Investigation, Remediation and Validation Management Plan* (Coffey Environments, 2009) details how this area will be managed.

There are three locations where chromium is found at or marginally above the EIL of 50mg/kg in undisturbed soil comprising mottled sandy clay (locations TP90, TP113, and TP139 Figure 5). It is considered that the slightly elevated chromium concentrations at these three locations are a result of naturally occurring concentrations in Guildford Formation soils, as there is no evidence of anthropogenic contamination at the depths where these samples were encountered and no chromium contamination was identified in uncontrolled fill at the site. Accordingly, it is considered that this material does not require remediation.

### 2.3.3 Delineation of Uncontrolled Fill

The density of sampling performed by ATA Environmental allowed the identification of uncontrolled fill across the site to be further refined from Coffey's previous investigations. This is reflected in Figure 5 which delineates the areas of uncontrolled fill across the site.

#### **2.3.4 Soil Contamination**

The results summarised above indicate that samples at locations TP34, 39, 46, 48, 55, 56, 60, 73, 75, 76, 120, and 121 exceed the assessment criteria, and soil remediation is therefore required (Figure 5) (refer to Coffey Environments, 2009a) for specific management procedures regarding site contamination, validation and remediation strategy. Chrysotile and/or crocidolite asbestos was confirmed to be present in the uncontrolled fill material at sampling location and depth intervals TP34 0.3m, TP39 0.5m, TP73 0.5m and TP76 0.2m (Figure 5). The scattered nature of the asbestos found suggests that the fibres have been released from the fragments of asbestos cement sheeting present in the uncontrolled fill (ATA, 2004a; Coffey, 2000). Most of the areas of contamination identified require excavation for geotechnical reasons, as they fall within areas of uncontrolled fill. It is estimated that the uncontrolled fill covers approximately 2ha of the site and varies in thickness between 0.1m and 1.5m (ATA, 2003b).

In order to minimise potential environmental and health risks associated with fugitive dust emissions during civil works, the stringent excavation and dust management strategies outlined in Section 5 will be implemented.

#### **2.3.5 Summary of Asbestos Contamination**

In summary, asbestos has been detected within soil samples taken from uncontrolled fill areas as delineated in Figure 5. Of the 289 samples analysed for asbestos during the 2003 sampling (ATA, 2003b), fibres were only detected in four samples from the upper soil profile. Specifically chrysotile and/or crocidolite asbestos were confirmed to be present at sampling locations TP34, TP39, TP73 and TP76 (ATA 2003b). Visual observations during the 2003 detailed soil investigation indicate that asbestos cement sheeting fragments are scattered throughout the areas of uncontrolled fill (Figure 5).

Analysis of a section of cement piping collected from test pit CTP10 confirmed that chrysotile and amosite asbestos were the major constituents.

The data collected from these investigations suggests that asbestos is limited to isolated areas of uncontrolled fill which contain asbestos cement sheeting and/or cement piping.

### 3 CONCEPTUAL SITE MODEL

#### 3.1 Introduction

As per DEC (2006), a Conceptual Site Model (CSM) describes the pathways by which exposure to potential contamination at a site may occur. For exposure to occur, a complete pathway must exist between the source of contamination and the receptor (i.e. the person or ecosystem components potentially affected by the contamination). Where the exposure pathway is incomplete, exposure cannot occur, leaving no risk present via that pathway. The potential for components of the CSM to change over time should be considered as part of the risk assessment and risk management.

It is noted that Commitment number 6 in Schedule 2 of Ministerial Statement No. 692 requires a determination of the nature and extent of any soil or groundwater contamination present within the site which may pose a risk to human health or the environment.

The following sections review the contaminants of potential concern found in soil and groundwater on-site, the possible sources, receptors and exposure pathways that may pose a risk to human health or the environment prior to, and during, any remedial works on the site. Figures 7A and 7B provide a schematic of the CSM under current conditions and under future land uses.

#### 3.2 Contaminants of Potential Concern (COPCs)

Previous investigations at the site have found contaminants in soil and groundwater at concentrations equal to, or in exceedance of, relevant assessment criteria. Contaminant levels in soil were screened against Ecological Investigation Levels (EILs) presented in *Assessment Levels for Soil, Sediment and Water* (DoE, 2003). COPCs in exceedance of the screening criteria were found across various parts of the site, and include several metals (arsenic, cadmium, chromium, lead, and zinc), pesticides (dieldrin, DDE), and chrysotile and/or crocidolite asbestos. These COPCs have been found primarily in upper soil layers and areas of uncontrolled fill.

Groundwater on-site naturally flows towards the south and slightly south-south-westerly (ATA, 2003). Due to the groundwater flow direction and the proximity to the Canning River, groundwater monitoring results were screened using the Fresh Waters assessment criteria for Aquatic Ecosystems (using Lowland Rivers values where available) specified in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC & ARMCANZ, 2000). Where no Fresh Waters guidelines existed (e.g. ammonia-N, NO<sub>x</sub>-N, total nitrogen, total phosphorus), monitoring results were screened using Drinking Water Guidelines specified in *Australian Drinking Water Guidelines* (NHMRC & ARMCANZ, 1996). COPCs which exceeded the criteria in groundwater at various locations on the site, in one or more rounds of monitoring between 2001 and 2006, include several metals (aluminium, arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc), naphthalene, pesticides (DDE, dieldrin), TPH (C<sub>15-28</sub>), and various nutrients (total phosphorus, ammonia-N, NO<sub>x</sub>-N, total nitrogen, chloride, sulphate).

#### 3.3 Sources

Based on previous investigations, several potential sources of COPCs in the soil and groundwater have been identified. These sources are summarised in Table 2.

**TABLE 2**  
**CONTAMINANT SOURCES AND AREAS OF POTENTIAL CONCERN**

Source	Area of Concern	COPCs
<b>Off-Site Sources</b>		
Former and current land uses (e.g. residential septic tanks)	Up-gradient (north of the site)	Heavy metals (Al, As, Cr, Cu, Hg, Ni, Zn), TPH, pesticides (DDE), various nutrients (total phosphorus, total nitrogen, NH <sub>3</sub> -N, chloride, sulphate, NO <sub>x</sub> -N) (groundwater)
Surface drainage piped into wetland	Up-gradient (north and south-east of the site)	Various nutrients (total nitrogen, total phosphorus), aluminium, dieldrin (surface water)
Former landfill site	Cross and slightly up-gradient (south-east boundary of the site)	Heavy metals (Cd, Cr, Cu, Ni, Pb, Zn), naphthalene, dieldrin, various nutrients (total nitrogen, total phosphorus, NH <sub>3</sub> -N, chloride, sulphate, NO <sub>x</sub> -N) (groundwater); heavy metals (Cr) (soil)
<b>On-Site Non-Point Sources</b>		
Components of naturally occurring Guildford Formation soils	Various	Chromium (soil)
Naturally occurring acid sulphate soils	Various areas on-site, particularly surrounding wetland	Potential for increased acidity to surrounding soil and groundwater
<b>On-Site Point Sources</b>		
Fill material	Historical placement of fill materials across the site	Asbestos, heavy metals (As, Cd, Pb, Zn), organochlorine pesticides (dieldrin)
Former market garden	Land use as community market garden (north-east corner)	Various nutrients (total nitrogen, total phosphorus, ammonia-N, NO <sub>x</sub> -N), pesticide (DDE) and heavy metals (As, Cu, Hg, Ni, Zn) in groundwater; COPCs did not exceed criteria in soil
Proposed temporary abstraction well	North-eastern corner of the site	Heavy metals (Al, As, Cr, Cu, Ni, Zn), various nutrients (total phosphorus, ammonia-N, NO <sub>x</sub> -N), pesticide (DDE) in groundwater

### **3.3.1 Off-Site Sources**

Impacted groundwater entering the site may be a result of the current and former land uses of the surrounding properties. Elevated nutrients and heavy metals in groundwater entering the site across the northern boundary are likely a result of residential septic tanks or other off-site sources. TPH, detected in a single sample along the northern boundary of the site is suspected to originate from an off-site source in the near vicinity of the site (Coffey Environments, 2008a). Surface drainage from external catchments to the north (across Manning Road) and south-east of the site (across Centenary Avenue) discharge into the wetland via drainage pipes, creating another potential off-site source of contaminants. Elevated nutrient levels in groundwater measured along the south-eastern border of the site are likely to be associated with the former municipal landfill site.

### **3.3.2 On-Site Sources**

Areas of concern on-site include various areas of uncontrolled fill, historically brought on-site to even out the surface of the land in certain areas. These regions of uncontrolled fill are a source of asbestos and various heavy metals. Chromium detected at elevated levels in soil at various areas on-site may be attributed to the naturally occurring Guildford Formation in the area; however, chromium-impacted soil along the south-eastern border of the site is suspected to be a result of the adjacent former landfill. The former market garden area (north-east corner of the site) is a potential source of COPCs due to historical activities related to the community garden. Finally, acid sulphate soils occur naturally on the site and are a potential source of increased acidity and elevated metals in the soil at various areas on-site, particularly surrounding the wetland area.

## **3.4 Release Mechanisms**

Movement or behaviour of the COPCs within the environment depends on the physio-chemical characteristics of the contaminants and of the media in which the COPCs are present. Physical and chemical characteristics of surrounding media may also contribute to the transport of COPCs on- and off-site. The following potential contaminant transport or release mechanisms were identified:

- vertical migration of COPCs through dissolution in rainwater and infiltration to the subsurface and groundwater;
- lateral migration of COPCs in groundwater along the down-gradient flow path, into the wetland, and the Canning River;
- dispersion of COPCs in groundwater via abstraction from superficial aquifer for use in on-site irrigation and dust suppression;
- volatilisation of COPCs in soil or open water (i.e. wetland); and
- atmospheric transport of dust and asbestos fibres via wind currents.

## **3.5 Human Health**

### **3.5.1 Receptors of Concern**

Receptors are defined as persons, structures, and utilities, which are, or may be, adversely affected by COPCs. Investigations at the site indicate that previous facilities at the site, including a market garden and sports oval, are no longer in use. The site is considered private property (excluding the foreshore

reserve area). An access track is located along the western boundary of the site and the wetland comprises the central part of the site. Potential receptors located on the site, near or down hydraulic gradient from the site, with potential for exposure, either directly or indirectly are as follows:

- On-site recreational visitor (on access track);
- On-site maintenance workers (during remediation and redevelopment);
- Off-site recreational visitor (on foreshore);
- Off-site residents/students;
- Off-site recreational swimmer; and
- Off-site recreational angler/fisherman.

### 3.5.2 Exposure Pathways

An exposure pathway is a means by which an ecosystem, human population or individual (receptor) may be exposed to site-derived contaminants. Human exposure to chemicals in the environment can occur by inhalation, ingestion or dermal contact. Exposure pathways are natural and/or man-made and are based on a review of the site geology, hydrogeology, infrastructure and land use.

If a source, a transport mechanism (pathway) and a receptor are all present, then a complete exposure pathway exists. An evaluation of the potential exposure pathways previous to, and during, the site remedial works are presented in Tables 3 and 4.

A schematic of the conceptual site model is included as Figure 7A presenting a general overview of the reported and observed impacts. Further discussion of on- and off-site impacts are presented in Sections 3.5.3 and 3.5.4.

**TABLE 3**  
**EXPOSURE PATHWAY EVALUATION - SOIL**

Exposure Pathway				Receptors	Potential for Complete Pathway <sup>1</sup>
Source	Release Mechanism	Exposure Point	Exposure Route		
Fill Material	Wind blown dust (asbestos fibres) during remediation works on-site	Outdoor air	<input checked="" type="checkbox"/> Inhalation	<input checked="" type="checkbox"/> Recreational visitor	✓
			<input type="checkbox"/> Dermal	<input checked="" type="checkbox"/> Maintenance worker	✓
				<input checked="" type="checkbox"/> Off-site visitor	✓
			<input type="checkbox"/> Ingestion	<input checked="" type="checkbox"/> Off-site residents	✓
				<input type="checkbox"/> Off-site swimmer	✗
				<input type="checkbox"/> Off-site angler	✗

**TABLE 3**  
**EXPOSURE PATHWAY EVALUATION - SOIL**

Exposure Pathway				Receptors	Potential for Complete Pathway <sup>1</sup>
Source	Release Mechanism	Exposure Point	Exposure Route		
	Soil and fill material exposed and transported during remedial works	Direct contact	<input type="checkbox"/> Inhalation	<input type="checkbox"/> Recreational visitor	<b>x</b>
			<input checked="" type="checkbox"/> Dermal	<input checked="" type="checkbox"/> Maintenance worker	<b>✓</b>
			<input type="checkbox"/> Ingestion	<input type="checkbox"/> Off-site visitor	<b>x</b>
				<input type="checkbox"/> Off-site residents	<b>x</b>
				<input type="checkbox"/> Off-site swimmer	<b>x</b>
				<input type="checkbox"/> Off-site angler	<b>x</b>
Guildford Formation soils	Naturally occurring metals at depth	Direct contact	<input type="checkbox"/> Inhalation	<input type="checkbox"/> Recreational visitor	<b>x</b>
			<input checked="" type="checkbox"/> Dermal	<input checked="" type="checkbox"/> Maintenance worker	<b>✓</b>
			<input checked="" type="checkbox"/> Ingestion	<input type="checkbox"/> Off-site visitor	<b>x</b>
				<input type="checkbox"/> Off-site residents	<b>x</b>
				<input type="checkbox"/> Off-site swimmer	<b>x</b>
				<input type="checkbox"/> Off-site angler	<b>x</b>
Acid Sulphate soils	Disturbance during remedial works	Direct and indirect contact	<input type="checkbox"/> Inhalation	<input checked="" type="checkbox"/> Recreational visitor	<b>✓</b>
			<input checked="" type="checkbox"/> Dermal	<input checked="" type="checkbox"/> Maintenance worker	<b>✓</b>
			<input checked="" type="checkbox"/> Ingestion	<input checked="" type="checkbox"/> Off-site visitor	<b>✓</b>
				<input type="checkbox"/> Off-site residents	<b>x</b>
				<input checked="" type="checkbox"/> Off-site swimmer	<b>✓</b>
				<input checked="" type="checkbox"/> Off-site angler	<b>✓</b>

**TABLE 3**  
**EXPOSURE PATHWAY EVALUATION - SOIL**

Exposure Pathway				Receptors	Potential for Complete Pathway <sup>1</sup>
Source	Release Mechanism	Exposure Point	Exposure Route		
Former landfill	Migration (leaching) onto site	Direct contact	<input type="checkbox"/> Inhalation	<input checked="" type="checkbox"/> Recreational visitor	✓
			<input checked="" type="checkbox"/> Dermal	<input checked="" type="checkbox"/> Maintenance worker	✓
			<input checked="" type="checkbox"/> Ingestion	<input type="checkbox"/> Off-site visitor	✗
				<input type="checkbox"/> Off-site residents	✗
				<input checked="" type="checkbox"/> Off-site swimmer	✓
				<input checked="" type="checkbox"/> Off-site angler	✓

<sup>1</sup> Includes both current and potential pathways encountered during remedial works at the site. Refer to Sections 3.5.3 and 3.5.4 for a discussion of the complete and excluded exposure pathways.

**TABLE 4**  
**EXPOSURE PATHWAY EVALUATION - GROUNDWATER**

Exposure Pathway				Receptors	Potential for Complete Pathway <sup>1</sup>
Source	Release Mechanism	Exposure Point	Exposure Route		
Off-site groundwater and stormwater (entering site across northern site boundary)	Off-site groundwater following natural flow direction towards Canning River; stormwater drainage into wetland	Direct and indirect contact	<input type="checkbox"/> Inhalation	<input checked="" type="checkbox"/> Recreational visitor	✓
			<input checked="" type="checkbox"/> Dermal	<input checked="" type="checkbox"/> Maintenance worker	✓
			<input checked="" type="checkbox"/> Ingestion	<input checked="" type="checkbox"/> Off-site visitor	✓
				<input type="checkbox"/> Off-site residents	✗
				<input checked="" type="checkbox"/> Off-site swimmer	✓
				<input checked="" type="checkbox"/> Off-site angler	✓

**TABLE 4**  
**EXPOSURE PATHWAY EVALUATION - GROUNDWATER**

Exposure Pathway				Receptors	Potential for Complete Pathway <sup>1</sup>
Source	Release Mechanism	Exposure Point	Exposure Route		
Former Landfill site	Vertical migration or leaching into groundwater; following natural flow direction towards Canning River	Direct and indirect contact	<input type="checkbox"/> Inhalation	<input type="checkbox"/> Recreational visitor	✖
			<input checked="" type="checkbox"/> Dermal	<input checked="" type="checkbox"/> Maintenance worker	✓
				<input type="checkbox"/> Off-site visitor	✖
			<input checked="" type="checkbox"/> Ingestion	<input type="checkbox"/> Off-site residents	✖
				<input checked="" type="checkbox"/> Off-site swimmer	✓
				<input checked="" type="checkbox"/> Off-site angler	✓
Temporary abstraction well (north-east corner of the site)	Abstracted groundwater used for land and garden irrigation and dust suppression	Direct and indirect contact	<input checked="" type="checkbox"/> Inhalation	<input checked="" type="checkbox"/> Recreational visitor	✓
			<input checked="" type="checkbox"/> Dermal	<input checked="" type="checkbox"/> Maintenance worker	✓
				<input type="checkbox"/> Off-site visitor	✖
			<input type="checkbox"/> Ingestion	<input type="checkbox"/> Off-site residents	✖
				<input type="checkbox"/> Off-site swimmer	✖
				<input type="checkbox"/> Off-site angler	✖
Acid Sulphate soils	Disturbance during remedial works causing leaching to wetland and Canning River	Direct and indirect contact	<input type="checkbox"/> Inhalation	<input checked="" type="checkbox"/> Recreational visitor	✓
			<input checked="" type="checkbox"/> Dermal	<input checked="" type="checkbox"/> Maintenance worker	✓
				<input checked="" type="checkbox"/> Off-site visitor	✓
			<input checked="" type="checkbox"/> Ingestion	<input type="checkbox"/> Off-site residents	✖
				<input checked="" type="checkbox"/> Off-site swimmer	✓
				<input checked="" type="checkbox"/> Off-site angler	✓

**TABLE 4**  
**EXPOSURE PATHWAY EVALUATION - GROUNDWATER**

Exposure Pathway				Receptors	Potential for Complete Pathway <sup>1</sup>
Source	Release Mechanism	Exposure Point	Exposure Route		
Former market garden	Vertical and lateral migration of groundwater from this area	Direct and indirect contact	<input type="checkbox"/> Inhalation	<input checked="" type="checkbox"/> Recreational visitor	✓
			<input checked="" type="checkbox"/> Dermal	<input checked="" type="checkbox"/> Maintenance worker	✓
				<input checked="" type="checkbox"/> Off-site visitor	✓
			<input checked="" type="checkbox"/> Ingestion	<input type="checkbox"/> Off-site residents	✗
				<input checked="" type="checkbox"/> Off-site swimmer	✓
				<input checked="" type="checkbox"/> Off-site angler	✓

<sup>1</sup> Includes both current and potential pathways encountered during remedial works at the site. Refer to Sections 3.5.3 and 3.5.4 for a discussion of the complete and excluded exposure pathways.

### 3.5.3 On-Site Impacts

An evaluation of the potential exposure pathways (Tables 3 and 4) suggests complete pathways may presently exist, or be created during proposed remedial works for on-site visitors and remediation workers exposed to soil or groundwater.

Chrysotile and/or crocidolite asbestos in uncontrolled fill at various locations on the site do not pose a health risk when left undisturbed. Asbestos material is not expected to migrate on- or off-site in its current state; however, remedial works at the site, including the proposed removal of the uncontrolled fill, may work to release dust and asbestos fibres into the air, which then may be carried by off-site by wind currents. Inhalation of the disturbed dust and asbestos fibres may pose a health risk to on-site maintenance workers and users of the access track on-site, as well as residents and students off-site.

Maintenance workers may also be exposed to COPCs via dermal contact with both the soil and groundwater on-site, as a result of excavation and removal of the geotechnically unsuitable fill material and surficial soils.

Chromium detected at concentrations equal to or slightly greater than the EIL (50mg/kg) in mottled sandy clay at various locations on the site is considered to be a result of the naturally occurring concentrations in Guildford Formation soils. As there is no evidence of anthropogenic contamination at the depths where these samples were encountered and no chromium contamination was identified in uncontrolled fill at the site. Given the depth at which the samples were detected (0.5m to 1.5m) and the natural properties of the clays, chromium is not expected to impact human health on-site.

A temporary groundwater abstraction well is scheduled for construction on the north-east corner of the site. Abstracted groundwater is intended for use as irrigation water for the lawns and gardens of the

proposed residential development, as well as for dust suppression during redevelopment of the site. Groundwater abstracted from the superficial aquifer will be filtered and treated before use and is not expected to adversely impact human health.

Disturbance of acid sulphate soils on-site have the potential to cause impacts to human health through the release of acidity into the surrounding environment. In order to manage and minimise the generation and release of acidity, an Acid Sulphate Soils Management Plan has been devised and will be followed during all remedial works and development at the site.

#### **3.5.4 Off-Site Impacts**

Groundwater and surface water sampled up hydraulic gradient of the wetland and along the outlet drain to the Canning River showed lower concentrations of aluminium, dieldrin and several nutrients (total nitrogen and total phosphorous) than the water from the outlet drain. This is considered to be a result of elements being absorbed in the sediment and plant matter of the wetland or potentially a result of significant dilution effects within the wetland system.

Bores located slightly down-gradient of the former landfill area had elevated results for nutrients, arsenic and zinc. Due to the topography at the boundary of the former landfill site to the south-east, it is possible that run-off from the former landfill may flow in a north-westerly direction, and possibly introduce some component of north-westerly groundwater flow in this area of the site due to the porous nature of the Bassendean Sand.

Saline ingression is expected to impact the migration and dilution of COPCs in groundwater. Due to the proximity of the superficial groundwater system to the Canning River, it is expected to be in hydraulic conductivity with the tidal fluctuations occurring in the river. Based on the direction of groundwater flow, and as a result of the absorption and dilution effects of the wetland, and the expected dilution of groundwater discharged into the Canning River, COPCs in the groundwater on-site are not expected to adversely impact any off-site receptors.

### **3.6 Ecological**

#### **3.6.1 Receptors of Concern**

Ecological receptors are defined as plants, animals, fungi or biota supporting ecological processes associated with a defined area, which are considered to be of significant societal relevance, ecological or economic significance, and are, or may be, adversely affected by COPCs.

Based on investigations at the site, the main habitats are considered to be the wetland, dominated by Bulrush and other sedges and occupying one third of the site, grassland surrounding the wetland and the Canning River including the adjoining foreshore (ATA, 2001).

The kidney-shaped wetland is assigned a management category of Resource Enhancement and is an Estuary-Peripheral wetland. Resource Enhancement wetlands are defined as wetlands that have been partially modified but still support substantial ecological attributes and functions (Hill et al, 1996).

Historically, the wetland was used as a water supply for irrigation and water consumption on-site. More recent investigations at the site indicate the natural wetland environment has been modified over time and does not provide a diverse natural environment. Currently, the wetland does not provide any recreational function, and no evidence exists suggesting it is used as a site for scientific or educational resource purposes. The wetland does not appear to serve many significant functions other than as part

of a drainage system to the Canning River, in which the presence of reeds contributes to maintaining water quality within the wetland and discharge to Canning River (ATA, 2001a).

There is no open water in the wetland area and the absence of native vegetation around the wetland has enabled weed species to become established. Several native and non-native flora species were identified at the site; however, no Declared Rare or Priority flora species were recorded during flora surveys. The wetland vegetation and its immediate surrounds are of variable condition ranging from Completely Degraded to Very Good. Large areas are mapped as Completely Degraded or Degraded to Good due to the absence of native species and the dominance of introduced species (ATA, 2001a). No native mammals were observed on-site.

Based on previous environmental surveys and the current conditions of the wetland and Canning River, the following lists potential ecological receptors to consider:

- Frogs (various species);
- Reptiles (snakes, lizards, long-necked tortoises);
- Waterbirds (three species);
- Black Swans;
- Southern Brown Bandicoot; and
- Riparian vegetation.

### **3.6.2 Exposure Pathways**

An exposure pathway is a means by which an ecosystem, human population or individual (receptor) may be exposed to site-derived contaminants. Exposure pathways are natural and/or man-made and are based on a review of the site geology, hydrogeology, infrastructure and land use.

If a source, a transport mechanism (pathway) and a receptor are all present, then a complete exposure pathway exists. An evaluation of the potential exposure pathways previous to, and during, the site remedial works are presented in Table 5.

**TABLE 5**  
**ECOLOGICAL EXPOSURE PATHWAY EVALUATION**

Exposure Pathway			Receptors	Potential for Complete Pathway <sup>1</sup>
Source	Release Mechanism	Exposure Point		
Off-site groundwater and stormwater (entering site across northern and south-eastern site boundary)	Groundwater following natural flow direction towards Canning River; stormwater drainage into wetland	Surface water and sediment in wetland and Canning River	<input checked="" type="checkbox"/> Frogs	✓
			<input checked="" type="checkbox"/> Reptiles	✓
			<input checked="" type="checkbox"/> Waterbirds	✓
			<input checked="" type="checkbox"/> Black Swans	✓
			<input checked="" type="checkbox"/> Southern Bandicoot	✓
			<input checked="" type="checkbox"/> Riparian vegetation	✓
Former Landfill site	Vertical migration or leaching into groundwater; following natural flow direction towards Canning River	Surface water in Canning River	<input checked="" type="checkbox"/> Frogs	✓
			<input checked="" type="checkbox"/> Reptiles	✓
			<input checked="" type="checkbox"/> Waterbirds	✓
			<input checked="" type="checkbox"/> Black Swans	✓
			<input checked="" type="checkbox"/> Southern Bandicoot	✓
			<input checked="" type="checkbox"/> Riparian vegetation	✓
Temporary abstraction well (north-east corner of the site)	Abstracted groundwater used for land and garden irrigation and dust suppression	Infiltration to groundwater entering the wetland and the Canning River	<input checked="" type="checkbox"/> Frogs	✓
			<input checked="" type="checkbox"/> Reptiles	✓
			<input checked="" type="checkbox"/> Waterbirds	✓
			<input checked="" type="checkbox"/> Black Swans	✓
			<input checked="" type="checkbox"/> Southern Bandicoot	✓
			<input checked="" type="checkbox"/> Riparian vegetation	✓

**TABLE 5**  
**ECOLOGICAL EXPOSURE PATHWAY EVALUATION**

Exposure Pathway			Receptors	Potential for Complete Pathway <sup>1</sup>
Source	Release Mechanism	Exposure Point		
Acid Sulphate soils	Disturbance during remedial works causing leaching to wetland and Canning River	Sediment and soils	<input checked="" type="checkbox"/> Frogs	✓
			<input checked="" type="checkbox"/> Reptiles	✓
			<input checked="" type="checkbox"/> Waterbirds	✓
			<input checked="" type="checkbox"/> Black Swans	✓
			<input checked="" type="checkbox"/> Southern Bandicoot	✓
			<input checked="" type="checkbox"/> Riparian vegetation	✓
Former market garden	Vertical and lateral migration of groundwater from this area	Historically impacted soil in region; Surface water in wetland and Canning River	<input checked="" type="checkbox"/> Frogs	✓
			<input checked="" type="checkbox"/> Reptiles	✓
			<input checked="" type="checkbox"/> Waterbirds	✓
			<input checked="" type="checkbox"/> Black Swans	✓
			<input checked="" type="checkbox"/> Southern Bandicoot	✓
			<input checked="" type="checkbox"/> Riparian vegetation	✓
Fill material	Soil and fill material excavation	Surficial soil	<input type="checkbox"/> Frogs	✗
			<input type="checkbox"/> Reptiles	✗
			<input type="checkbox"/> Waterbirds	✗
			<input type="checkbox"/> Black Swans	✗
			<input type="checkbox"/> Southern Bandicoot	✗
			<input type="checkbox"/> Riparian vegetation	✗

**TABLE 5**  
**ECOLOGICAL EXPOSURE PATHWAY EVALUATION**

Exposure Pathway			Receptors	Potential for Complete Pathway <sup>1</sup>
Source	Release Mechanism	Exposure Point		
Guildford Formation soils	Naturally occurring at depth	Subsurface soil	<input type="checkbox"/> Frogs	x
			<input type="checkbox"/> Reptiles	x
			<input type="checkbox"/> Waterbirds	x
			<input type="checkbox"/> Black Swans	x
			<input type="checkbox"/> Southern Bandicoot	x
			<input type="checkbox"/> Riparian vegetation	x

An evaluation of the potential exposure pathways (Table 5) suggests complete pathways may presently exist, or be created during proposed remedial works for ecological receptors.

Groundwater entering the site from the north or south-east may adversely impact ecological receptors reliant on the wetland, the drainage channel or the Canning River as a primary source of food or shelter. The wetland is considered to be a flow through system, with approximately 83% of the total current wetland inflow coming from the superficial aquifer (JDA, 2004). Monitoring of the up hydraulic gradient groundwater (north of the wetland) and surface water along the drainage channel to the Canning River showed lower concentrations of aluminium, dieldrin and several nutrients (total nitrogen and total phosphorous) in the drainage channel. This is considered to be a result of elements being absorbed in the sediment and plant matter of the wetland or potentially a result of significant dilution effects within the wetland system.

Acid sulphate soils have been identified at various locations nearby the wetland and along the drainage channel. Acidity is primarily associated with the black peaty horizons as well as the grey silty sands. Although vulnerability of the groundwater to acidification is considered to be low, disturbance of these areas has the potential to impact ecological receptors (Coffey Environments, 2008a). In order to manage and minimise the generation and release of acidity, an Acid Sulphate Soils Management Plan has been devised and will be followed during all remedial works and development at the site.

Ecological receptors are not expected to be impacted by COPCs in the soil based on the depth and limited migration of COPCs in the soil. Any concentration of contaminant in groundwater that has the potential to reach the Canning River is expected to be diluted to the extent that it does not pose a risk to ecological or environmental health of the river.

### 3.7 Future Land Use

Following remediation, the site is intended for redevelopment as a residential subdivision, Cygnia Cove Estate. Plans for redevelopment include up to 200 residential lots, creation of approximately 8,000m<sup>2</sup> of

public open space, re-designing the wetland and rehabilitation of the foreshore area. The future land uses at the site will be residential and recreational. The residential lots will be on scheme water and walking paths, including a boardwalk, will be constructed in the wetland area.

As the conditions and land uses at the site change, so do the parameters of the CSM. A review of the potential remaining sources, future receptors and possible exposure pathways is presented in the following sections. Figure 7B provides a schematic of the CSM under future land uses.

### 3.7.1 Future Sources and Areas of Concern

Following remediation and redevelopment of the site, previously identified sources and areas of concern may no longer exist. Based on the proposed remediation works and future land uses, an overview of potential sources and areas of concern are presented in Table 6.

**TABLE 6**  
**FUTURE SOURCES AND AREAS OF POTENTIAL CONCERN**

Source	Area of Concern	Impacted Media
<b>Off-Site Sources</b>		
Former and current land uses in surrounding area	Up-gradient (across northern border of the site)	Groundwater
<b>Off-Site Sources</b>		
Former landfill site	Cross and slightly up-gradient (south eastern border)	Groundwater
Surface drainage piped into wetland	Upgradient and slightly cross gradient (northern and eastern borders of the site)	Surface water in wetland, drainage channel, Canning River
<b>On-Site Sources</b>		
Guildford Formation soils	Various areas at depth	Subsurface soil
Temporary abstraction well	North-eastern corner of the site	Groundwater and surficial soil

On-site sources of COPCs will be limited following remediation and redevelopment of the site. Slightly elevated concentrations of chromium detected at depth in Guildford Formation soils are considered to be naturally occurring and are not expected to pose a risk to human health, due to their inaccessibility. The subsurface soils will be beneath the residential lots, or as part of the open public space, are unlikely to be disturbed by future residents or visitors to the site.

Groundwater entering the site from nearby off-site sources may continue to be slightly impacted by nutrients and heavy metals. Although the groundwater is considered to be consistent with typical urban water quality, mitigation activities and site management plans will be implemented in order to minimise

the impact to human health and the environment. The residential development will be on scheme water and due to the limiting size of the residential lots, creation of gardens and lawns is expected to be minimal. Based on the proposed development, residents are unlikely to access bore water on-site.

As per the *Drainage, Nutrient, Irrigation and Water Quality Management Plan* (Coffey Environments, 2008), stormwater drainage entering the site will be directed to detention storage areas and then slowly permitted to flow through the wetland, allowing sedges to naturally filter the water entering the wetland, and subsequently, the Canning River. Stormwater entering the site across the south-eastern boundary will be continually monitored to ensure it is not impacting the wetland or the Canning River.

### 3.7.2 Future Receptors of Concern

As a residential subdivision and public open space, the receptors of concern and the potential exposure pathways on and off-site will be modified. Table 7 presents the potential human receptors and possible complete exposure pathways. Also listed are the relevant site management plans which, once implemented, will work to mitigate or eliminate the risk of exposure to contaminants for humans and the environment on, or near, the site.

**TABLE 7**  
**HUMAN EXPOSURE PATHWAY MANAGEMENT AND ASSESSMENT**

Exposure Pathway			Complete Pathway <sup>1</sup>	Associated Management Plan(s)
Source	Release Mechanism	Potential Receptors		
Off-site groundwater and stormwater (entering site across northern and south-eastern site boundary)	Off-site groundwater following natural flow direction towards Canning River; stormwater drainage into wetland	<input checked="" type="checkbox"/> Subdivision residents	x	» Wetland Management Plan » Drainage, Nutrient, Irrigation and Water Quality Management Plan » Baseline and Groundwater Monitoring and Management Plan
		<input checked="" type="checkbox"/> Recreational visitor	x	
		<input type="checkbox"/> Off-site visitor	x	
		<input type="checkbox"/> Off-site residents	x	
		<input checked="" type="checkbox"/> Off-site swimmer	x	
		<input checked="" type="checkbox"/> Off-site angler	x	

**TABLE 7**  
**HUMAN EXPOSURE PATHWAY MANAGEMENT AND ASSESSMENT**

Exposure Pathway			Complete Pathway <sup>1</sup>	Associated Management Plan(s)
Source	Release Mechanism	Potential Receptors		
Former landfill site	Vertical migration or leaching into groundwater; following natural flow direction towards Canning River	<input checked="" type="checkbox"/> Subdivision residents	x	» Wetland Management Plan  » Drainage, Nutrient, Irrigation and Water Quality Management Plan  » Baseline and Groundwater Monitoring and Management Plan
		<input checked="" type="checkbox"/> Recreational visitor	x	
		<input type="checkbox"/> Off-site visitor	x	
		<input type="checkbox"/> Off-site residents	x	
		<input checked="" type="checkbox"/> Off-site swimmer	x	
		<input checked="" type="checkbox"/> Off-site angler	x	
Temporary abstraction well (north-east corner of the site)	Abstracted groundwater used for land and garden irrigation	<input type="checkbox"/> Subdivision residents	x	» Contaminated Sites Reporting Guideline for Chemicals in Groundwater (DoH, 2006)
		<input type="checkbox"/> Recreational visitor	x	
		<input type="checkbox"/> Off-site visitor	x	
		<input type="checkbox"/> Off-site residents	x	
		<input checked="" type="checkbox"/> Off-site swimmer	x	
		<input checked="" type="checkbox"/> Off-site angler	x	
Guildford Formation soils	Naturally occurring metals (chromium) at depth	<input checked="" type="checkbox"/> Subdivision residents	x	Not applicable
		<input type="checkbox"/> Recreational visitor	x	
		<input type="checkbox"/> Off-site visitor	x	
		<input type="checkbox"/> Off-site residents	x	
		<input type="checkbox"/> Off-site swimmer	x	
		<input type="checkbox"/> Off-site angler	x	

<sup>1</sup> Under final site conditions and land uses, following implementation of management plans and mitigating activities.

Ecological receptors on-site will not change instantly with redevelopment of the site; however, it is anticipated that the functioning of the wetland and the quality of the habitat will improve, leading to increased use and inhabitation by ecological receptors.

### **3.8 Conclusions**

As recommended by the DEC (2006), a conceptual site model is a critical component of the assessment of a contaminated site and should be created in order to identify the sources and receptors with the potential to be adversely impacted by exposure to contaminants at a site.

Contaminant sources and complete exposure pathways for humans and the environment have been identified at the site. Mitigation and management of these potential risks are addressed by a suite of management plans related to the remediation, redevelopment and final land uses.

It should be noted that this conceptual site model aims to satisfy Commitment number 6 in Schedule 2 of Ministerial Statement No. 692 requiring a determination of the nature and extent of any soil or groundwater contamination present within the site which may pose a risk to human health or the environment.

## 4 REMEDIATION OPTIONS

### 4.1 Remediation Hierarchy

The remediation hierarchy adopted by the DEC is based on the approach to remediation and management outlined in the ANZECC/NHMRC Guidelines for the Assessment and Management of Contaminated Sites in Australia and New Zealand (1992) and the EPA Guidance Statement for Remediation Hierarchy for Contaminated Land (No. 17, July 2000).

The ANZECC Guidelines provide a preferred hierarchy of options for site clean-up and/or management which are as follows:

- on-site treatment of the contamination so that it is destroyed and the associated risk is reduced to an acceptable level; and
- off-site treatment of excavated soil, so that the contamination is destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to site.

If the above cannot be implemented then other options that should be considered include:

- removal of contaminated soil to an approved facility, followed, where necessary, by replacement with appropriate material; or
- consolidation and isolation of the soil on-site by containment with a properly designed barrier.

If remediation is likely to cause a greater adverse effect than would occur if left undisturbed then remediation should not proceed. In cases where it is not viable to remediate large quantities of soil with low levels of contamination alternative strategies might need to be considered or developed. The appropriateness of any particular option will vary depending on a range of local factors.

### 4.2 Remediation Option Review

There are a range of different management options and remediation approaches/technologies that are available for contaminated sites. Some of these remediation technologies are proven while others have not yet been successfully implemented, particularly in Australia and/or there is limited local expertise for implementation.

The remedial requirements for the site relate to the presence of asbestos, metals (arsenic, cadmium, lead, zinc) and an organochlorine pesticide (dieldrin) contaminated soils identified within uncontrolled fill. It is noted that the uncontrolled fill material is not suitable to be retained on-site from a geotechnical perspective.

The available soil remediation methods and technologies applicable to ACM from the *Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia* (DoH, 2009) indicated the following potential options as outlined in Table 8 below. These options are also considered applicable to the localised heavy metal and pesticide contamination also identified in soils.

**TABLE 8**  
**COMPARISON OF REMEDIAL OPTIONS**

Management Options	Description
Management in-situ	Management in-situ comprises providing a barrier (a cap) preventing or reducing the contact between site users and the contaminated soil. This SMP needs to ensure the integrity of the cap is maintained and that any work penetrating the cap is undertaken in accordance with adequate health and safety measures and environmental controls.
Treatment on-site	Treatment on-site involves hand picking, tilling or screening the soil for ACM. On-site treatment of metals and dieldrin are not considered feasible owing to the localised occurrence and marginally elevated concentrations recorded.
Excavation and on-site burial	Excavation and on-site burial involves the excavation of fully delineated contaminated areas and re-burial in another section of the site (commonly referred to as on-site encapsulation). An Asbestos and Contamination Management Plan would be required for the containment system.
Excavation and removal off-site	Excavation and removal off-site requires the contaminated soil to be excavated and disposed of at a licensed landfill following waste controls in order to reduce the risk from transport.

A comparison of the options is provided in Table 9 below.

**TABLE 9**  
**ADVANTAGES AND DISADVANTAGES OF REMEDIAL OPTIONS**

Option	Advantages	Disadvantages
Management in-situ	<p>Minimal soil disturbance and therefore minimal dust generation.</p> <p>Less risk from transport of contaminated materials.</p> <p>Minimisation of the amount of sampling necessary.</p> <p>Lower initial costs.</p>	<p>Restrictions on land use and a Memorial on Title (MOT).</p> <p>Restrictions on-site excavations.</p> <p>Requirement for ongoing maintenance of cap.</p> <p>Requirement for ongoing management plan.</p> <p>Level of the site to be raised.</p>

**TABLE 9**  
**ADVANTAGES AND DISADVANTAGES OF REMEDIAL OPTIONS**

Option	Advantages	Disadvantages
Treatment on-site (hand picking, tilling or screening)	<p>No requirement for ongoing management plan.</p> <p>No requirement for ongoing maintenance of cap.</p> <p>A MOT is not required.</p> <p>No further restriction of land use.</p> <p>Minimise the amount of validation sampling required.</p>	<p>Some risk of dust generation.</p> <p>Only applicable where ACM is in surface soils.</p> <p>Only applicable where ACM is well delineated.</p> <p>Only applicable where contamination includes a very small quantity of asbestos free fibres.</p>
Excavation and on-site burial	<p>Less risk from transport of contaminated materials.</p> <p>No contaminated material going to landfill.</p>	<p>Some risk of dust generation.</p> <p>Restrictions on land use and a MOT.</p> <p>Requirement for ongoing maintenance of cap.</p> <p>Requirement for ongoing management plan.</p>
Excavation and removal off-site	<p>No further restriction of land use.</p> <p>Reduced time delay for implementation.</p> <p>No requirement for ongoing management plan.</p> <p>In most cases a MOT is not required.</p> <p>No requirement for ongoing maintenance of cap.</p>	<p>Cost of disposal to landfill.</p> <p>Some risk of dust generation.</p> <p>Some risk from transport of materials.</p> <p>Use of valuable landfill space.</p>

### 4.3 Rationale for Selection of Preferred Remedial Strategy

Insitu management of contaminated soil is not considered a suitable strategy as there would be a requirement to effectively manage the ongoing health risk and the following limitations also apply:

- management difficulties in ensuring long term implementation of the SMP; and
- the site would be identified as 'remediated - restricted use' (asbestos being the contaminant) upon the DEC Contaminated Sites Register indefinitely with property memorials placed upon individual Certificates of Title(s).

It is generally understood that ACM in 'good' condition is generally low risk hazardous material but requires specialised handling and disposal. The excavation and removal of the asbestos and chemical impacted materials to an appropriately licensed landfill facility will address the ongoing risk. In addition, the contamination is located within uncontrolled fill that is deemed unsuitable for retention on-site from a geotechnical perspective. On the basis that suitable management strategies will be implemented, excavation and off-site disposal is considered the most appropriate remedial option for the site.

## 5 MANAGEMENT STRATEGIES

The following text has been written in a manner suitable for use in tender documentation and includes the following terms:

Principal	Trustees of the Christian Brothers in Western Australia Incorporated.
Civil Works Contractor	Civil earthworks contractor appointed by Trustees of the Christian Brothers.
Principal's Environmental Consultant	Environmental consultant appointed by Trustees of the Christian Brothers.
Superintendent	Superintendent appointed by Trustees of the Christian Brothers.

The following management strategy has been developed by Coffey Environments for application at the Cygnia Cove development site. The Civil Works Contractor will be responsible for ensuring that all management measures outlined in the management plan (or as agreed otherwise) are adhered to for the duration of their contract. It should be noted that the contractors operational plan will be subject to review and approval by the Environmental Consultant to ensure that it meets the requirements of the DAMP prior to the commencement of works.

### 5.1 Site Access

The site is bounded to the north by Manning Road, to the east by Centenary Avenue, to the south by foreshore reserve, and to the west by the Clontarf Aboriginal Education and Training College. In order to limit access to the site during site works, fencing will be placed around the perimeter of the site.

### 5.2 Services

A Dial Before You Dig database search was conducted in May 2006 (reference no. 200511-6279). The resulting information has been included in Appendix C. Please note that fibre optic cables were identified within the site near its north-west corner; other infrastructure items appear to be generally adjacent Manning Road and Centenary Avenue.

It is the responsibility of the Civil Works Contractor to ensure that services information is up to date prior to the commencement of earthworks, and to take appropriate actions to ensure that infrastructure is not inadvertently damaged during site works.

### 5.3 Asbestos Management

Asbestos cement products were commonly manufactured in WA from 1921 to 1987. Generally, undisturbed asbestos cement products do not pose a health risk, as the fibres are bound together in a solid cement matrix. However, if the material is damaged or disturbed, fibres may be released into the air, and the potential exists for workers and/or nearby residents to inhale them.

Asbestos is a known carcinogen. A nation-wide ban on all new uses of asbestos and asbestos containing materials came into effect on 31 December 2003 (NOHSC, 2005a). The inhalation of

asbestos fibres can result in bronchial carcinoma, mesothelioma, lung cancers and fibrosis of the lungs (NOHSC, 2005a).

Accordingly, exposure should be prevented. The national exposure standard (NES) of 0.1 fibres/mL should never be exceeded, and control measures should be reassessed whenever air monitoring indicates the 'control level' of 0.01 fibres/mL has been reached (NOHSC, 2005b).

### **5.3.1 Overview**

It is firstly noted that all identified and unidentified uncontrolled fill material across the site is deemed geotechnically unsuitable to be retained on-site and as such will be excavated and removed as waste material. Asbestos fibres have been identified at four localised locations (refer Section 2.3.2.3) within the areas of uncontrolled fill material (see Figure 5 and Figure 6), however, previous geotechnical investigations at the site suggest that asbestos cement products are likely to be distributed throughout the areas of uncontrolled fill as identified on Figure 5 and Figure 6. Consequently, all areas identified as containing uncontrolled fill will be treated as potentially containing asbestos material. In addition, it is acknowledged that there is the potential for asbestos-containing material (such as cement sheeting fragments or cement pipes) to be encountered outside identified areas of uncontrolled fill, during general site works. All asbestos encountered will be excavated and segregated from the remainder of the material and areas will be clearly identified by signage so that it can be managed according to the procedures outlined in the following section.

In order to minimise the potential for the release of asbestos fibres from the exposure and removal of any asbestos containing material encountered, strict compliance will be maintained with the procedures outlined in Section 5 for the possible scenarios i.e. where asbestos fibres have been detected in soil, where uncontrolled fill that is potentially affected by ACM is to be excavated and where discrete quantities of ACM (e.g. sheet or pipe) are unexpectedly encountered.

### **5.3.2 Precautionary Measures**

As a precautionary measure, the following actions will be undertaken:

- The proposed remediation areas (associated with uncontrolled fill, chemicals contaminants and identified asbestos fibres) outlined in Figure 6 will be located and marked prior to the commencement of remediation works at the site, to ensure that contaminated soil, fill and ACM is managed separately from soil excavated as part of general cut to fill requirements;
- Areas with a potential for asbestos (i.e. all areas of uncontrolled fill) will be identified to the Civil Works Contractor;
- Surface soil removal will extend initially 10m from the areas defined as containing uncontrolled fill to account for any variation in the notional boundary of these areas (Figure 6). The remedial excavation will be extended as necessary based on a visual inspection undertaken by the Supervising Engineer and Environmental Consultant;
- Excavations in potential asbestos containing areas will be visually inspected by the Civil Works Contractor and advice sought from the Environmental Supervisor to confirm status and management;
- All workers (including new employees/contractors who commence working on-site following commencement of remedial works) will undergo a site induction that informs them of the dangers of

asbestos, how to recognise asbestos products and the procedures to follow should asbestos products be uncovered. The contractor will also undertake ongoing refreshment and reinforcement of this training at site meetings and toolbox meetings;

- Asbestos fibre monitoring will be conducted in areas of the site which may potentially contain asbestos products (refer Section 6.5); and
- Procedures to minimise dust emissions will be employed (as outlined in Section 5.4).

### **5.3.3 Security, Signs and Barriers**

When asbestos containing materials are being removed, signs and barriers will be erected to warn of the danger and to prevent unauthorised people entering. The asbestos removal working area is to be clearly defined and all barriers and warning signs should remain in place until removal is complete. The location and extent of any access control areas will be agreed in discussion between the Contractor, the Supervising Engineer and the Environmental Consultant and will be established in accordance with NOHSC:2002 (2005) *Code of Practice for the Safe Removal of Asbestos* (2<sup>nd</sup> Ed) guidelines. The extent of controlled areas will be set with the objective of preventing unacceptable exposures to personnel working in other areas of the site while maintaining the operational efficiency of the overall site.

Potential entry points to the asbestos work area should be signposted or labelled in accordance with AS 1319 (1994) *Safety Signs for the Occupational Environment* and NOHSC:2002 (2005).

Any waste bags, skips, or vehicle trays used to store and/or transport potentially asbestos containing material should be appropriately labelled advising handlers of the nature of the contents. Transport of asbestos must be undertaken in accordance with the *Environmental Protection (Controlled Waste) Regulations 2004*.

### **5.3.4 Personal Protective Equipment**

Only personnel with appropriate personal protective equipment (PPE) and training will be allowed to work inside the asbestos work area. The minimum protective equipment worn for personnel will be disposable overalls and a personal air-purifying respirator. The filter type within the respirator should be Class P1 or P2, as stipulated in the *Code of Practice for the Safe Removal of Asbestos* (NOHSC, 2<sup>nd</sup> Edition, 2005a).

### **5.3.5 Strategy for Excavation of Uncontrolled Fill and Areas of Soil Known of Potentially Affected by Asbestos**

Uncontrolled fill covers an area of approximately 17,000m<sup>2</sup>, and varies in thickness from 0.1m to 1.5m. It is proposed to excavate all areas of uncontrolled fill, as this material is not considered geotechnically suitable for the proposed development. All known areas of uncontrolled fill material, chemically contaminated soil and asbestos (as identified on Figures 5 and 6) will be marked out to ensure that the material is managed separately from soil excavated as part of general cut to fill requirements. The approximate extent of uncontrolled fill is presented on Figure 6.

As indicated in section 5.3.1, all known areas of uncontrolled fill are suspected of containing ACM and will be disposed of as asbestos contaminated waste. With respect to remedial excavations associated with uncontrolled fill material, it is proposed to over-excavate 10m laterally beyond the boundary of identified fill material. The remedial excavations will vertically extend 0.30m below the maximum extent of asbestos in that grid/location in accordance with DoH Guidelines (DoH, 2009). The proposed area of

excavation has been based on information contained within previous investigations, however a 10m buffer has been allowed for on the basis that the actual extent of the fill material may deviate slightly. On completion of the remedial excavation to the proposed boundary, the Environmental Consultant and Supervising Engineer will inspect the base and sides of the excavation to verify that all uncontrolled fill and ACM has been removed. The remedial excavation will be extended should any fill material or ACM be identified.

### **5.3.6 Validation Sampling**

The floors and walls of excavations completed for the purpose of asbestos remediation within areas of uncontrolled fill will be validated. This validation will be completed in accordance with the recommendations contained within the DoH Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (May, 2009) and will comprise one sample from each wall per 5m length of strata of interest (or per 1m depth). Floors will be visually inspected and if suspect will be sampled at twice the minimum density outlined in the Department of Environment and Conservation (DEC) Contaminated Sites Management Series<sup>1</sup>.

The Civil Works Contractor will liaise with the Superintendent and/or Principal's Environmental Consultant to arrange for testing of the excavated remediation areas prior to backfilling the excavations. Validation testing will be undertaken by the Principal's Environmental Consultant. The Civil Works Contractor will allow for a period of up to three weeks between notifying the Superintendent and/or Principal's Environmental Consultant and receiving the validation testing results and/or disposal advice, although every endeavour will be made to turn validation results around more quickly. Additional time will be required if initial validation samples fail to meet the criteria. To summarise, validating the remedial works will involve the following:

- Recover samples from remediation excavations;
- Perform analytical testing on validation samples;
- Assess against applicable criteria;
- Remove any soil found to contain contaminant levels above the response levels; and
- Retest or re-validate those locations where contamination is removed.

Remediated areas will be backfilled following written advice from the Superintendent or Principal's Environmental Consultant that the validation testing results are acceptable. Further details are provided in Section 5.3.11.

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<sup>1</sup> Department of Environment and Conservation (DEC) Contaminated Sites Management Series, Government of Western Australia, Perth: Assessment Level for Soil, Sediment and Water (DoE, 2003); Community Consultation (DEC, 2006a); Development of Sampling and Analysis Programs (DEP, 2001); Reporting of Site Assessments (2001); The Use of Risk Assessment in Contaminated Sites Assessment and Management - Guidance on the Overall Approach (DEC, 2006b).

### 5.3.7 Contingency Response

Asbestos fibres in soil have only been positively identified at four locations; however, previous geotechnical investigations at the site suggest that asbestos cement products are distributed throughout the areas of uncontrolled fill (Figure 5 and 6). As such, all areas identified as containing uncontrolled fill will be treated as potential asbestos-containing material. Where asbestos-containing material (such as cement sheeting fragments or cement pipes) is identified in non-uncontrolled fill areas during site works, it will be excavated and segregated from the remainder of the material. Where isolated fragments of asbestos containing material are identified, the asbestos containing material will be handpicked by personnel with an appropriate level of Personal Protective Equipment and placed in suitable heavy duty plastic bags prior to off-site disposal. Where more extensive contamination is observed, the affected soil will be excavated and segregated from the remainder of the uncontrolled fill so that it can be managed appropriately, adhering to the procedures outlined in Sections 5.3.5 and 5.3.6. The soil or fill remaining after removal of the asbestos outside known areas of contamination / uncontrolled can then be handled as though it is not affected by asbestos.

#### 5.3.7.1 Stockpile Contingency Measures

The following contingency measures will be put in place should stockpiling of contaminated soils be required.

- In order to reduce potential impacts of stockpiles on surface water quality, all stockpiles will be placed at least 30m from surface water.
- All stockpiles will be bunded to contain soil or surface run-off. Material used for bunding will be incorporated into the stockpile prior to off-site disposal.
- Any stockpiles of asbestos contaminated soil will be maintained under moist conditions and remain covered with tarpaulins at all times.
- Stockpiled material will be disposed of off-site in accordance with the Landfill Waste Classification and Waste Definitions 1996 (DoE, 2005).
- In order to confirm that all contaminated soil has been removed, validation sampling beneath 'small' stockpiles (<20m<sup>3</sup>) will comprise one composite sample analysed for asbestos. Validation sampling beneath stockpiles of greater volume will be dictated by the footprint area of the stockpile and sampled in accordance with DEC guidelines using systematic grid sampling strategy for asbestos.
- Validation samples from beneath stockpiles will be analysed for asbestos and compared against the nominated validation criteria as outlined in the *Site Contamination Investigation, Remediation and Validation Management Plan* (Coffey Environments, 2009).

### 5.3.8 Procedures for Controlling Exposed Asbestos Products

Where asbestos products such as cement sheeting fragments or piping are visibly encountered during remedial activities and bulk earthworks, the asbestos must be removed in accordance with Worksafe WA and the *Code of Practice for the Safe Removal of Asbestos* (NOHSC, 2<sup>nd</sup> Edition, 2005a). Asbestos containing material will be excavated and segregated from the remainder of the material so that it can be managed appropriately.

The following measures are to be undertaken to prevent the release of asbestos fibres:

1. Where staff identify ACM or suspected ACM, the Site Manager should be immediately informed so that appropriate management controls can be implemented. The Site Manager will be responsible for logging the location where the material was found and the management response that was implemented.
2. All suspected contaminated material should be saturated and maintained in a wet condition prior to disturbance and/or removal. Large volumes of water applied at low pressure minimises the generation of dust from water droplets. If available, a wetting agent should be added to the water as this facilitates more rapid wetting of the asbestos containing material.
3. In no circumstances will high-speed abrasive power or pneumatic tools such as angle grinders, sanders, saws and high speed drills be used in the removal of suspected asbestos containing material. If cement piping suspected to contain asbestos is uncovered, and tools are required to be used for its extraction and removal, low-speed battery powered drills used in conjunction with wet methods for dust control are preferred. All tools are to be decontaminated prior to removal from site.
4. Battery-powered tools should be fitted with a local exhaust ventilation (LEV) dust control hood wherever other dust control methods (e.g. use of wet removal methods) are determined to be unsuitable (NOHSC, 2005a).
5. In the instance of surface soil removal which has been recommended to be conducted in a radius extending 10m from all areas identified as containing uncontrolled fill (Figure 6), the soil will be loaded directly into tip trucks for off-site disposal.
6. Trucks transporting ACM off-site will be covered with well maintained and tight fitting tarpaulins to prevent drying of the soil or dust lift-off from the soil during transport.
7. Any asbestos sheet fragments identified during uncontrolled fill removal or in subsequent works will be placed by hand into heavy duty 200µm (minimum thickness) polythene bags that are no more than 1,200mm and 900mm wide for ease of handling. The bags should be labelled with an appropriate warning, clearly stating that they contain asbestos and that dust creation and inhalation should be avoided. Earthmoving equipment will be operated so as to minimise ground disturbance, dust generation and asbestos breakage. Material will be sprayed with low pressure water as it is loaded into the bags, which in turn should be placed into leak proof containers.
8. A decontamination facility will be provided for personnel in direct contact with asbestos to ensure safe removal of their PPE.
9. Used disposable coveralls and masks are to be removed prior to exiting the site and placed in bags for disposal along with the other asbestos waste.
10. Asbestos fibres in the air will be continuously monitored whilst the areas identified in Figure 6 are being remediated.

### **5.3.9 Asbestos Waste Collection and Disposal**

Uncontrolled waste containing minor quantities or fragments of ACM will be wetted down prior to loading into trucks which will then be covered (e.g. tarpaulins) prior to leaving the site to prevent dust emissions whilst in transit. Trucks will be washed down prior to leaving the site in a designated

washdown area. (Note: any significant quantities of ACM will be handled as described in Section 5.3).

Transport and final disposal of asbestos containing material shall be carried out in accordance with the *Occupational Safety and Health Regulations 1996* and the *Code of Practice for the Management and Control of Asbestos in Workplaces* (NOHSC, 2005b) and the *Environmental Protection (Controlled Waste) Regulations 2004*.

Asbestos containing materials removed from the site will be disposed of to a landfill licensed to accept asbestos waste in accordance with the *Landfill Waste Classifications and Waste Definitions* (DoE, 2005). Under the *Landfill Waste Classifications and Waste Definitions* (DoE, 2005), asbestos containing materials, including cement sheeting and/or fibres is classed as a Type 1 Special Waste.

The responsibilities of the waste producers, transporters and operators of disposal sites are outlined in the *Environmental Protection (Controlled Waste) Regulations 2004*. The transportation and disposal of any waste materials containing asbestos is controlled by the DEC. Under the *Environmental Protection (Controlled Waste) Regulations 2004*, the contractor responsible for transportation of asbestos containing material must be licensed to undertake such activities. Asbestos may only be disposed of at a site approved by the DEC.

Material will only be transported off-site once approval has been provided by the landfill operator, with copies of all tip dockets for material disposed of to landfill to be provided to the Superintendent and/or Principal's Environmental Consultant as per the *Site Contamination Investigation, Remediation and Validation Management Plan* (Coffey Environments, 2009).

### **5.3.10 Decontamination**

Decontamination must include the asbestos work area as identified in Section 5.3, all tools and equipment utilised and personal decontamination. All contaminated materials, including cleaning rags, plastic sheeting and PPE etc, must be disposed of as asbestos waste (NOHSC, 2005a). The following procedures have been written utilising the decontamination procedures outlined in the *Code of Practice for the Safe Removal of Asbestos* (NOHSC, 2<sup>nd</sup> Edition, 2005a).

#### **Tools and Equipment**

At the end of removal work, all tools should be decontaminated in the following manner:

- Decontaminated using wet or dry decontamination methods as outlined in the NOHSC *Code of Practice for the Safe Removal of Asbestos* (2<sup>nd</sup> Edition, 2005a) (i.e. fully dismantled and cleaned under controlled conditions); or
- Placed in sealed containers (and used only for asbestos removal work); or
- Disposed of as asbestos waste.

If tools cannot be decontaminated within the asbestos work area, or are to be re-used on another project, they should be tagged to indicate possible contamination and double bagged in asbestos waste bags before being removed from the asbestos work area.

### **Personal Decontamination**

Personal decontamination must be undertaken each time employees leave the asbestos work area (NOHSC, 2005a). This should occur within the asbestos work area so as to not transport material off-site, but should be located within an area where re-contamination is minimised.

Throughout the asbestos removal process, asbestos contaminated PPE should not be transported outside the asbestos work area except for disposal purposes.

Before work clothes and footwear worn during asbestos work are removed from the work area, they should be thoroughly vacuumed with an asbestos vacuum cleaner to remove any asbestos fibres, and footwear should be wet wiped.

Personal respiratory protective equipment should continue to be worn until all contaminated disposable coveralls and clothing has been vacuumed and/or removed and bagged for disposal; and personal washing completed.

### **Vehicle Decontamination**

To prevent the spread of contaminated material back into remediated areas, a vehicle washdown area will be provided on the exit route from contaminated areas to remove any soil adhering to vehicle tyres and undercarriage. If required, vehicles leaving the contaminated zone will be cleaned by low pressure water sprays and brushing where necessary. Any sediments which accumulate in the washdown area will be considered waste and will be disposed of off-site to landfill after sampling and analyses to determine contaminant levels. Any wastewater from the washing process will either be disposed of off-site in accordance with the *Environmental Protection (Controlled Waste) Regulations 2004* or directed to a lined evaporation dam.

#### **5.3.11 Strategy for Management of Fill**

It will be necessary to backfill areas where contaminated or geotechnically unsuitable soil has been removed (following validation sampling, as required). In addition, it may be necessary to add fill to areas where the existing elevations need to be raised to achieve finished levels. If sufficient suitable material is not available within the site, it will be necessary to import material from off-site.

If material is imported from off-site, it will be the responsibility of the Civil Works Contractor to ensure that the material comprises "clean fill", defined as follows:

'Material that will have no harmful effects on the environment and which consists of rocks or soil arising from the excavation of undisturbed material. For material not from a clean undisturbed excavation, it must be validated to have contaminants below the relevant human health and ecological investigation levels' (as defined in the document *Assessment Levels for Soil, Sediment and Water*, DoE, 2003).

The Principal's Environmental Consultant will undertake one or more of the following steps to confirm that the material is clean fill:

1. Request a letter from the sand supplier stating the source of the material and the quantity supplied;
2. Visually inspect material delivered to the site periodically to assess if it has visual indications suggesting contamination; and
3. Collect a limited number of samples for analysis.

## 5.4 Dust Management

### 5.4.1 Overview

Impacts on air quality as a result of site works are a function of many factors including, but not limited to, the following:

- Time of year, which determines the moisture content of the soil and thus dust emission potential;
- The prevailing weather conditions, particularly temperature and wind speed;
- Magnitude or the size of the earthworks;
- Rate at which the earthworks are undertaken;
- Proximity of residents or sensitive receptors to the works; and
- The effectiveness of dust management controls.

Dust management procedures will vary according to the separate stages of development and the operations being conducted at the time.

Remediation works are expected to be completed over a three to four month period, with the commencement date dependent on the granting of environmental approvals. It is noted however, that the remediation schedule is dependent on the contractors work programme, which will be subject to ongoing review and approval by the Environmental Consultant.

The majority of the site is currently covered with some form of vegetative cover and this will bind the surface of the soil and act to lessen the potential problem of dust for surrounding residences. The nearest residential premises are located approximately 50m to the east of the site along the eastern boundary of Centenary Avenue, with other residences being located approximately 50m to the north-east of Manning Road. Clontarf College is located on the western boundary of the development site. The majority of soil to be remediated is located in the south-west portion of the site and as a result, separation distances between the remediation operations and sensitive land uses is larger than the distances stated above. Nearest residences along Centenary Avenue are in excess of 200m from the remediation area, and residences along Manning Road are greater than 120m from the remediation area.

Bureau of Meteorology (2006) data for the Perth Metro station is considered relevant to the weather patterns experienced at the site and is presented in Appendix E.

Spring and summer are the windiest months of the year in Perth. Additional attention must be given to control of dust generation during these periods, Summer also coincides with higher rates of evaporation, so increased water application over disturbed areas, or reduced earthmoving activities may need to be considered on days where excavated material is drying out quicker than water can be applied.

Seasonal wind patterns indicate that winds in the afternoons (3pm) are dominated by west to south-westerly winds in all seasons, being at their strongest during spring and summer, whilst mornings (9am) are predominantly east to north-easterlies, again at their strongest during the spring and summer months (Appendix E).

Dust may be created during construction due to vehicular movement on unsealed roads and ground disturbing construction activities. As the majority of the disturbed areas of the site will be landscaped and paved following construction, significant dust generation post construction is unlikely.

Dust management will comprise wind fencing, surface stabilisation, and the use of dust suppression in the form of water trucks and sprinklers. Dust suppression binding agents may be used to enhance the dust suppression effectiveness of water sprays.

Windscreens will be constructed as required on the boundaries of earthworks areas where they have an interface with adjacent land users. This may include the Manning Road boundary, Centenary Avenue boundary, and the western boundary which backs onto Clontarf Aboriginal Education and Training College. The wind fences act to reduce wind velocities over areas and thereby reduce dust lift-off. This is particularly important given the proximity to Manning Road, and the need to ensure visibility to road users is maintained. The windscreens will be constructed of shade cloth or Hessian on a 1.8m high security fence. This will also act as a visual screen to the remedial and construction earthworks.

Clean fill imported onto the site will be sufficiently damp to prevent dust emissions during transportation to site and tipping. The moisture content of the fill being brought onto site will be inspected periodically by the Civil Works Contractor and if found to be too dry, it will be wetted down using a water cart.

It is recommended that a Site Classification Assessment Chart (Appendix D) is completed for each stage of development by the Civil Works Contractor. The Site Classification Assessment Chart provides a process for determining a site's potential for dust generation and presents dust management procedures which should be adopted for each Site Classification rating. These procedures are also included within Appendix D.

#### **5.4.2 Earthworks**

Dust control measures will conform with DEP Guidelines (DEP, 1996). This will involve the following measures:

- Earthworks will be undertaken in stages to avoid the creation of large areas of disturbance which represent a source of dust emissions.
- Wind fencing will be used as required as described previously.
- Water carts will be available with a total storage capacity of 10,000L per 7.5ha of disturbed site. This equates to at least three trucks with a total of 30,000L available.
- Watering will be conducted using water trucks and impulse sprinklers may also be considered as required. Watering will be conducted at the following areas.
- Sites undergoing excavations. In areas being remediated, the application of water will be controlled to prevent ponding or run-off occurring.
- Uncovered, short-term stockpiles.
- On all internal access tracks and machinery storage areas.
- Long-term stockpiles or large exposed areas that will remain open for extended periods will be hydro mulched. Hydro mulch or soil stabilisers such as Dust-Tex will also be used as required to stabilise areas that may be emitting excessive dust in strong winds or during extended periods of hot dry weather.

- Regular maintenance checks of dust suppression equipment will be conducted to ensure effective operation.

#### **5.4.3 Internal Access Tracks**

Internal access tracks will be hard surfaced at the earliest possible stage and appropriate speed limits will be imposed to reduce dust generation.

Trucks and roads will be wetted down and fine water sprays will be applied to minimise dust generation in transport areas. Application of a fine water spray will prevent water run-off from occurring in these areas. Water will be applied to the access tracks in the morning prior to each day or activity. Additional water will be applied to the tracks as required throughout the day.

To prevent the spread of contaminated material back into remediated areas, a vehicle washdown area will be provided on the exit route from contaminated areas to remove any soil adhering to vehicle tyres and undercarriage. If required, vehicles leaving the contaminated zone will be cleaned by a low pressure water spray. Any sediments which accumulate in the washdown area will be considered waste and after sampling and analyses to determine contaminant levels will be disposed of off-site to landfill.

#### **5.4.4 Off-Site Transport of Waste**

Waste fill will be disposed of off-site. Any material that is carted off-site will be transported along the major arterial road network, including Manning Road, Canning Highway, the Kwinana Freeway etc.

To prevent the spread of contaminated material onto the public road system, all loads will be below tare, thoroughly wetted, covered with tarpaulins and fitted with tight tailgates. As discussed in Section 5.3.10, a vehicle wash-down area will be provided on the exit route from contaminated areas to remove any soil adhering to vehicle tyres and undercarriage. If required, vehicles leaving the contaminated zone will be cleaned by a low pressure water spray.

The responsibilities of the waste producers, transporters and operators of disposal sites are outlined in the *Environmental Protection (Controlled Waste) Regulations 2004*. The transportation and disposal of any waste materials containing asbestos is controlled by the DEC. Under the *Environmental Protection (Controlled Waste) Regulations 2004*, the contractor responsible for transportation of asbestos containing material must be licensed to undertake such activities. Asbestos will only be disposed of at a site approved by the DEC.

#### **5.4.5 Importation and Placement of Clean Fill**

Clean fill will be imported to the site using the public road system. In order to prevent nuisance dust emissions arising, all fill will be sufficiently damp to prevent dust emissions en route and during tipping. The moisture content of the fill being brought onto site will be inspected periodically by the Civil Works Contractor and if found to be too dry, the cartage firm will be required to wet the fill at the source.

## 6 MONITORING

### 6.1 Overview

At the time of preparation of this DAMP, the detailed design and civil works staging and contract specifications had not yet been finalised. Accordingly, this section details a framework for the development of a site-specific monitoring regime by the Civil Works Contractor.

This section describes the suggested monitoring program and rationale that should apply to ensure that the removal and relocation of the contaminated soil does not result in air quality levels that exceed criteria set for the protection of human health.

Monitoring in relation to asbestos and other contaminants in soil is detailed in the *Site Contamination Investigation, Remediation and Validation Management Plan* (Coffey Environments, 2009), and will primarily involve verification testing to ensure all contaminated soil is removed from site. Copies of all tip dockets for material disposed of to landfill will be provided to the Superintendent and/or the Principal's Environmental Consultant (Coffey Environments, 2009).

Monitoring for airborne particulates will consist of a mixture of permanent monitoring stations measuring a combination of TSP (High Volume Samplers), Asbestos Fibre concentrations, and fine particulates (TEOM or DusTrak) supplemented, as necessary by *ad hoc* use of DusTrak samplers to assess situations where it is considered dust emissions may be impacting off-site. Personal samplers will also be used to monitor air quality within the occupational environment of site workers, particularly where asbestos contaminated material is being handled.

The following subsections provide detail on air quality monitoring:

- Section 6.5 Asbestos Fibres;
- Section 6.6 Total Suspended Particulates (TSP);
- Section 6.7 Fine Particulates (PM<sub>10</sub>);
- Section 6.8 Heavy Metals;
- Section 6.9 Baseline Monitoring; and
- Section 6.10 Visible Nuisance Dust.

Daily visual dust inspections will be conducted at the site boundary by the Civil Works Contractor following the completion of site remedial works.

In designing the particulate monitoring program for the site, the following matters have been considered:

1. The Cygnia Cove development is a major earthworks exercise in an exposed location and has the potential to cause significant dust impacts if strict dust controls are not enforced throughout the bulk earthworks program.
2. Whilst soil contamination is present on the site, the concentrations of contaminants are generally quite low and the volume of soil relatively small in comparison with the overall works program. Thus the monitoring program design is primarily focussed at measuring inert dust levels to ensure that they do not exceed relevant TSP (amenity) criteria and PM<sub>10</sub> (health) criteria.

3. There will be limited use of High Volume samplers during the period when soils contaminated with metals and pesticides are being removed. This data will also be used to correlate PM<sub>10</sub> and TSP readings so that the PM<sub>10</sub> monitors can be used to estimate TSP.
4. The primary monitoring device used on the site will be DusTrak optical scattering instruments which provide an estimate of PM<sub>10</sub> levels.
5. One TEOM continuous monitor will be sited at the permanent measurement station on the northern boundary throughout the remediation phase of the bulk earthworks program. This will be co-located with a DusTrak instrument to provide calibration between the DusTrak results and the actual PM<sub>10</sub> readings from the TEOM monitor. This calibration will be used to interpret data from the other DusTrak monitors on the eastern and western boundaries of the site.
6. TSP measurements will also be taken at this site during the active remediation phase of the project.

The results of monitoring will be reviewed fortnightly by the Environmental Consultant and adjustments made to the monitoring regime if warranted. Any proposal to reduce the monitoring program will only be implemented after discussion with the DEC, Worksafe WA and the Department of Health (DoH).

## **6.2 Dust Management Objectives**

The objective of the dust management program is to manage earthworks to prevent the exposure of remedial workers, employees in nearby workplaces and members of the public in areas outside the site boundary to possibly harmful levels of airborne contaminants.

The purpose of the dust monitoring is to confirm that members of the groups mentioned above are not being exposed to potentially hazardous levels of contaminants.

Given the relatively minor occurrence of contaminated soil at the site, it is not expected that airborne contaminants will attain harmful levels, however, monitoring will be undertaken at all times when active remediation works are being undertaken to ensure the health of workers and others in the vicinity of the site is not compromised.

## **6.3 Air Quality Areas**

The proposed remediation areas identified in Figure 6 will be located and clearly marked prior to the commencement of earthworks at the site, to prevent unprotected personnel coming into contact with contaminated material. The Civil Works Contractor will be responsible for assessing the exposure of employees within the remediation areas and ensuring compliance with occupational legislation and policy. The Civil Works Contractor will also be responsible for controlling access into the remediation areas and ensuring that all necessary PPE is worn.

Air quality outside of the site boundary is considered to be a public area and will be monitored by the Principal's appointed Civil Works Contractor to ensure compliance with standards for the protection of public health. This may include monitoring along the northern, eastern and western site boundaries depending on the nature and scale of civil works at the time, and will be confirmed as part of the Civil Works Contractor's specification.

## 6.4 Siting of Monitoring Stations

Air monitoring stations will, as far as practicable, be situated so that they are representative of the particular location and contaminant being tested for. In accordance with *AS/NZ 3580.1.1:2007 Methods for sampling and analysis of ambient air - Guide to siting air monitoring equipment*, the following considerations will need to be taken into account when locating permanent monitoring sites:

- Avoiding sites with restricted air flows such as near buildings and trees. The minimum clear sky angle for the sampling inlet should be 120 degrees.
- Avoiding sites that may cause physical and chemical interference such as motor vehicle emissions.
- Avoiding sites that may adsorb and absorb contaminants such as trees. Monitoring stations should be located at least 20m from trees and leafy vegetation.
- Locating the monitoring inlet near the human breathing zone, i.e. 1m to 2m above ground level.

To assist with locating short-term monitoring sites, a wind vane and anemometer will be permanently located at the Cygnia Cove development site. Fixed monitoring locations will be located in positions that account for the location of sensitive receptors and will be positioned downwind of the most dominant prevailing winds for that particular season.

Monitoring of public exposure will be undertaken continuously with stations located along the eastern, northern, and/or western boundaries (See Figure 6 for notional locations). The location on the western boundary may not fully comply with *AS/NZ 3580.1.1:2007* because of the number of large buildings and trees present on the Clontarf Aboriginal College site, which may induce major wake effects in the air flow, but it is the nearest area where a substantial number of persons may be impacted by emissions.

The static air monitor located on the western boundary is required to be relocated north of its proposed location (identified on Figure 6) when earthworks are being undertaken within the vicinity of soil sampling location TP34 (Remediation Area 1 - Figure 8). Specific activities and areas of work on a day-by-day basis will determine the actual locations of any monitoring equipment and will be determined by the Civil Works Contractor in discussion with The Christian Brothers, the City of South Perth and the City of Canning.

In addition to the permanent monitoring stations on the boundary of the site, personal air samplers will be used to monitor air quality within the breathing zone of site workers with respect to asbestos fibres.

Table 10 details the preferred monitoring equipment that can be used to assess air quality impacts for the various potential contaminants.

**TABLE 10**  
**AIR MONITORING EQUIPMENT**

Equipment	Parameters
Static Air Samplers	Airborne Asbestos Fibres
Personal Air Samplers	Airborne Asbestos Fibres
Hi-Vol Sampler with TSP fitting	TSP, Heavy Metals
TEOM <sup>1</sup> /Dustrak <sup>2</sup>	Continuous, real time monitoring for PM <sub>10</sub>

<sup>1</sup> TEOM used to calibrate DusTrak data and utilised for compliance monitoring.

<sup>2</sup> DusTrak used as a management measure to trigger reactive dust mitigation measures.

## 6.5 Asbestos Fibres

### 6.5.1 Monitoring Program

Airborne asbestos fibres will be monitored using personal air samplers at a number of locations within the active remediation areas.

The personal air samplers are to be used in consultation with occupational testing procedures and sampling will be undertaken for no less than eight hours during each day of activity. This form of monitoring is known as *exposure monitoring* and involves the taking of regular samples within the breathing zone to determine a person's risk from, or level of exposure to, airborne asbestos fibres. The results of this sampling can then be used to determine compliance with asbestos exposure standards.

In addition, static air samplers will be strategically located on the western, northern and/or eastern boundaries to assess the effectiveness of controls within the working area. This type of sampling is known as *control monitoring* and is often conducted in areas that contain high proportions of non-asbestos fibres or particles.

Asbestos was mostly detected within areas of uncontrolled fill across the site, and then only as a few discrete fibres in soil samples or as asbestos cement sheeting. Although asbestos containing material has not been detected (or rarely detected) at the balance of the site, asbestos air samplers will operate at all times when active remediation works are being undertaken to be conservative.

Once the site has been validated as being free of asbestos, ambient sampling for fugitive asbestos fibres will cease for the remainder of civil works associated with subdivision development.

### 6.5.2 Analytical Method

Asbestos will be measured in accordance with the NOHSC's *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres* (NOHSC, 2006) for the determination of airborne fibres. In the field, a sample of air is collected, with a known volume of air passing through the filter and trapping any asbestos fibres that are present. The filter is treated in order to become transparent, and the respirable fibres are sized and counted in accordance with defined geometric criteria using phase contrast optical microscopic techniques. Particles which conform in dimensions and size to the

conforming criteria are 'counted' as fibres (including non-asbestos fibres). Hence it is possible this method can overestimate the true amount of asbestos present (i.e. err on the side of caution). The result is expressed as fibres per millilitre of air, calculated from the number of fibres observed on a known area of filter and the volume of air sampled, allowing an average concentration of airborne fibres to be determined.

### 6.5.3 Air Quality Standards

The applicable standards for monitoring asbestos are provided in Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres (NOHSC, 2006), the Code of Practice for the Safe Removal of Asbestos (NOHSC, 2005a) and the Occupational Safety and Health Regulations 1996.

The National Exposure Standard (NES) as established by the Australian Safety and Compensation Council (ASCC, formerly the NOHSC), is 01. fibres/mL of air measured using the membrane filter method for all forms of asbestos.

Table 11 below defines suggested 'control levels' of airborne asbestos fibre concentrations which, if exceeded within the filters of the personal air samplers, will instigate a series of actions to rectify the situation.

**TABLE 11**  
**PERSONAL AIR MONITORING ASBESTOS CRITERIA**

Control Level (fibres/mL)	Control/Action (fibres/mL)
<0.01	Continue with control measures
≥0.01	Review control measures
≥0.02	Stop remedial work and find the cause

In terms of protecting public health, the target background level within the three static air samplers will be the NATA collection and detection limit of 0.01 fibres/mL (10 times below the occupational limit). It is proposed that excavation work will cease while dust management procedures are reviewed if this target criteria is exceeded. Table 12 outlines the asbestos fibre air quality criteria for the static air samplers.

**TABLE 12**  
**STATIC AIR MONITOR ASBESTOS CRITERIA**

Target Criteria (fibres/mL)	Work Stoppage Criteria (fibres/mL)
<0.01	0.01

#### **6.5.4 Air Monitors Cycle Duration and Analysis Timeframes**

It is proposed to run the static air monitors on a 7hr cycle (8am-4pm) based on the adjacent schools operational hours with samples then being processed at an appropriately accredited laboratory on a 24hr/next working day turnaround. If for any reason samples fail to reach the laboratory in time, then samples will be analysed on a 48hr/two working day turnaround. The reason for failure to deliver the samples on the day will be required to be reported by the Civil Works Contractor to the Principal and Principal's Environmental Consultant within 24hrs of becoming aware of the event.

### **6.6 Total Suspended Particulates**

#### **6.6.1 Monitoring Program**

Total Suspended Particulates (TSP) dust monitoring is a general measurement for assessing the performance of the dust management program and is primarily directed at assessing impacts on amenity. TSP includes fine particulates (PM<sub>10</sub> and PM<sub>2.5</sub>) and larger particles that are suspended in air as dust. It is anticipated that, with good dust prevention and management measures in place, there may not be the requirement to undertake continuous PM<sub>10</sub> and/or TSP monitoring throughout the civil works program.

TSP monitoring will be undertaken for off-site exposure at the northern site location during the active remediation phase of the bulk earthworks program.

The TSP program will be undertaken for two reasons:

1. Firstly to provide a specific relationship between TSP and PM<sub>10</sub> results to allow the TEOM and DusTrak results to be used to develop conservative estimates of TSP values. It is recognised that this relationship will be affected by factors such as meteorology and the distance between the remediation site and monitoring sites, however the PM<sub>10</sub> measurement is the primary result of concern and the TSP estimate will simply be used to estimate amenity impacts.

To allow this relationship to be developed and used, a TEOM and DusTrak monitor will operate continuously at the northern boundary monitoring location throughout remediation phase of the bulk earthworks program.

2. To provide an estimate of contaminant levels contained in TSP. This will be achieved by analysing the daily filter papers for the following parameters:

- metals (zinc, lead, arsenic, cadmium)

As indicated above, the High Volume Sampler will operate on the northern site throughout the active remediation phase of the project. The results will be assessed fortnightly and used with the results from the TEOM and DusTrak monitors to provide estimates of contaminant concentrations recorded at the other fixed monitoring sites. If these results suggest contaminant concentrations are of concern, then additional High Volume Samplers will be installed at the other monitoring stations.

#### **6.6.2 Analytical Method**

TSP's will be measured at the site boundary using a High Volume (Hi-vol) sampler with TSP fittings as per AS 3580.9.3 (2003) Methods for Sampling and Analysis of Ambient Air - Determination of Suspended Particulate Matter - Total Suspended Particulate Matter (TSP) - High Volume Sampler Gravimetric Method. Information on TSP concentrations in air may also be determined by extrapolating

PM<sub>10</sub> monitoring results from DusTrak or TEOM samplers and adopting an assumed factor to convert PM<sub>10</sub> to TSP concentrations. The National Pollutant Inventory Emission Estimation Technique Manual for Mining (Environment Australia, 2001) presents a range of possible ratios between TSP and PM<sub>10</sub> depending upon the nature of operations and activities where a general estimation is that particulates of size fraction 10 microns and below (PM<sub>10</sub>) generally constitute approximately 35% to 50% of total particulate concentrations. A conservative assumption would therefore be that PM<sub>10</sub> dust measured by the DusTrak samplers from around the Cygnia Cove development site during the monitoring program, constitutes 25% of total suspended particulate concentrations.

### 6.6.3 Assessment Criteria

TSP results will initially be compared to the TSP criteria (Table 13) used in the current *Kwinana Air Quality Environmental Protection Policy* for residential area air quality (DEP, 1999).

**TABLE 13**  
**TSP CRITERIA**

Location	Target Criteria (µg/m <sup>3</sup> )	Work Stoppage (µg/m <sup>3</sup> )
Site Boundary	90 (24 hours average) 750 (15 minute average)	150 (24 hour average) 1,000 (15 minute average)

In view of the low levels of contamination on-site, the 15 minute criteria will only be used in the event that complaints regarding excessive dust emissions are being received, as the measurement of 15 minute average data for TSP requires the use of specialised portable equipment or expensive TEOMs. The continuous PM<sub>10</sub> measurements can act as surrogate 15 minute TSP data in the first instance.

As described in Section 6.6.1, the filter papers digested in a NATA-accredited laboratory and analysed to determine whether there is a need to adjust the TSP or PM<sub>10</sub> criteria adopted as a result of contaminant loads in the particulate matter.

## 6.7 Fine Particulates (PM10)

### 6.7.1 Monitoring Program

Fine particulate (PM<sub>10</sub>) dust monitoring captures the fraction of airborne particulates which represents the greatest potential health issue as it is capable of being respired into the lung.

PM<sub>10</sub> monitoring will be undertaken for off-site exposure at the eastern, northern and/or western boundaries for the duration of remedial works. Monitoring will be with a continuous air sampler (DusTrak) capable of providing alert messages for initiating corrective action.

Results will be assessed against the relevant standards as outlined in Section 6.7.3.

### 6.7.2 Analytical Methods

Particulate monitoring for public exposure will be undertaken using:

- A TEOM (Tapered Element Oscillating Microbalance) analyser in accordance with AS 3580.9.8 (2001) Method for Sampling and Analysis of Ambient Air - Determination of Suspended Particulate Matter - PM(sub)10(/sub) Continuous Direct Mass Method Using a Tapered Element Oscillating Microbalance Analyser; and
- DusTrak Particulate Monitors.

A single TEOM instrument will be located on the northern boundary monitoring station throughout the remediation phase of the bulk earthworks program, with one DusTrak monitor deployed at each of the three permanent monitoring stations. A fourth spare DusTrak unit is to be used by the Site Supervisor to assess local or short-term dust issues.

A visual alarm (rotating light) and an SMS text alert will be connected to the DusTrak monitor's and set up so that an SMS message will be sent to the Civil Works Contractor and Principal's Environmental Consultant if the Corrective Action Response Level is exceeded. The averaging period for results will be set at 10 minutes as this is the monitor default settings.

As indicated in Section 6.1, DusTrak particulate monitors which use an optical light scattering technique will be used to estimate PM<sub>10</sub> levels at other fixed monitoring stations.

### 6.7.3 Assessment Criteria

PM<sub>10</sub> results will be assessed against the *National Environmental Protection Measure (NEPM) for Ambient Air Quality 1998 (as varied)* (NEPC, 2003). This standard represents a longer term goal for ambient air quality that "allows for the adequate protection of human health and well being".

The NEPM specifies an ambient air quality target of 50µg/m<sup>3</sup> for PM<sub>10</sub>. The NEPM criterion is a 24hr average.

## 6.8 Heavy Metals

### 6.8.1 Monitoring Program

The potential for elevated concentrations of metals and pesticides to be present in airborne particulates is assessed as being low given the isolated occurrence of soil samples, which exceed EIL levels.

It is proposed that metal concentrations will be assessed in High Volume Sampler filter papers for a limited period (e.g. initial 2-4 weeks) of the remedial works to assess the levels of metals present in the particulate matter. Monitoring will target the significant contaminants present in the soils from a human health perspective (i.e. zinc, lead, arsenic and cadmium). The filter papers will be provided to the laboratory on the same day, where possible, to obtain the fastest possible turnaround in results and prompt responses to dust management protocols if required.

Assessment criteria for metals present within airborne particulates are outlined in Section 6.8.3, however these may be reviewed following the completion of baseline monitoring.

Once the site has been validated as being remediated and concentrations of residual contaminants are in accordance with DEC guidelines, ambient sampling for heavy metals will cease for the remainder of civil works associated with subdivision development.

### 6.8.2 Analytical Method

Metal particulates monitoring for public exposure will be undertaken using High Volume Sampling in accordance with AS 3580.9.3 (2003) *Methods for Sampling and Analysis of Ambient Air - Determination of Suspended Particulate Matter - Total Suspended Particulate Matter (TSP) - High Volume Sampler Gravimetric Method*. Laboratory analysis of the filters will be undertaken for the first two weeks of remediation earthworks. This approach provides quantitative results for concentrations of metals in the air, but there is a delay (of 3-5 days) before results are available from the laboratory so that Hi-Vol monitoring is not suitable for immediate management purposes. However, DusTrak samplers will also be employed to assess the effectiveness of dust prevention and management measures.

The results of High Volume monitoring will be assessed against the assessment criteria outlined in Section 6.8.3. If the metal results are below the developed target criteria, no further monitoring will be required. If concerns exist regarding metal concentrations in airborne dust, monitoring will continue or be re-initiated.

### 6.8.3 Assessment Criteria

Metal concentrations will be assessed against the criteria specified in Table 14. The Target Criteria and Corrective Action have been combined, reflecting the practicalities of High Volume monitoring i.e. results will be received several days after monitoring so that and Corrective Action undertaken will be made in response to values approaching the Target Criteria. Justification for the application of the criteria at the Cygnia Cove development site is discussed below.

The Target Criteria/Corrective Action for arsenic, cadmium, lead and zinc reflect other criteria currently being used at other remediation sites in the Perth Metropolitan area. These guidelines were supported in writing by DoH and DEC in correspondence dated 12 May 2004 (see copy of letter in Appendix F). The DoH advised that these were also applicable to the South Beach ANI Bradken remediation site. As such, the guidelines are considered to be suitable for Cygnia Cove remediation given the nature and location of the sensitive receptors.

**TABLE 14**  
**HEAVY METAL PARTICULATES AIR QUALITY**  
**CRITERIA (24 HOUR AVERAGES)**

<b>Metal</b>	<b>Target Criteria/Corrective Action (<math>\mu\text{g}/\text{m}^3/24\text{hr}</math>)</b>
Arsenic	0.8
Cadmium	0.2
Lead	1.3
Zinc	350

It is recognised that the above criteria are not ambient criteria, and are suitable only for situations where exposure to potential contaminants will only be of a short duration (i.e. days to weeks). Therefore, if metal concentration results are consistently approaching the criteria levels such that longer terms

average values are also high, management practices will be reviewed as a priority. The above criteria will be reviewed following the completion of baseline monitoring as detailed in Section 6.9, and on a fortnightly basis for the first month of monitoring during remediation works.

## **6.9 Baseline Monitoring**

Baseline continuous monitoring will be conducted before the commencement of works for a period of two weeks at the monitoring sites to provide a background measure of air quality for the local area. The observed range of background levels will be used as the benchmark for assessing any degradation of air quality following the commencement of works. Weather conditions will also be noted during this observation period.

The following baseline monitoring will be undertaken:

- Asbestos;
- TSP (Total Suspended Particulates) using High Volume Samplers;
- PM<sub>10</sub> (Fine Particulates) using DusTrak samplers;
- PM<sub>10</sub> (Fine Particulates) using TEOM; and
- Metals (zinc, lead, arsenic, cadmium).

## **6.10 Visible Nuisance Dust**

Once all works associated with site remediation including validation phase of bulk earthworks have been completed, particulate monitoring will cease. At this point, nuisance dust will be assessed at the site boundary by visual inspection. Visual inspection results will be maintained on a daily logging sheet for reference. Visible assessment of airborne particulate material generally equates to 1,000µg/m<sup>3</sup> of dust emissions.

Proactive measures detailed in Section 5.4 will be employed to control dust at this stage. In addition, logs of dust complaints received will also be used as a reactive tool to manage fugitive dust from the site, until such time as the subdivision is populated.

## **7 CONTINGENCY RESPONSE**

### **7.1 Dust Management**

Should air quality monitoring show that dust and airborne contaminant emissions including asbestos, exceed the Control or Target Levels, dust and asbestos management practices will be immediately reviewed by the Principal's Environmental Consultant and corrective action taken to improve air quality. If the Work Stoppage Level is exceeded, all site work creating dust sources will cease until monitored levels fall below the Target Levels.

#### **7.1.1 Corrective Action During Site Works**

The corrective action taken will typically comprise the following sequence of actions:

- Check all trucks are appropriately covered and that earthmoving machinery is operating in wetted down areas;
- Increase the water application rates over all disturbed areas;
- Reduce the level of earthmoving activity if evaporation rates are drying the fill quicker than water can be applied;
- Reduce the area of disturbance to minimise emissions;
- Apply a suitable physical dust suppressant to any inactive areas; and
- Cease all work if extreme weather conditions are the prime reason for excessive dust levels and dust suppression techniques have been ineffective in controlling the dust.

### **7.2 Notification of Exceedance**

The DEC will be notified in writing by the Principal's Environmental Consultant within 24hrs if there has been an exceedance of the corrective action or target values. Should there be a work stoppage, this will be notified immediately on the day by phone and in writing.

## 8 REPORTING, TRAINING AND RESPONSIBILITY

### 8.1 Reporting

Reporting of the Dust and Asbestos Management Plan for the Cygnia Cove site will be broken down into four components as shown below.

#### 8.1.1 General Reporting

As detailed in the *Site Contamination Investigation, Remediation and Validation Management Plan* (Coffey Environments, 2009), the progress and management of remedial works will be reviewed on an ongoing basis.

#### 8.1.2 Soil Reporting Requirements

As detailed in the *Site Contamination Investigation, Remediation and Validation Management Plan* (Coffey Environments, 2009), project specific reporting requirements relating to the implementation of remedial and validation works, including that pertaining to asbestos contaminated soil removal are outlined in Table 15.

**TABLE 15**  
**SOIL REPORTING REQUIREMENTS**

Responsibility	Item	To Whom	Timing
Civil Works Contractor	Log of the remedial earthworks operation, tracking dates of excavation, location of the stockpile for each remediation area, and the management and/or disposal of excavated material.  Provision of tip dockets for all material disposed of off-site.	Site Superintendent and Principal's Environmental Consultant	At the end of remedial works <sup>2</sup> .
Principal's Environmental Consultant	Soil validation testing results and disposal advice.	Superintendent/Civil Works Contractor	Within three weeks of notification of excavation.

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<sup>2</sup> Recorded keeping will be maintained for the duration of the development however it is envisaged that the Environmental Consultant will correspond with the Civil Works Contractor with regular updates on-site activities and remedial work logs and tracking.

**TABLE 15**  
**SOIL REPORTING REQUIREMENTS**

Responsibility	Item	To Whom	Timing
Principal's Environmental Consultant	Preparation of Progress and Compliance Reports.	Principal and DEC	Encompassing: Design, Construction and Post Construction phases reporting on a quarterly basis.
Principal's Environmental Consultant	Close-out report.	Site Auditor, Principal and DEC	At the end of remedial works.

\* Any significant issues will be addressed appropriately as per Section 8.2.1

Upon submission of the Close-out Report, Coffey Environments behalf of The Christian Brothers, will request that any condition(s) regarding asbestos management are formally cleared by the DEC.

### 8.1.3 Dust Reporting Requirements

Dust reporting will be undertaken in three formats as detailed below and summarised in Table 17:

- Periodic reporting during remediation works;
- A Close-out report will be prepared after the conclusion of the remedial works; and
- Visual dust inspection results will be maintained on a daily logging sheet during bulk earthworks and construction.

The periodic reporting will provide information on general trends of dust management via dust monitoring results to the DEC. In addition, the DEC will be provided with notification of any compliance breaches (if they should occur) within 24hrs of occurrence.

A Close-out Report including the following information will be provided after the conclusion of the remedial works:

- Air Monitoring Parameters;
- Air Quality Standards;
- Air Monitoring Methods;
- Air Monitoring Locations;
- Air Monitoring Results;
- Complaints, Incidents or Exceedances; and
- Conclusion.

**TABLE 17**  
**DUST REPORTING REQUIREMENTS**

Responsibility	Item	To Whom	Timing
Principal's Environmental Consultant	Preparation of Progress Reports	Principal and DEC	Encompassing: Design, Construction and Post Construction phases reporting on a quarterly basis*.
Principal's Environmental Consultant	Close-out report.	Site Auditor, Principal and DEC	At the end of remedial works.
Civil Works Contractor	Daily Dust Inspection log sheets	Principal and DEC	Encompassing: During Construction as requested and Post Construction phases reporting on a quarterly basis*.

\* Any significant issues will be addressed appropriately as per Section 8.2.1

Upon submission of the Report, Coffey Environments on behalf of The Christian Brothers, will request that any condition(s) regarding dust management are formally cleared by the DEC.

## 8.2 Community Consultation

There has been an ongoing consultation with the community throughout the life of the project. This has included:

- The public consultation that formed part of the Environmental and Planning Approval process for the project;
- A number of information evenings held to inform the community in relation to the project; and
- Ongoing discussion with various regulatory authorities and community interest groups. A summary of the Community Consultation report is provided in PER document.

In addition, the following is proposed:

- Prior to construction works commencing, signage will be placed at key points along the boundary of the installed on the site to inform the community that development works are commencing. Signage will include contact details in the event that dust or noise emissions are causing concern.
- A notice will be placed in the letterboxes of residents adjoining the development site. The notice will provide a summary of the nature and duration of the works and re-iterate contact details in the event that there are any concerns or issues.

### 8.2.1 Complaints, Incidents and Exceedances

Site personnel will be responsible for reporting environmental incidents and complaints on a designated Accident and Incident Report form. Environmental incidents are defined as discharges or impacts that result from site works that exceed or have the potential to exceed the criteria specified in this Management Plan, and result in environmental harm.

Any complaints received by the Civil Works Contractor Site Manager from members of the public and other key stakeholders (regulators, local authorities) will be reported Contractor to the Site Superintendent and Principal's Environmental Consultant and addressed within 24hrs.

Any environmental incidents (if they should occur) will be reported by the Civil Works Contractor Site Manager within 24hrs of occurrence to the Site Superintendent and Principal's Environmental Consultant.

The DEC will be provided with notification of any compliance breaches (if they should occur) within 24hrs of occurrence (as per Section 8.1.3 and 8.2.1).

Accident and Incident Reports and contact details for management of site activities will be provided in a readily accessible place while site works are being carried out. This will ensure that staff are able to immediately complete and submit a written record in the event of any environmental incident.

The Accident and Incident Report should include:

1. An *Incident Reporting Section* to be completed by the person reporting the incident. This section will require input of initial details of the incident, including:
  - the name of the person submitting the report;
  - the source of off-site impacts or discharges, including a description of the details of the operations that were being undertaken that resulted in the discharge or impact;
  - the duration of the environmental incident if it results in, or had the potential to result in, unacceptable off-site impacts;
  - a description of equipment or machinery being operated at the time that caused the discharge or impact; and
  - a description of the impact management measures that were in place and being used when the discharge or impact occurred.
2. An *Assessment Section* of the Incident Form will be completed which requires the incident to be assessed in terms of urgency and actions considered appropriate to remedy the incident and minimise environmental impacts. Information to be supplied in this section includes:
  - a brief assessment of the urgency and immediate impacts of the incident;
  - a description of the actions to be taken to rectify the discharges or impacts; and
  - an *Action Report Section* which includes:
    - details of the actions taken to immediately remedy the incident;
    - a brief report on the success of those actions; and
    - a description of changes to work practices or operations that are required to ensure that the incident will not re-occur together with a timetable for implementation of those changes.

The Accident and Incident Report will be given a sequenced identification number so that each form may be accounted for.

Coffey Environments will provide environmental management/monitoring record templates. Should the Civil Work Contractor provide alternative reporting formats/templates, they will be subject to review and approval by the environmental consultant prior to circulation for use on-site.

## **8.3 Training and Awareness**

### **8.3.1 Site Induction**

Site inductions will be held prior to the commencement of works for all Civil Works Contractors and subcontractors involved in the project. During the site induction, potential environmental impacts and issues will be communicated to all site personnel. These communications may be in the form of training sessions and notices in a prominent position in the work place and will include:

- Overview of regulatory requirements relevant to the project;
- Information on the potential impacts of on-site works;
- Information to assist site personnel in identifying unacceptable off-site environmental impact problems;
- All workers will undergo a site induction that informs them of the dangers of asbestos, how to recognise asbestos products and the procedures to follow should asbestos products be uncovered;
- Protocols for the reporting of Occupational, Health, Safety and Environmental (OHS&E) incidents including a list of site contacts to be notified. Incidents are to be reported on an Accident and Incident Reporting Form;
- Instructions that all site personnel are responsible for reporting and where appropriate, taking action in the event of unacceptable impacts; and
- An outline of the contingency action plan that is to be used to rectify unacceptable off-site environmental impact or discharge problems.

### **8.3.2 Personnel Training**

The Civil Works Contractor will be assessed as to their ability to achieve environmental performance consistent with the requirements of this Management Plan. The Site Superintendent or delegated nominee will assess the requirements of the subcontract package and, where considered necessary, the Subcontractor(s) will be required to attend a specific training session.

The Civil Works Contractor will ensure all personnel performing duties required by this Management Plan are properly briefed. Where a need is identified, arrangements shall be made for appropriate environmental training including training to enable Civil Works Subcontractors to identify and report unexpected finds of asbestos. If necessary, assistance shall be provided initially to personnel (including sub-Civil Works Contractors) when carrying out assigned environmental duties until such time as the required training has been completed.

## **8.4 Responsibilities**

### **8.4.1 Principal**

The Principal or the Proponent for the project is ultimately responsible for the overall compliance with prescribed Ministerial Environmental Conditions and legislation relevant to the project.

### **8.4.2 Site Superintendent**

The Site Superintendent will ensure that the appointed Civil Works Contractor is required to prepare and implement environmental protection programs, appropriate to their activities and to cooperate in any environmental management plans implemented on the project.

The Principal's Environmental Consultant will be the main contact and conduit for ongoing liaison between regulatory authorities. Advice from the Civil Works Contractor and Site Superintendent may be sought as required.

The Civil Works Contractor will report directly to the Site Superintendent and will be responsible for implementing the *Site Contamination Investigation, Remediation and Validation Management Plan* (Coffey Environments, 2009) with assistance and direction from Principal's Environmental Consultant.

### **8.4.3 Principal's Environmental Consultant**

The Principal's Environmental Consultant will be responsible for activities associated with inspection and/or sampling of soil and dust, such as:

- Identify areas of potential asbestos soil contamination;
- Review soil validation data and provide advice with respect to appropriate management and/or off-site disposal of material;
- Review and evaluate analytical data obtained from all ongoing monitoring programs described in Section 5. The results of the monitoring will be included in a Close-out report to be submitted to Site Auditor and the DEC as well as in accordance with post-development Progress and Compliance reporting.

The Principal's Environmental Consultant will be available to provide ongoing environmental advice and support to the Site Superintendent and Civil Works Contractor as needed.

Where necessary, the Principal's Environmental Consultant will be responsible for ongoing liaison with regulatory authorities and the community in relation to environmental issues.

The Principal's Environmental Consultant will coordinate community consultation initiatives relevant to the project, particularly the release of documentation for public review.

### **8.4.4 Civil Works Contractor's Site Manager**

The responsibility for day-to-day site management lies with the Civil Works Contractor's Site Manager. He will be assisted by the nominated Principal's Environmental Consultant as necessary. The Civil Works Contractor's Site Manager will take overall responsibility for the environmental performance during construction and site development.

The Civil Works Contractor has responsibility to ensure activities under their direct control are completed in compliance with this Dust and Asbestos Management Plan and related Work Procedures, Inspection Plans, Procedural Checklists and Environmental Management Plans, as applicable.

In the event of absence from site, the Civil Works Contractor Site Manager will be represented by his delegate responsible for civil works.

The Civil Works Contractor is responsible for ensuring that all employees and civil works Subcontractors are fully cognisant of, and abide by, the Dust and Asbestos Management Plan.

The Civil Works Contractor will ensure all employees and Subcontractors are responsible for putting into practice the Dust and Asbestos Management Plan and shall ensure that the factors which may compromise the achievement of overall project or environmental objectives are brought to the attention of the Site Superintendent and Principal's Environmental Consultant.

The Civil Works Contractor's Site Manager will:

- Be the initial central point of contact for all site related environmental issues;
- Be responsible for ensuring employee and Civil Works Contractor adherence to the Dust and Asbestos Management Plan;
- Maintain the content and implementation of induction training and tool box sessions;
- Keep records of who has been trained and to advise the Environmental Manager when new staff commence;
- Undertake and implement procedures and controls with respect to asbestos containing material and dust management as outlined within Section 5;
- Instigate and maintain a program of environmental recording and (as appropriate) environmental reporting against key performance objectives as outlined within the DAMP;
- Maintain a log of remedial earthworks operations and associated management and/or off-site disposal of material;
- Periodically inspect pollution management structures and equipment to confirm availability and completeness; and
- Be responsible for reporting all incidents of breach of this Dust and Asbestos Management Plan to the Site Superintendent and Environmental Consultant.

The Civil Works Contractors Site Manager and Environmental Consultant shall, in conjunction, be responsible for the follow works:

- Inspection of excavations for residual asbestos material to determine extent of remediation (as outlined within Section 5.3.5);
- Identification of access controlled work areas (as outlined within Section 5.3.1 and 5.3.2); and
- Review and management of imported fill (as outlined within Section 5.3.11).

#### **8.4.5 All Employees**

All employees engaged in field activities and under the direct control of Civil Works Contractor shall comply with the requirements of this Dust and Asbestos Management Plan. Formal commitment to abide by project requirements will be ratified through the employees' respective employment contracts.

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**Occupational Safety and Health Regulations (1996)** Government of Western Australia.

**Standards Australia (1987)** Australian Standard AS 2922 - Ambient Air - Guide for Siting of Sampling Units. Standards Australia, Homebush.

**Standards Australia (1994)** Australian Standard AS 1319 - Safety Signs for the Occupational Environment. Standards Australia, Homebush.

**Standards Australia (2001)** Australian Standard AS 3580.9.8 - Methods for Sampling and Analysis of Ambient Air - Determination of Suspended Particulate Matter - PM(sub)10(/sub) Continuous Direct Mass Method Using a Tapered Element Oscillating Microbalance Analyser. Standards Australia, Homebush.

**Standards Australia (2003)** Australian Standard AS 3580.9.3 - Methods for Sampling and Analysis of Ambient Air - Determination of Suspended Particulate Matter - Total Suspended Particulate Matter (TSP) - High Volume Sampler Gravimetric Method. Standards Australia, Homebush.

## **10 STATEMENT OF LIMITATIONS**

(please refer over the page)

## Important information about your **Coffey** Environmental Report

Uncertainties as to what lies below the ground on potentially contaminated sites can lead to remediation costs blow outs, reduction in the value of the land and to delays in the redevelopment of land. These uncertainties are an inherent part of dealing with land contamination. The following notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

### **Your report has been written for a specific purpose**

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Your report has been developed on the basis of a specific purpose as understood by Coffey and applies only to the site or area investigated. For example, the purpose of your report may be:

- To assess the environmental effects of an on-going operation.
- To provide due diligence on behalf of a property vendor.
- To provide due diligence on behalf of a property purchaser.
- To provide information related to redevelopment of the site due to a proposed change in use, for example, industrial use to a residential use.
- To assess the existing baseline environmental, and sometimes geological and hydrological conditions or constraints of a site prior to an activity which may alter the sites environmental, geological or hydrological condition.

For each purpose, a specific approach to the assessment of potential soil and groundwater contamination is required. In most cases, a key objective is to identify, and if possible, quantify risks that both recognised and unrecognised contamination pose to the proposed activity. Such risks may be both financial (for example, clean up costs or limitations to the site use) and physical (for example, potential health risks to users of the site or the general public).

### **Scope of Investigations**

---

The work was conducted, and the report has been prepared, in response to specific instructions from the client to whom this report is addressed, within practical time and budgetary constraints, and in reliance on certain data and information made available to Coffey. The analyses, evaluations, opinions and conclusions presented in this report are based on those instructions, requirements, data or information, and they could change if such instructions etc. are in fact inaccurate or incomplete.

### **Subsurface conditions can change**

---

Subsurface conditions are created by natural processes and the activity of man and may change with time. For example, groundwater levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of the subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project and/or on the property.

### **Interpretation of factual data**

---

Environmental site assessments identify actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from indirect field measurements and sometimes other reports on the site are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how well qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, parties involved with land acquisition, management and/or redevelopment should retain the services of Coffey through the development and use of the site to identify variances, conduct additional tests if required, and recommend solutions to unexpected conditions or other problems encountered on site.

## Important information about your **Coffey** Environmental Report

### **Your report will only give preliminary recommendations**

---

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered with redevelopment or on-going use of the site. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

### **Your report is prepared for specific purposes and persons**

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To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. In particular, a due diligence report for a property vendor may not be suitable for satisfying the needs of a purchaser. Your report should not be applied for any purpose other than that originally specified at the time the report was issued.

### **Interpretation by other professionals**

---

Costly problems can occur when other professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other professionals who are affected by the report. Have Coffey explain the report implications to professionals affected by them and then review plans and specifications produced to see how they have incorporated the report findings.

### **Data should not be separated from the report**

---

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, laboratory data, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel), field testing and laboratory evaluation of field samples. This information should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

### **Contact Coffey for additional assistance**

---

Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to land development and land use. It is common that not all approaches will be necessarily dealt with in your environmental site assessment report due to concepts proposed at that time. As a project progresses through planning and design toward construction and/or maintenance, speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

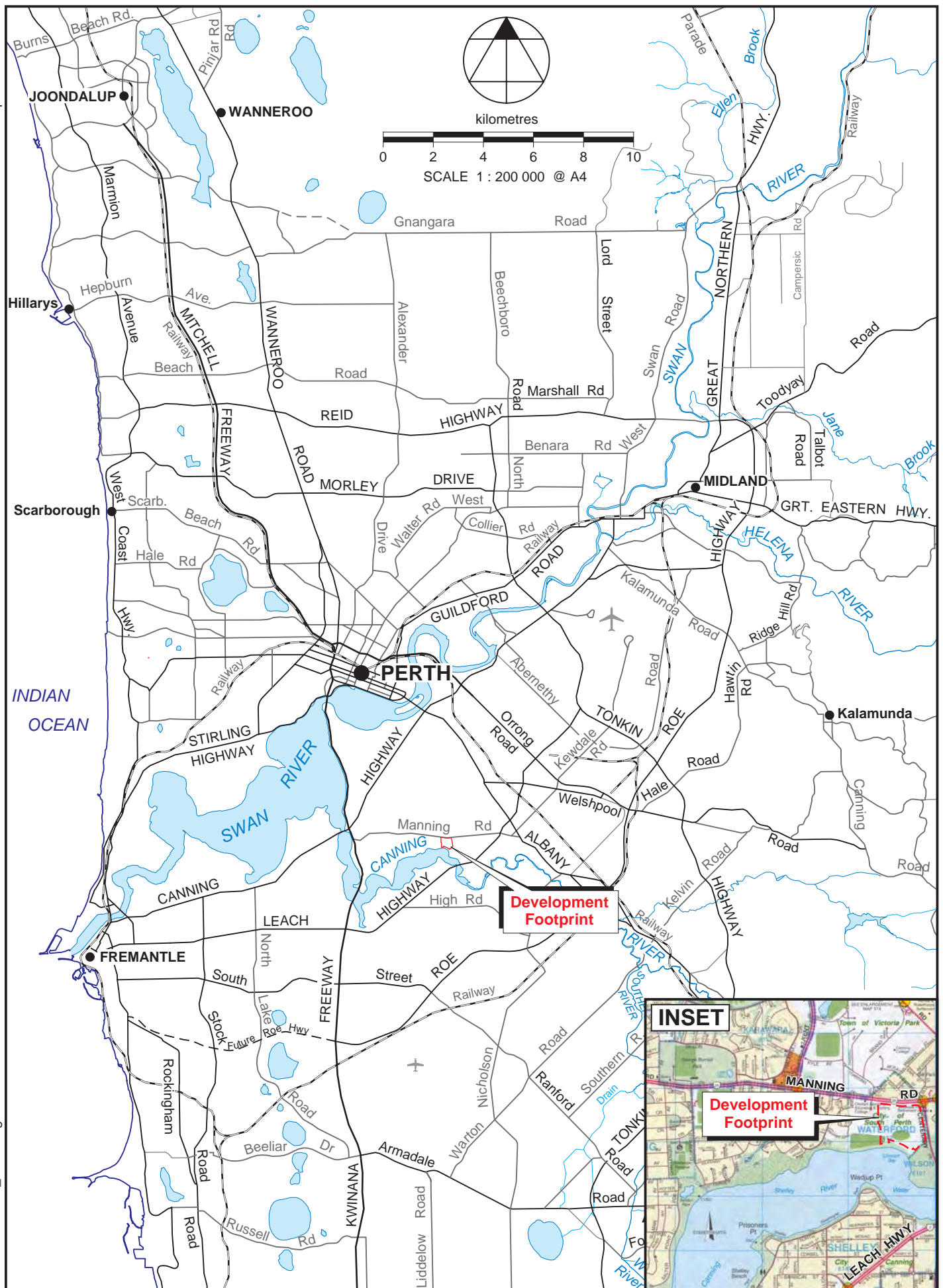
### **Responsibility**

---

Environmental reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than other design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

# Figures

**Dust and Asbestos Management Plan  
Cygnia Cove, Waterford**

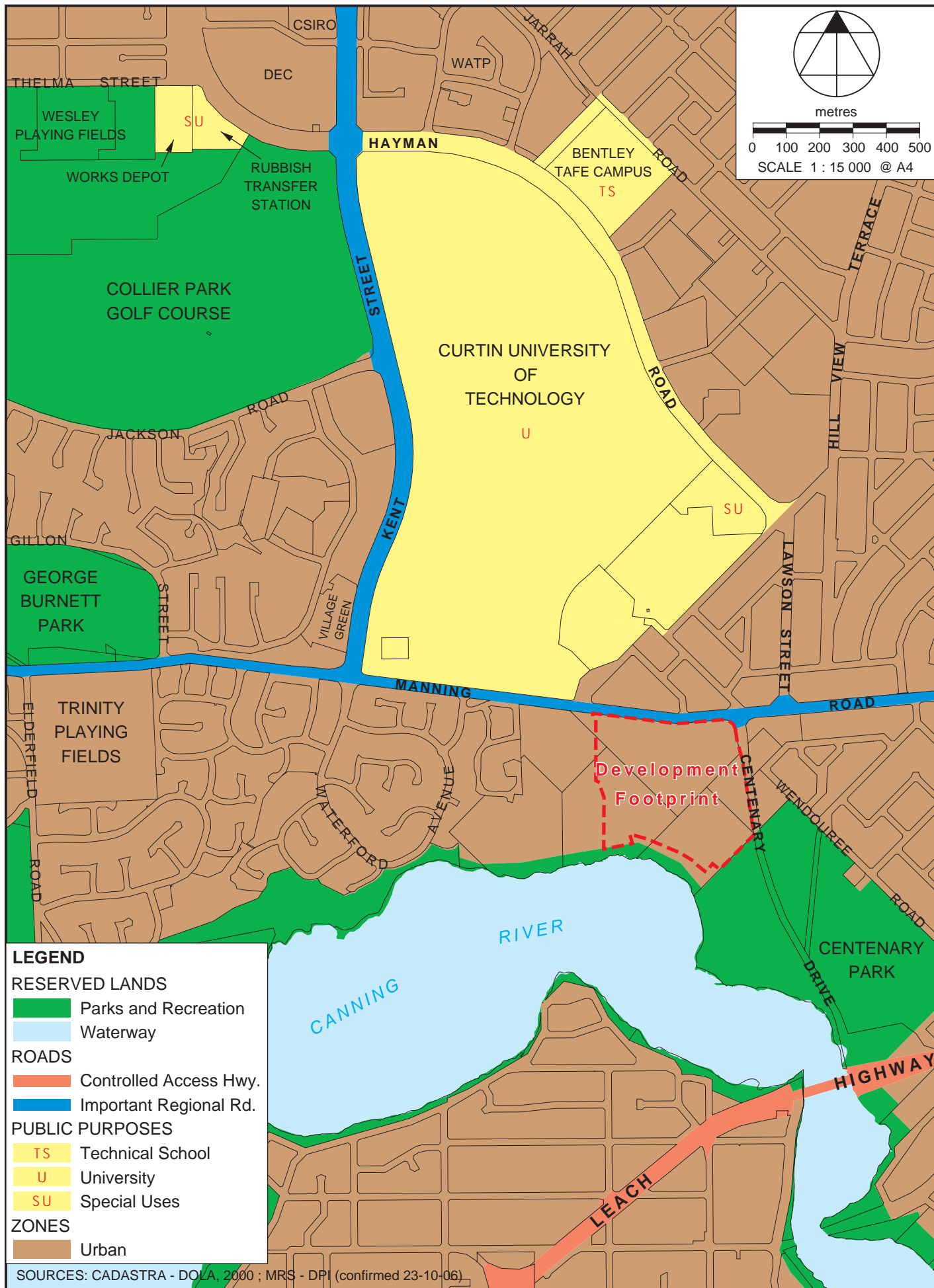


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DATUM: MGA50

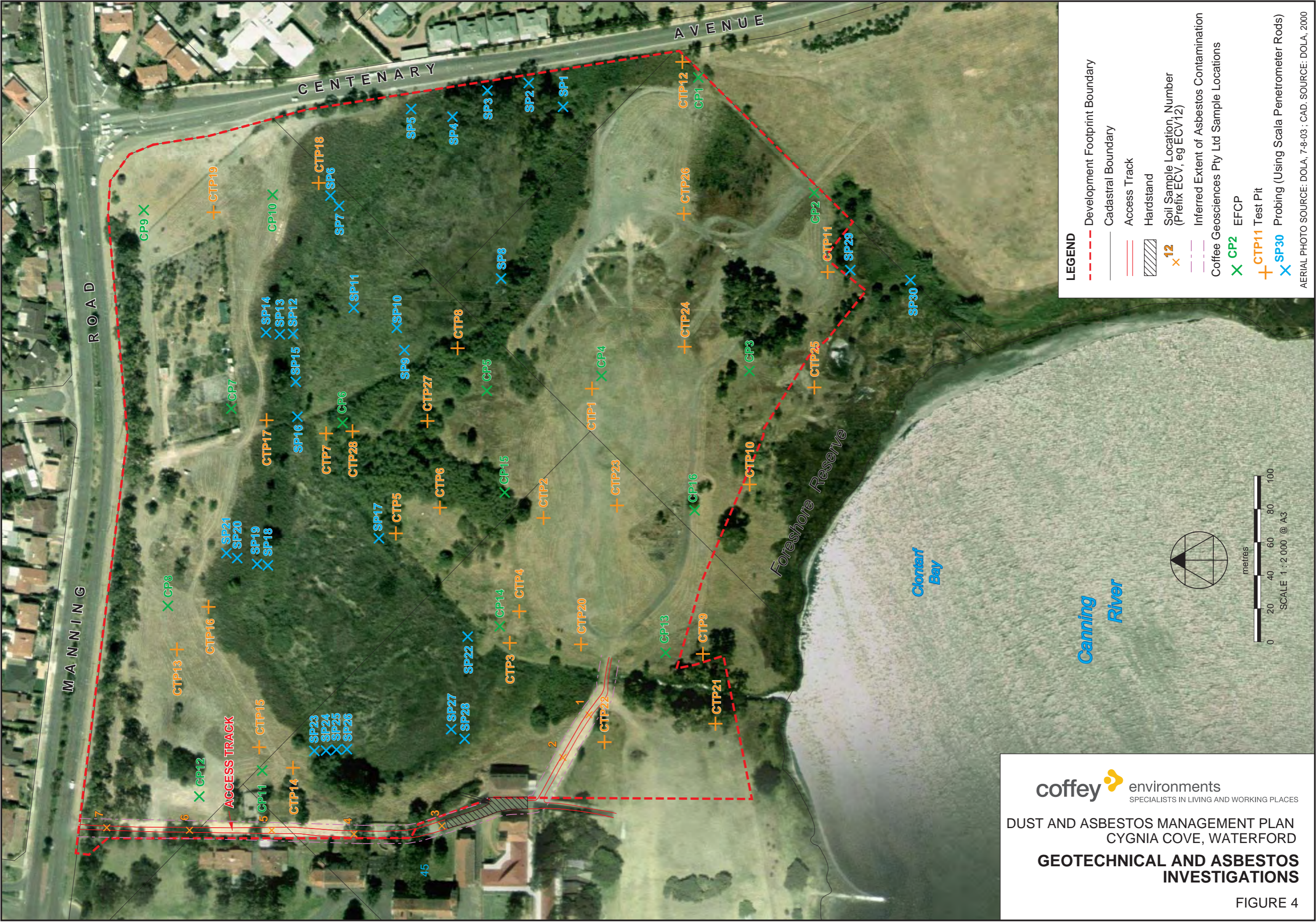
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DUST AND ASBESTOS MANAGEMENT PLAN  
CYGNIA COVE, WATERFORD  
**SURROUNDING LAND USE**

FIGURE 2









metres  
0 20 40 60 80 100  
SCALE 1 : 2 000 @ A3

**LEGEND**

- Development Footprint Boundary
- Cadastral Boundary
- Monitoring Well Location
- Soil Sample Location (colour indicates Area)
- Areas of Uncontrolled Fill
- Asbestos fibers detected
- Analytical concentration of Chromium > EIL in natural sandy clay
- Analytical concentration > EIL in soil profile
- Suspected asbestos containing material visually observed

MW5

36

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SPECIALISTS IN LIVING AND WORKING PLACES

DUST AND ASBESTOS MANAGEMENT PLAN

CYGNIA COVE, WATERFORD

SOIL CONTAMINATION

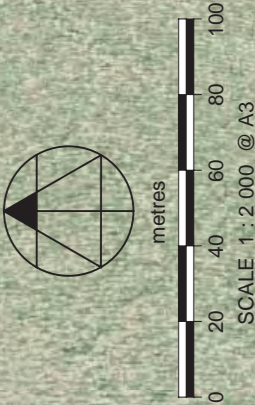
FIGURE 5

AERIAL PHOTO SOURCE: DOLA, 7-8-03  
CAD. SOURCE: PGS HOPE & Partners, 29-5-03



**LEGEND**

- Development Footprint Boundary (dashed red line)
- Cadastral Boundary (solid black line)
- Monitoring Well Location (orange circle with crosshair)
- Indicative Location of Permanent Air Monitoring Station (red 'X')
- Soil Sample Location (colour indicates Area) (numbered orange dots)
- Areas of Uncontrolled Fill (yellow dashed outline)
- Surface Soil Removal Buffer Zone (yellow solid outline)
- Asbestos fibers detected: Proposed remediation area (pink square)
- Analytical concentration of Chromium > EIL in natural sandy clay (blue dashed outline)
- Analytical concentration > EIL in soil profile: Proposed remediation area (pink square)





**coffey environments**  
SPECIALISTS IN LIVING AND WORKING PLACES

**DUST AND ASBESTOS MANAGEMENT PLAN**  
**CYGNIA COVE, WATERFORD**  
**REMEDIATION AREAS**  
**FIGURE 6**

NOTE:  
DIAGRAMMATIC-NOT TO SCALE

[illegible]

NOTE:  
DIAGRAMMATIC-NOT TO SCALE

				<p>Ground Floor 89-91 Burswood Rd Burswood , WA 6100 Ph: (08) 9355 7100 Fax: (08) 9355 7197</p>	Client:  TRUSTEES OF THE CHRISTIAN BROTHERS IN WESTERN AUSTRALIA INCORPORATED	Project: CYGNIA COVE DEVELOPMENT (FORMERLY EAST CLONTARF)	Drawing Title:  <b>FIGURE 7B (SITE CONCEPTUAL MODEL (B))</b>	Coffey Environments Pty Ltd <sup>©</sup>	Date	
A	22.08.08	ISSUE	LZ					Drawn LZ	22.08.08	
Rev.	Date	Revision Details	Dwn			Location:			Figure No.	Rev.
						LOT 83 AND LOTS 501 & 829 MANNING ROAD WATERFORD, WESTERN AUSTRALIA			Project - Drawing No. ENVIPERT00209AA~D01	A



LEGEND

- Development Footprint Boundary
- Areas of Uncontrolled Fill
- Surface Soil Removal Buffer Zone
- Asbestos fibres detected: Proposed remediation area
- Analytical concentration > EIL in soil profile: Proposed remediation area

Drawing Title:		
REMEDIATION AREAS		
Drawn	Date	
LZ	22.08.08	
Project - Drawing No.	Figure No.	Rev.
ENVIPERT00209AA-D01	8	A

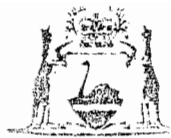
<div><div>coffey</div><div>environments</div><div>SPECIALISTS IN LIVING AND WORKING PLACES</div></div> <div>Ground Floor 89-91 Burswood Rd Burswood , WA 6100 Ph: (08) 9355 7100 Fax: (08) 9355 7197</div>			
Rev	Date	Revision Details	Drn
A	10.03.09	ISSUE	LZ

Client:	TRUSTEES OF THE CHRISTIAN BROTHERS IN WESTERN AUSTRALIA INCORPORATED
Project:	CYGNIA COVE DEVELOPMENT (FORMERLY EAST CLONTARF)
Location:	LOT 83 AND LOTS 501 & 829 MANNING ROAD WATERFORD, WESTERN AUSTRALIA
<div><div>02040608100</div><div>SCALE1:2000 (A3)METRES</div></div>	

# Appendix A

## Ministerial Statement 692

**Dust and Asbestos Management Plan  
Cygnia Cove, Waterford**



GOVERNMENT OF WESTERN AUSTRALIA

**MINISTER FOR THE ENVIRONMENT; SCIENCE**

Statement No.

000692

**STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED  
(PURSUANT TO THE PROVISIONS OF THE  
ENVIRONMENTAL PROTECTION ACT 1986)**

**EAST CLONTARF RESIDENTIAL DEVELOPMENT  
WATERFORD, CITY OF SOUTH PERTH**

**Proposal:** The residential development of the East Clontarf site, Waterford, as documented in schedule 1 of this statement.

**Proponent:** Trustees for The Christian Brothers in Western Australia Inc

**Proponent Address:** c/- Richard Noble and Associates, PO Box 7071 Cloisters' Square, PERTH WA 6850.

**Assessment Number:** 1467

**Report of the Environmental Protection Authority:** Bulletin 1156

The proposal referred to above may be implemented by the proponent subject to the following conditions and procedures:

**1 Implementation**

- 1-1 The proponent shall implement the proposal as documented in schedule 1 of this statement subject to the conditions and procedures of this statement.

**2 Proponent Commitments**

- 2-1 The proponent shall implement the environmental management commitments documented in schedule 2 of this statement.

Published on

11 OCT 2005

### **3 Proponent Nomination and Contact Details**

- 3-1 The proponent for the time being nominated by the Minister for the Environment under section 38(6) or (7) of the *Environmental Protection Act 1986* is responsible for the implementation of the proposal until such time as the Minister for the Environment has exercised the Minister's power under section 38(7) of the Act to revoke the nomination of that proponent and nominate another person as the proponent for the proposal.
- 3-2 If the proponent wishes to relinquish the nomination, the proponent shall apply for the transfer of proponent and provide a letter with a copy of this statement endorsed by the proposed replacement proponent that the proposal will be carried out in accordance with this statement. Contact details and appropriate documentation on the capability of the proposed replacement proponent to carry out the proposal shall also be provided.
- 3-3 The nominated proponent shall notify the Department of Environment of any change of contact name and address within 60 days of such change.

### **4 Commencement and Time Limit of Approval**

- 4-1 The proponent shall substantially commence the proposal within five years of the date of this statement or the approval granted in this statement shall lapse and be void.

Note: The Minister for the Environment will determine any dispute as to whether the proposal has been substantially commenced.

- 4-2 The proponent shall make application for any extension of approval for the substantial commencement of the proposal beyond five years from the date of this statement to the Minister for the Environment, prior to the expiration of the five-year period referred to in condition 4-1.

The application shall demonstrate that:

- 1. the environmental factors of the proposal have not changed significantly;
- 2. new, significant, environmental issues have not arisen; and
- 3. all relevant government authorities have been consulted.

Note: The Minister for the Environment may consider the grant of an extension of the time limit of approval not exceeding five years for the substantial commencement of the proposal.

### **5 Compliance Audit and Performance Review**

- 5-1 The proponent shall prepare an audit program and submit compliance reports to the Department of Environment which address:

1. the status of implementation of the proposal as defined in schedule 1 of this statement;
2. evidence of compliance with the conditions and commitments; and
3. the performance of the environmental management plans and programs.

Note: Under sections 48(1) and 47(2) of the *Environmental Protection Act 1986*, the Chief Executive Officer of the Department of Environment is empowered to monitor the compliance of the proponent with the statement and should directly receive the compliance documentation, including environmental management plans, related to the conditions, procedures and commitments contained in this statement.

## **6 Wetland**

- 6-1 Within 12 months following subdivision/development approval, the proponent shall substantially commence construction of an approximately 1.9-hectare wetland shown in Figure 1 of schedule 1 as Public Open Space, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

This wetland shall include the following:

1. Black Swan breeding habitat;
  2. revegetation with local indigenous species;
  3. landform recontouring;
  4. establishment and maintenance of wetland connection to Clontarf Bay and the Canning River;
  5. weed control measures;
  6. water quality and quantity monitoring; and
  7. contingency measures to maintain or improve water quality of water flowing into Clontarf Bay and the Canning River.
- 6-2 Prior to commencement of construction of the wetland required by condition 6-1, the proponent shall prepare a Wetland Management Plan which includes identification of species to be used in revegetation works on site, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.
- 6-3 The proponent shall implement the Wetland Management Plan required by condition 6-2.
- 6-4 The proponent shall make the Wetland Management Plan required by condition 6-2 publicly available.

## **7 Water Quality**

- 7-1 Prior to ground-disturbing activity, the proponent shall prepare a Drainage, Nutrient, Irrigation and Water Quality Management Plan to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

This Plan shall address the following environmental quality objectives as described in *Riverplan – An Environmental Management Framework for the Swan and Canning Rivers (August 2004)* to protect, restore and maintain:

1. ecosystem health;
  2. biological diversity;
  3. natural landscape;
  4. recreation; and
  5. water supply.
- 7-2 The proponent shall implement the Drainage, Nutrient, Irrigation and Water Quality Management Plan required by condition 7-1.
- 7-3 The proponent shall make the Drainage, Nutrient, Irrigation and Water Quality Management Plan required by condition 7-1 publicly available.
- 7-4 Prior to ground-disturbing activity, the proponent shall prepare an Ecotoxological Testing Plan to monitor the benthic habitat at the wetland discharge point into Clontarf Bay, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.
- 7-5 The proponent shall implement the Ecotoxological Testing Plan required by condition 7-4.
- 7-6 The proponent shall make the Ecotoxological Testing Plan required by condition 7-4 publicly available.

## **8 Site Contamination**

- 8-1 Prior to ground-disturbing activity, the proponent shall prepare a Site (Soil and Groundwater) Contamination Investigation, Remediation and Validation Plan to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority with the concurrence of the Department of Health.

This Plan shall be prepared in general accordance with the Department of Environment *Contaminated Sites Management Series of Guidelines*, and shall include:

1. an Acid Sulfate Soil Management Plan; and
  2. an Asbestos Management Plan.
- 8-2 The proponent shall implement the Site (Soil and Groundwater) Contamination Investigation, Remediation and Validation Plan required by condition 8-1.
- 8-3 The proponent shall make the Site (Soil and Groundwater) Contamination Investigation, Remediation and Validation Plan required by condition 8-1 publicly available.

### **Procedures**

- 1 Where a condition states “to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority”, the Environmental Protection Authority will provide that advice to the Department of Environment for the preparation of written notice to the proponent.
- 2 The Environmental Protection Authority may seek advice from other agencies or organisations, as required, in order to provide its advice to the Department of Environment.
- 3 Where a condition lists advisory bodies, it is expected that the proponent will obtain the advice of those listed as part of its compliance reporting to the Department of Environment.

### **Notes**

- 1 The Minister for the Environment will determine any dispute between the proponent and the Environmental Protection Authority or the Department of Environment over the fulfilment of the requirements of the conditions.

Dr Judy Edwards MLA  
MINISTER FOR THE ENVIRONMENT; SCIENCE

11 OCT 2005

**The Proposal (Assessment No. 1467)**

The proposal is for:

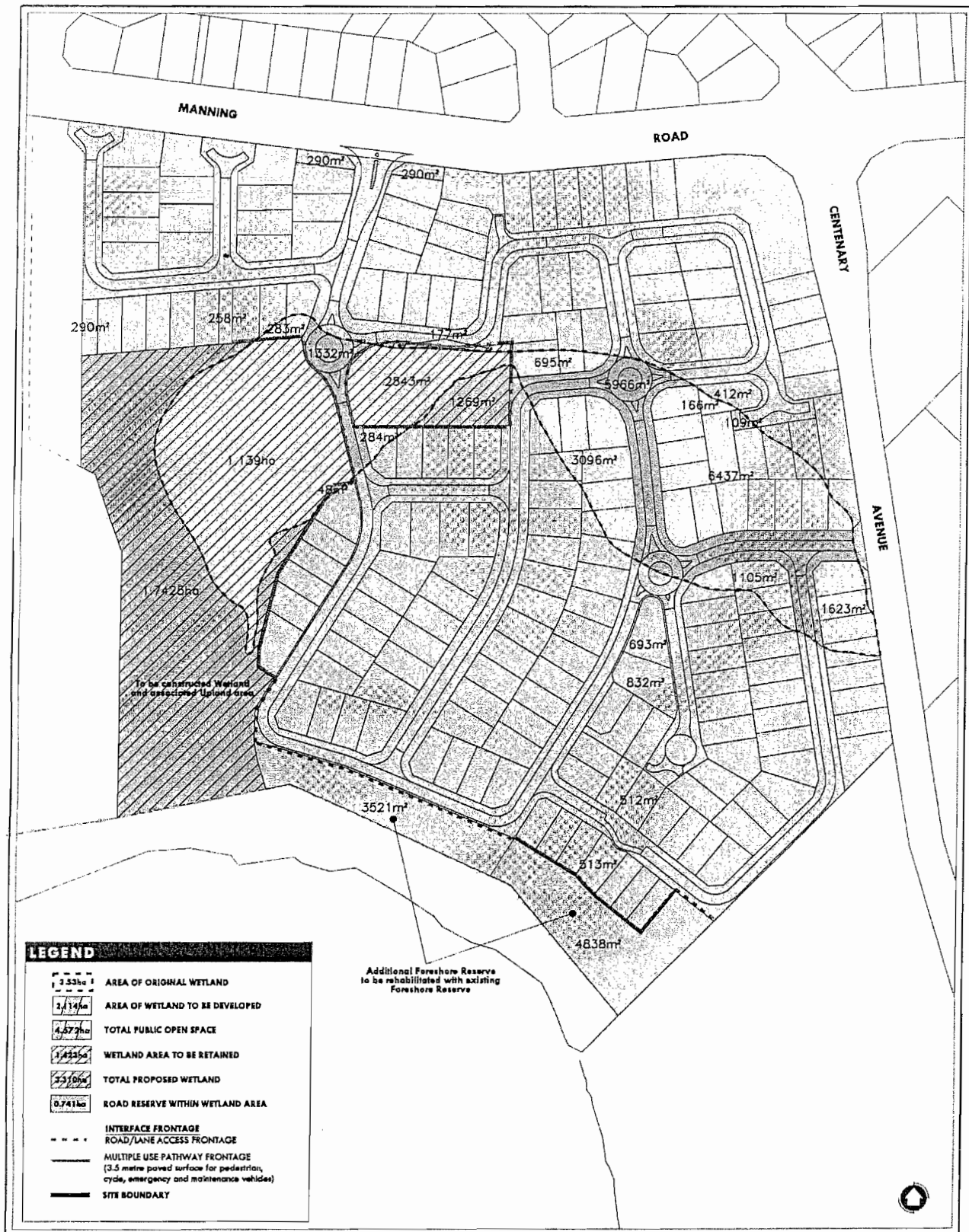
- the residential development of the 18-hectare East Clontarf site bounded by Manning Road, Centenary Avenue, the Clontarf Aboriginal Campus and the Canning River, creating up to 200 lots, as shown in Figure 1;
- the filling and draining of approximately 2.1 hectares of Resource Enhancement wetland identified in the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* and the *Draft Environmental Protection (Swan Coastal Plain Wetlands) Policy 2004*;
- the creation of an approximately 1.9-hectare wetland and associated upland vegetation adjacent to the existing wetland and Canning River;
- increasing the river foreshore area by approximately 8350 square metres;
- investigation into soil and groundwater contamination, and remediation as required;
- installation of two additional monitoring bores to perform additional ground and surface water monitoring; and
- provision of road frontage along both the wetland and the river foreshore, but not including the western section of Public Open Space which is to be a revegetated dryland buffer.

**Table 1 – Key Proposal Characteristics**

Element	Description
Proposal	Creation of up to 200 residential allotments
Area of disturbance	Approximately 16 hectares
Major components – <ul style="list-style-type: none"> <li>• Wetland modification</li> <li>• Dewatering</li> <li>• Disturbance to site hydrology</li> <li>• Remediation of site contamination</li> <li>• Additional foreshore reserve</li> <li>• Potential acid sulfate disturbance</li> <li>• Created wetland</li> <li>• Noise and dust creation</li> </ul>	<p>Draining and filling of approximately 2.1 hectares of Resource Enhancement wetland as depicted on schedule 1.</p> <p>Creation of not less than 1.9 hectares (approximately) of wetland.</p> <p>Provision of 8350 square metres of additional foreshore reserve.</p> <p>Hydrological maintenance – water quality and quantity.</p> <p>Remediation of on-site contamination.</p>

**Figure (attached).**

Figure 1 - Residential Development Plan



**Figure 1 - Residential Development Plan**

Note: The area for residential development is within the "site boundary", but excludes "Public Open Space", the "Wetland Area", and the "Area of Proposed Rehabilitated Wetland" indicated above.

**Schedule 2**

**Proponent's Environmental Management Commitments**

(September 2005)

**East Clontarf Residential Development  
Waterford, City of South Perth**

(Assessment No. 1467)

Trustees for  
The Christian Brothers in Western Australia Inc

## Proponent's Environmental Management Commitments – September 2005

### EAST CLONTARF RESIDENTIAL DEVELOPMENT, WATERFORD (Assessment No. 1467)

**Note:** The term “commitment” as used in this schedule includes the entire row of the table and its six separate parts as follows:

- a commitment number;
- a commitment topic;
- the objective of the commitment;
- the ‘action’ to be undertaken by the proponent;
- the timing requirements of the commitment; and
- the body/agency to provide technical advice to the Department of Environment.

No.	Topic	Objective	Action	Timing	Advice
1.	Construction Management	<p>To protect the remnant wetland vegetation identified for protection within <i>Bush Forever</i> adjoining the development from potential impacts associated with construction.</p> <p>To minimise (direct and indirect) impacts associated with the construction of the residential development and surrounds on fauna, surface and groundwater quality and quantity and local residents.</p>	<p>Prepare and implement a Construction Environmental Management Plan (CEMP) to the satisfaction of the DoE and the Cities of South Perth and Canning, which addresses:</p> <ol style="list-style-type: none"> <li>1. Dewatering Program;</li> <li>2. Detailed Remediation Assessment of Contaminated Soils;</li> <li>3. Acid Sulfate Soils Management Plan;</li> <li>4. Construction Noise Management Procedures; and</li> <li>5. Construction Dust Management Procedures.</li> </ol>	<p>Prepared and approved prior to construction.</p> <p>Implemented during construction.</p> <p>Audits to be completed during construction works and post-construction.</p>	<p>City of South Perth</p> <p>City of Canning</p>

No.	Topic	Objective	Action	Timing	Advice
2.	Foreshore Management	<p>To protect the conservation values identified for protection within the development adjacent to the Canning River foreshore.</p> <p>To mitigate proposed clearing within the development and enhance linkages and habitat value.</p>	<p>Prepare and implement a detailed Foreshore Management Plan to the satisfaction of the DPI, the SRT and the City of South Perth, which will include:</p> <ol style="list-style-type: none"> <li>1. Comprehensive weed eradication program;</li> <li>2. Revegetating and restoring foreshore POS adjoining conservation areas with appropriate indigenous flora of the Canning River;</li> <li>3. Increase the area contained within POS adjoining Bush Forever Site No. 333;</li> <li>4. Creation of habitat and wildlife corridors;</li> <li>5. Controlling vehicle and pedestrian access;</li> <li>6. Construction of a dog-proof fence along the existing Foreshore Reserve, if considered appropriate;</li> <li>7. Provision of public facilities;</li> <li>8. Soil and plant source material hygiene;</li> <li>9. Fire management including provision of fire hydrants;</li> <li>10. Provision of educational and interpretative materials within the area to raise awareness of JAMBA/CAMBA species which frequent the area;</li> <li>11. Encouraging community involvement and awareness by promoting control of pets (eg cats and dogs);</li> <li>12. Water conservation principles;</li> <li>13. Monitoring re-establishment or native and exotic plant species for a period of not less than 2 years followed by review;</li> <li>14. Monitoring criteria to determine the success of the revegetation and weed eradication program;</li> <li>15. Progress and compliance reporting; and</li> <li>16. Timing and implementation schedule.</li> </ol>	<p>Preparation prior to construction.</p> <p>Implementation to be as determined in schedule within the Foreshore Management Plan.</p>	<p>CALM SRT City of South Perth</p>
3.	Wetland Management	To minimise impacts on wetlands and to offset any wetland impacts to ensure no net loss of function or value.	<p>Prepare and implement a Wetland Management Plan to the satisfaction of the DoE and the City of South Perth which will include:</p> <ol style="list-style-type: none"> <li>1. Identification of existing wetland area to be retained;</li> <li>2. Avoiding direct and minimising indirect impacts on the wetland;</li> <li>3. Ensuring no net loss of wetland values and functions;</li> <li>4. Rehabilitation techniques to be employed;</li> </ol>	<p>Preparation prior to construction.</p> <p>Implementation to be as determined in schedule within the Wetland Management Plan.</p>	City of South Perth

No.	Topic	Objective	Action	Timing	Advice
			<ol style="list-style-type: none"> <li>5. Selection of appropriate local wetland and dryland species to maintain and enhance existing habitats;</li> <li>6. Mitigation strategies for loss of any vegetation will be investigated, including both on-site and off-site options;</li> <li>7. Creation of a new wetland area to be located adjacent to the existing wetland and the river foreshore suitable for Black Swan breeding habitat;</li> <li>8. adopt existing mosquito and midge management protocols currently utilised by the City of South Perth;</li> <li>9. Monitoring criteria to determine the success of the plan;</li> <li>10. Progress and compliance reporting; and</li> <li>11. Timing and implementation schedule.</li> </ol>		
4.	Groundwater Management	<p>To ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.</p> <p>To determine the potential impacts of dewatering during the construction phase on the vegetation within the wetland areas, Canning River and groundwater quality.</p>	<p>(1) Prepare and implement a Groundwater Management Plan as a component of the CEMP to the satisfaction of the DoE, SRT and Water Corporation which will include:</p> <ol style="list-style-type: none"> <li>1. Determining the nature and extent of groundwater contamination;</li> <li>2. Installation of 2 additional monitoring bores;</li> <li>3. Quarterly sampling of both additional and existing monitoring bores for a 12-month period;</li> <li>4. Groundwater flow characteristics; and</li> <li>5. Groundwater contamination plume management.</li> </ol> <p>(2) Develop a Dewatering Program as a component of the CEMP to the satisfaction of the DoE.</p>	<p>Preparation of Groundwater Management Plan and Dewatering Program prior to construction.</p> <p>Implementation as per Plan/Program.</p> <p>Construction works to be timed and staged to minimise the volume of dewatering required.</p>	SRT Water Corporation

No.	Topic	Objective	Action	Timing	Advice
5.	Drainage, Nutrient, Irrigation and Water Quality Management	<p>To maintain acceptable water quality within the wetland and the Canning River in keeping with the Riverplan framework of management and best practice in urban stormwater management.</p> <p>To ensure that no road surface run-off directly enters the wetland.</p> <p>To ensure that there is provision for contaminant spillage entrapment.</p>	<p>Prepare and implement a Drainage, Nutrient, Irrigation and Water Quality Management Plan (DNIWQMP) to the satisfaction of the DoE, the SRT and the City of South Perth, which will include:</p> <ol style="list-style-type: none"> <li>1. Design and construction of the detention/infiltration basin;</li> <li>2. Periodic monitoring of the infiltration basin (post-construction) to ensure continued function and maintenance as required;</li> <li>3. Quarterly sampling of surface water body for a 12-month period;</li> <li>4. Maximising infiltration of uncontaminated stormwater at sources to recharge the groundwater system;</li> <li>5. Water conservation principles;</li> <li>6. Nutrient control;</li> <li>7. Prescribed fertilizer applications for areas of POS;</li> <li>8. Determination of flushing requirements, associated impacts and management options;</li> <li>9. Treating contaminated stormwater via gross pollutant and sediment traps;</li> <li>10. Directing treated stormwater into the Canning River along the south-eastern corner boundary of the site (as per DoE advice);</li> <li>11. Monitoring criteria to determine the success of the plan;</li> <li>12. Develop and implement contingency measures to be implemented in the event that monitoring criteria are exceeded;</li> <li>13. Progress and compliance reporting; and</li> <li>14. Timing and implementation schedule.</li> </ol>	<p>Preparation prior to construction.</p> <p>Implementation to be as determined within the DNIWQM Plan.</p>	SRT City of South Perth
6.	Site Contamination Assessments	To determine nature and extent of any soil or groundwater contamination present within the site which may pose a risk to human health or the environment.	<p>(1) Prepare and implement a Site Remediation (Contaminated Soils) Management Plan as a component of the CEMP to the satisfaction of the DoE.</p> <p>(2) Areas of soil identified as contaminated in excess of EIL or HIL criteria will be excavated (if directed by DoE) and the base and walls of the excavations validated in accordance with relevant DoE Guidelines for the Remediation of Contaminated Land.</p>	Preparation and implementation prior to site works in areas identified in the DSI as potentially contaminated.	DoH Worksafe City of South Perth City of Canning

No.	Topic	Objective	Action	Timing	Advice
			<p>(3) The excavated soil will then be assessed to determine the appropriate management option. A final decision on the management of excavated contaminated soils will be made once analytical results are available for excavated soil.</p> <p>(4) An alternative that may be considered is to screen the material to remove geotechnically unsuitable materials and then re-use the material as fill in appropriate areas on the site, such as POS.</p> <p>(5) A remediation assessment report will be submitted to DoE on conclusion of remediation works which provides detailed information on:</p> <ol style="list-style-type: none"> <li>1. The remediation strategy implemented;</li> <li>2. The results of validation and stockpile sampling; and</li> <li>3. Details of the management of all contaminated material.</li> </ol> <p>(6) Where areas have been identified as potentially affected by asbestos cement sheeting, prepare a specific Health and Safety Plan.</p> <p>This plan will be prepared as an appendix to the overall Site Remediation Management Plan.</p>	Before works commence	
7.	Water Conservation Principles	To conserve water.	<p>Water conservation measures will be applied within the development. These include:</p> <ol style="list-style-type: none"> <li>1. Promoting the use of plant species which have low water and fertiliser requirements;</li> <li>2. Utilising local native plant varieties in landscaping;</li> <li>3. Promoting landscape treatments sympathetic to climatic conditions and prevailing site conditions – soil types, topography, environment, wetlands etc.;</li> <li>4. Utilising "cluster or clump" plantings to provide useable shade areas and better use of reticulated water in preference to single item or symmetrical planting regimes;</li> <li>5. Irrigating POS areas at appropriate times so as to reduce evaporative loss and minimise transpiration losses; and</li> <li>6. Ensuring that the irrigation regime applied to areas of POS is responsive to prevailing weather conditions.</li> </ol>	To be considered within preparation of the Foreshore Management Plan, Groundwater Management Plan and the DNIWQMP (Commitments 3 and 9).	SRT City of South Perth

No.	Topic	Objective	Action	Timing	Advice
8.	Noise	To protect the amenity of nearby residents from noise impacts resulting from activities associated with the proposal by ensuring that the noise levels meet statutory requirements and acceptable standards.	<p>Noise Management Procedures will be prepared for the site as part of the overall CEMP (see commitment 1).</p> <p>Measures to minimise noise levels received by proposed residences within the development from existing roadways will include:</p> <ol style="list-style-type: none"> <li>1. Construction of noise barriers between the roadway and residential lots;</li> <li>2. Specifying appropriate setbacks of proposed residences from existing roadways; and</li> <li>3. Specification of construction methods and materials (in keeping with “quiet house design” principles).</li> </ol>	<p>Prepared and approved prior to construction. Implemented during construction.</p> <p>Audits completed during construction works and post-construction.</p>	City of South Perth City of Canning
9.	Dust	To protect the surrounding land users such that dust and particulate emissions will not adversely impact on their welfare and amenity or cause health problems in accordance with the EPA’s Guidance Statement No. 18: Prevention of Air Quality Impacts from Land Development Sites.	<p>(1) Dust generated during construction will be minimised by the application of EPA guidelines and best practice in dust suppression.</p> <p>(2) Dust Management Procedures will be prepared for the site as part of the overall CEMP (see commitment 1).</p> <p>Measures to minimise dust levels will include:</p> <ol style="list-style-type: none"> <li>1. Watering of exposed surfaces;</li> <li>2. Minimising working surfaces at any one time; and</li> <li>3. Progressive rehabilitation of disturbed areas.</li> </ol>	<p>Prepared and approved prior to construction. Implemented during construction.</p> <p>Audits to be completed during construction works and post-construction.</p>	City of South Perth City of Canning
10.	Acid Sulfate Soil (ASS)	To plan and manage development that may potentially impact on ASS to avoid adverse effects on the natural and built environment and human activities and health.	<p>Prepare and implement an Acid Sulfate Soil Management Plan as a component of the CEMP (see commitment 1) to the satisfaction of the DoE, which will include:</p> <ol style="list-style-type: none"> <li>1. The area of PASS soils to be disturbed by excavation or dewatering will be minimised as far as possible;</li> <li>2. Where ASS must be disturbed: <ul style="list-style-type: none"> <li>• Earthworks will be completed as quickly as possible to minimise the time that the walls and base of excavations are exposed to the atmosphere;</li> </ul> </li> </ol>	<p>Prepared prior to commencement of any earthworks or dewatering in areas identified as having potential for Acid Sulfate Soils.</p> <p>To be implemented during construction.</p>	SRT

No.	Topic	Objective	Action	Timing	Advice
			<ul style="list-style-type: none"> <li>• Un-neutralised ASS/PASS will be stored for only limited periods on on-site bunded hardstand areas constructed from alkaline materials;</li> <li>• The quality of groundwater and dewatering effluents will be monitored regularly to ensure early detection of any alteration in water chemistry; and</li> <li>• if necessary, dewatering effluent will be treated to ensure that appropriate water quality is maintained; and</li> </ul> <p>3. Where excavated soils must be directed for off-site disposal, they will be directed to a site approved for acceptance and/or treatment of ASS by the DoE.</p>		
11.	Archaeological Investigations	To fulfil the requirements stipulated on the Section 18 clearance of the <i>Aboriginal Heritage Act 1972</i> .	<p>(1) Apply for clearance under Section 18 of the <i>Aboriginal Heritage Act 1972</i> to remove both previously recorded sites and any new sites that emerge as a result of earthmoving procedures located within the site which will be impacted by the development.</p> <p>(2) Also undertake further archaeological investigations if required as part of the Section 18 clearance. Such investigations may include:</p> <ol style="list-style-type: none"> <li>1. Surface recording, mapping and collection of archaeological material;</li> <li>2. Archaeological excavation and/or sub-surface evaluation;</li> <li>3. Recovery of samples for radiometric dating; and</li> <li>4. Analysis of recovered material.</li> </ol>	Site Heritage Protocol will be prepared prior to commencement of construction and implemented during construction, with any statutory processes followed as per the requirements of the <i>Aboriginal Heritage Act 1972</i> .	DIA

#### Abbreviations:

ASS - Acid sulfate soils  
 CAMBA – China-Australia Migratory Birds Agreement  
 CALM - Department of Conservation and Land Management  
 DIA - Department of Indigenous Affairs  
 DoE - Department of Environment  
 DoH - Department of Health

Assessment No. 1467

**Abbreviations continued:**

DPI – Department for Planning & Infrastructure  
DSI – Detailed site investigation  
EIL – Ecological Investigation Levels  
HIL – Health Investigation Levels  
JAMBA - Japan-Australia Migratory Birds Agreement  
PASS – Potential acid sulfate soils  
POS – Public Open Space  
SRT - Swan River Trust

# Appendix B Site Summary Form and Certificates of Title

**Dust and Asbestos Management Plan  
Cygnia Cove, Waterford**

## Site Summary Form – Contaminated Site Assessment

For completion by the person(s) submitting a report(s) to be assessed by the Department of Environment and Conservation (DEC) as per the information requirements of the DEC *Reporting on Site Assessments (2001)* guideline. Completing this form enables DEC to maintain accurate records for the site.

Please note: A completed site summary form must accompany each report submitted to DEC for assessment.  
Each box must be filled out appropriately. Please do not write "refer to report" in any section.  
Copies of all relevant/current Certificates of Title must accompany this form.

Site location details:

Site name (e.g. where site may be known by a common/  
business name)

East Clontarf Subdivision

Lot no. 9001, 829, 83

House no. N/A

Street

Manning Road

Suburb

Waterford

State

WA

Postcode

6152

Crown Reserve (if applicable)

N/A

Certificate(s) of Title (or  
equivalent)

Lot 9001 on Deposited Plan 44883, Volume 2598 Folio 42;  
Lot 829 on Diagram 88770, Volume 2048 Folio 180; and  
Lot 83 on Plan 2461, Volume 2048 Folio 181.

Where the subject site comprises of multiple certificates of title, please list all certificates:

Where substances have migrated beyond the cadastral boundaries of the subject site, please provide the addresses, relevant Certificates of Title documentation and owners details for all offsite properties impacted (includes soil and/or groundwater), as an attachment to this form.

Is a hard copy of Certificate of Title and associated sketch for all listed sites attached? (Y/N) Yes

WAPC reference no. (where applicable)

Condition 8 of Ministerial Statement 692

Current Owner/Occupier details:

Site owner (Name and  
address)

Trustees of the Christian Brothers in WA, 53 Redmond Street, Manning

Site owner company ACN/ABN

Site occupier (name and  
address)

N/A – Site is currently unoccupied

Site occupier company ACN/ABN

N/A

Site status (at time of reporting):

Proposed land use (e.g. high density residential/child care  
facility)

Residential

Identified substances and relevant media  
(e.g. benzene in soil and groundwater, xylene in  
soil only)

Asbestos (uncontrolled fill), dieldrin, arsenic, cadmium, chromium and lead identified in soil. Acid Sulphate Soils identified. Marginally elevated concentrations of ammonia, chloride, copper, hydrogen sulphide, iron, selenium, zinc, manganese, nitrate, total nitrogen, phosphate and TDS recorded in groundwater exceeding FWG/ADWG/LTIWG. No contaminants exceeded the STIWG.

## Site Summary Form – Contaminated Site Assessment

For completion by the person(s) submitting a report(s) to be assessed by the Department of Environment and Conservation (DEC) as per the information requirements of the DEC *Reporting on Site Assessments (2001)* guideline. Completing this form enables DEC to maintain accurate records for the site.

Asbestos (Y/N)	<input type="text" value="Y"/>	Health Risk Assessment (Y/N)	<input type="text" value="N"/>	Community health concerns identified (Y/N)	<input type="text" value="N"/>	Radiological issues (Y/N)	<input type="text" value="N"/>
Air quality issues (Y/N)	<input type="text" value="N"/>	Past/present landfill (Y/N)	<input type="text" value="N"/>	Potential human exposure to identified substances > DEC's health investigation levels or equivalent (y/n)	<input type="text" value="N"/>	Other human health issues (Y/N)	<input type="text" value="Y"/>

Specify other health issues:

Where 'yes' is recorded for at least one of the above categories, please submit two copies of the report(s) (relevant documentation) to DEC for referral to the Department of Health (or Radiological Council, in the case of radiological issues)

Are site activities licensed under the Environmental Protection Act 1986? (Y/N)

N/A

Where laboratory analysis has been undertaken, is the laboratory NATA accredited for all analytes and analytical methodologies used? (Y/N) (If not, why not?)

Yes

Community Consultation: (as per the DEC's Community Consultation (December 2006) guideline)

Community consultation program commenced/proposed (Y/N)

Yes

Are consultation program details (e.g. community consultation plan) provided in attached report (Y/N)

Yes

History of Investigation:

Have previous site investigations been undertaken? (Y/N - if yes, please provide details below)

Yes

Report title, date and author:

- Environmental Assessment, East Clontarf, Manning (ATA, 2001). ATA Environmental Report 2000/179. Prepared for Trustees of the Christian Brothers, January 2001.
- Preliminary Assessment, East Clontarf, Manning (ATA, 2002a). ATA Environmental Report 2002/47. Prepared for Trustees of the Christian Brothers, May 2002.
- Remediation Report, Asbestos Contamination, Clontarf Aboriginal College, Manning (ATA, 2002b). ATA Environmental Report 2002/122. Prepared for Trustees of the Christian Brothers, September 2002.
- Detailed Soil/Groundwater Contamination and Preliminary Acid Sulphate Soils Investigation, Sampling and Analysis Program (ATA, 2002c). ATA Environmental Report 2002/147. Prepared for Trustees of the Christian Brothers, December 2002.
- Preliminary Acid Sulphate Soils Investigation, East Clontarf, Manning (ATA, 2003a). ATA Environmental Report 2003/115. Prepared for Trustees of the Christian Brothers, August 2003.
- Detailed Soil and Groundwater Investigation, East Clontarf, Waterford (ATA, 2003b). ATA Environmental Report 2003/144. Prepared for Trustees of the Christian Brothers, December 2003.



## Site Summary Form – Contaminated Site Assessment

For completion by the person(s) submitting a report(s) to be assessed by the Department of Environment and Conservation (DEC) as per the information requirements of the DEC *Reporting on Site Assessments (2001)* guideline. Completing this form enables DEC to maintain accurate records for the site.

### Declaration:

The information contained in this site summary form is a true representation of the information contained in the attached report(s)/document(s).

Full name (print)

Position held

Signature  Date

Please ensure that a hardcopy of the current Certificate(s) of Title and associated sketch accompanies the site summary form. DEC cannot proceed with the assessment of the report if this information is not provided.

### DEC Registrar Only

Registrar name:  Signature:

CoT verified (Y/N)  Owner details verified (Y/N)  Complete form (Y/N)

Awaiting Classification (Y/N)

Awaiting Re-Classification (Y/N)

Incomplete Form (Y/N)

LWQB Assessment Officer:

Comments/Actions:

Date of data entry:

WESTERN



AUSTRALIA

# RECORD OF CERTIFICATE OF TITLE UNDER THE TRANSFER OF LAND ACT 1893

REGISTER NUMBER <b>9001/DP44883</b>	
DUPLICATE EDITION <b>1</b>	DATE DUPLICATE ISSUED <b>29/7/2005</b>

VOLUME  
**2598**FOLIO  
**42**

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

*RG Roberts*  
REGISTRAR OF TITLES



## LAND DESCRIPTION:

LOT 9001 ON DEPOSITED PLAN 44883

## REGISTERED PROPRIETOR: (FIRST SCHEDULE)

TRUSTEES OF THE CHRISTIAN BROTHERS IN WESTERN AUSTRALIA INC OF 53 REDMOND STREET,  
MANNING

(AF J356146) REGISTERED 11 JULY 2005

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

1. A204584 EASEMENT TO CITY OF SOUTH PERTH - SEE SKETCH ON DEPOSITED PLAN 44883. REGISTERED 8.5.1969.
2. C225053 EASEMENT TO METROPOLITAN WATER SUPPLY, SEWERAGE AND DRAINAGE BOARD. SEE DEPOSITED PLAN 44883. REGISTERED 29.9.1981.
3. E874859 EASEMENT TO THE WATER AUTHORITY OF WESTERN AUSTRALIA - SEE DEPOSITED PLAN 44883. REGISTERED 6.5.1992.
4. H480522 EASEMENT TO WATER CORPORATION. SEE DEPOSITED PLAN 44883. REGISTERED 22.6.2000.
5. \*I080093 MEMORIAL HERITAGE OF WESTERN AUSTRALIA ACT 1990. AS TO PORTION ONLY. SEE DEPOSITED PLAN 44883. LODGED 19.4.2002.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.  
\* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.  
Lot as described in the land description may be a lot or location.

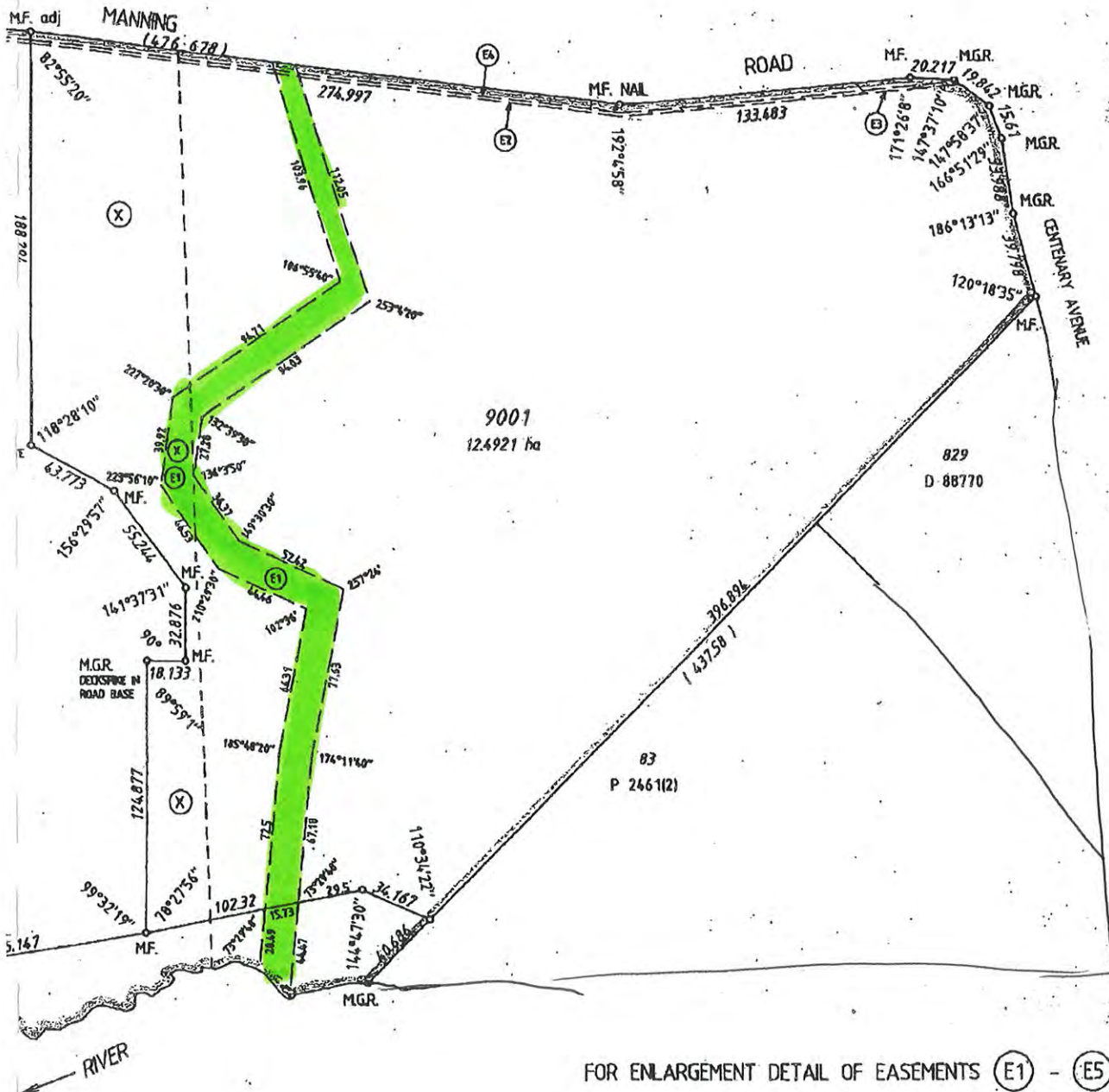
-----END OF CERTIFICATE OF TITLE-----

## 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: DP44883.  
PREVIOUS TITLE: 2222-238.  
PROPERTY STREET ADDRESS: NO STREET ADDRESS INFORMATION AVAILABLE.  
LOCAL GOVERNMENT AREA: CITY OF SOUTH PERTH.

DP 44883 (01)



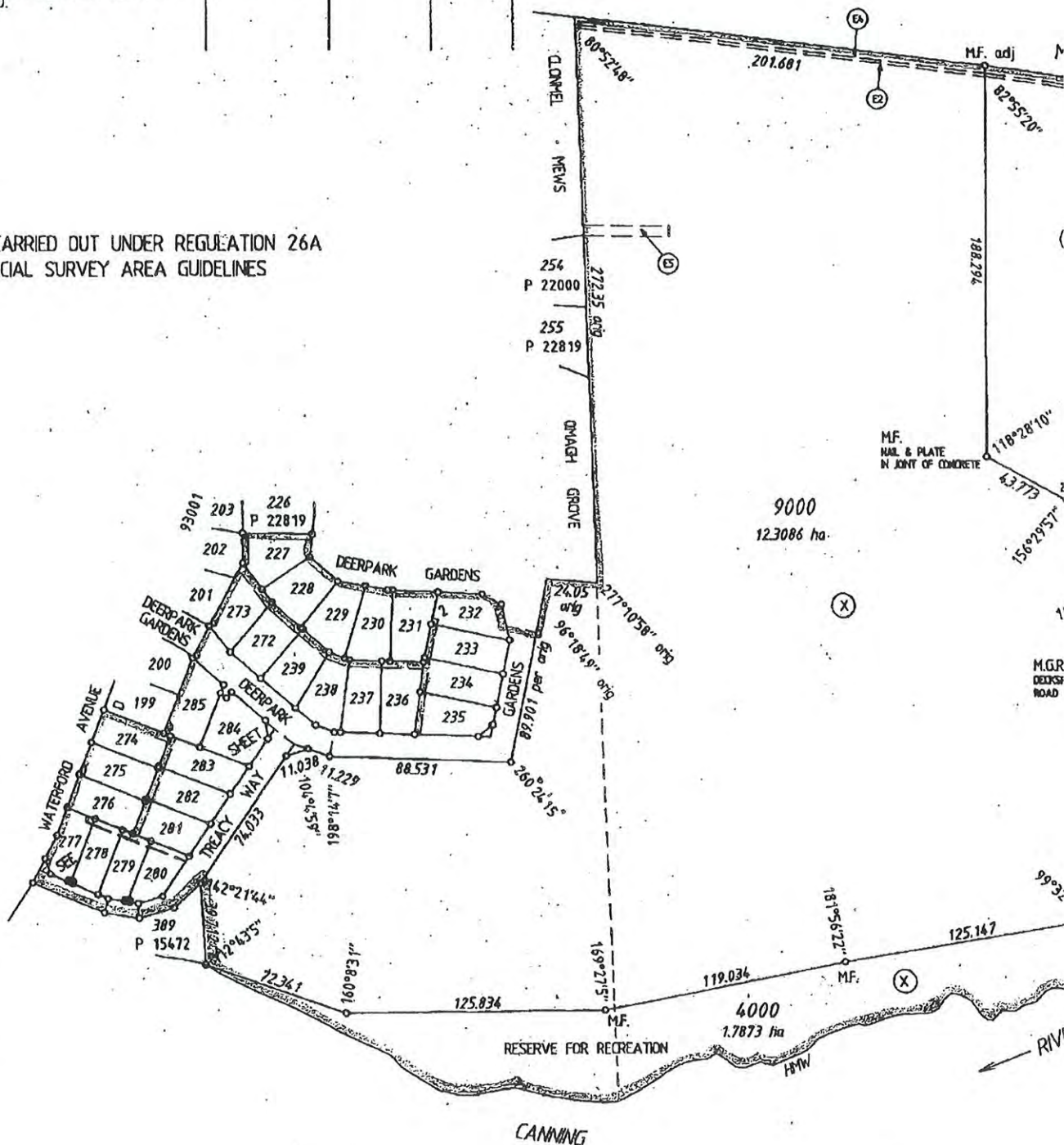
**SPECIAL  
SURVEY AREA  
SUBDIVISION**

LOT	FORMER PI/TENURE	ON PLAN / DIAGRAM	TITLE
227-239, 272-274, 282-285 & 9001	Pt LOT 501	DP 30878	2222 - 238
277-279	Pt LOT 17	P 3383(2)	2205 - 650
275, 276, 280, 281 & 4000	Pt LOT 17 Pt LOT 501	P 3383(2) DP 30878	2205 - 650 2222 - 238
9000	Pt LOT 17 LOT 500	P 3383(2) DP 30878	2205 - 650 2222 - 237

Reg 54 I hereby certify the survey and / or the field book lodged agrees with the is lodged. 10-2-05 Date	LOGGED DATE 10-2-05 FEE PAID \$1662 ASSESS No. 4446732	TYPE OF VALIDATION FULL AUDIT LEGAL COMPONENT DOCKET 44217 CERTIFIED CORRECT 11-4-05 I.R.C. F.S.C. 162-2005	IN ORDER FOR DEALINGS SUBJECT TO Application to Surrender pursuant to Sec 40(2)(b), Sec 205(5) of LGA, Sec 20 A & Sec 27A of J.P.O.D. Act & Sec 70 A of T.L.A. J. Gheorghiade 11-7-05 FOR REGISTRAR OF PLANS & SURVEYS / AUTHORIZED LAND OFFICER	DEPARTMENT OF Land Information DEPOSITED PLAN 44883 SHEET 1 OF 5 EDITION 1 VERSION 3
	APPROVED BY WESTERN AUSTRALIAN PLANNING COMMISSION FILE 118831 DELEGATED UNDER 320 WAPC ACT 1995 DATE 8-7-2005	APPROVED REG 26A (4) 11.07.2005 INSPECTOR OF PLANS & SURVEYS / AUTHORIZED LAND OFFICER		

ED/VER.	AMENDMENT	BY	SIGNATURE	DATE
1-2	REGULATION 6 SEWERAGE EASEMENTS IN LOTS 276 & 277 AMENDED.	Hope & Ptnrs	RLP	8-4-2005
1/3	SURVEY SHEET (ALSO SHOWING NON STANDARD MARKING) BEING SHEET 5 NOW LODGED.	DLI		11-7-2005

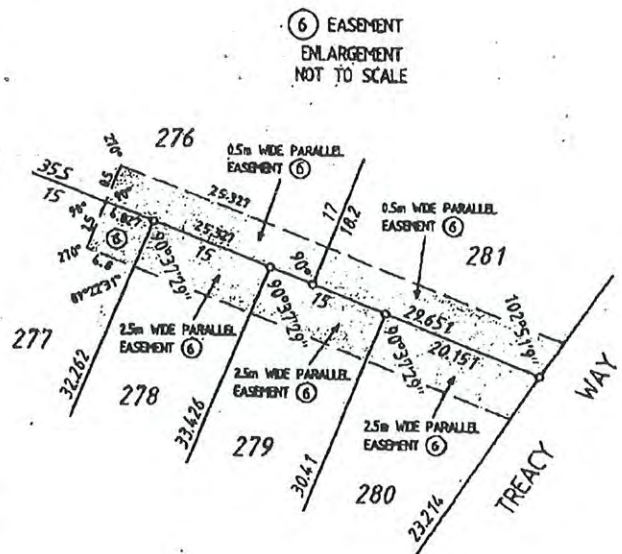
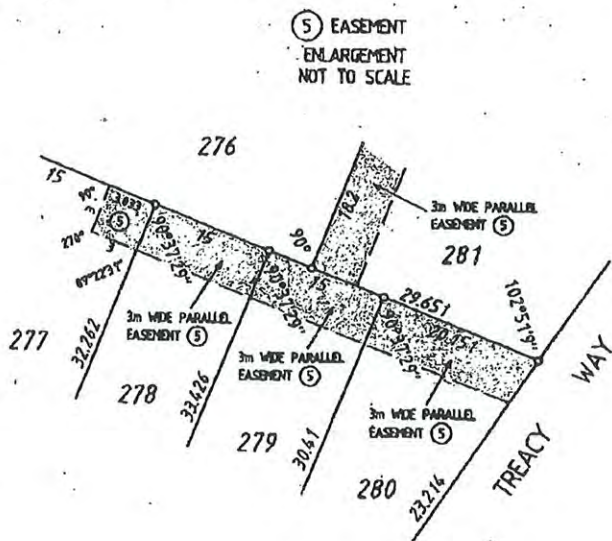
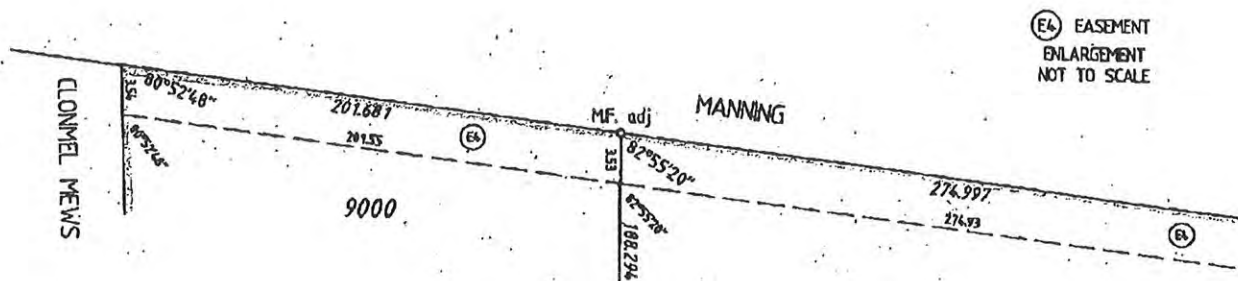
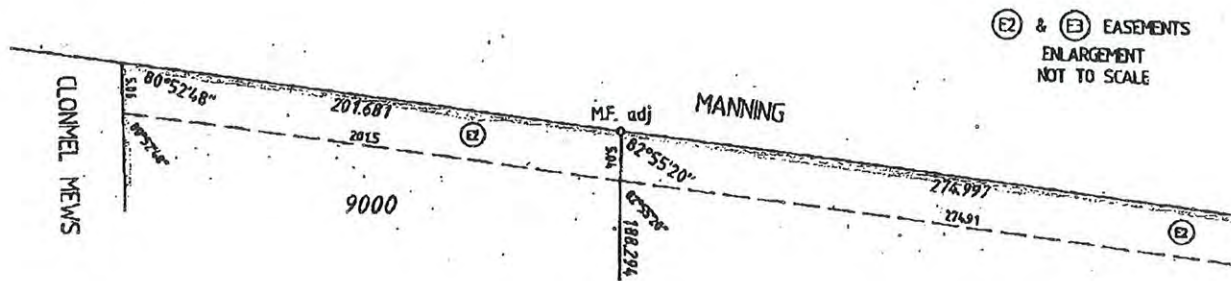
SURVEY CARRIED OUT UNDER REGULATION 26A  
SPECIAL SURVEY AREA GUIDELINES



FOR INTERESTS AND NOTIFICATIONS SEE SHEET 4

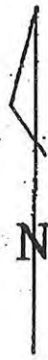
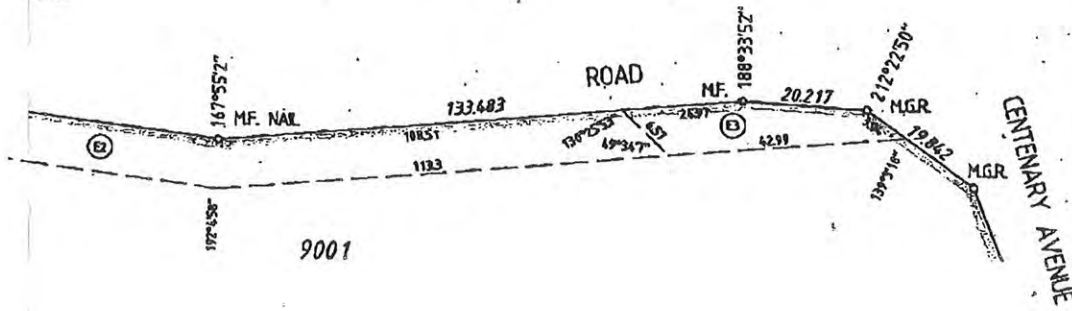
TYPE..... FREEHOLD	FORMER TENURE SEE TABLE	SCALE 1 : 2000 ALL DISTANCES ARE IN METRES
PURPOSE..... SUBDIVISION	ON INDEX BG34(2) 15.17, 15.18	<b>SURVEYOR'S CERTIFICATE - Reg 54</b> I, J. D. LUTLEY, hereby certify that this is a correct representation of the survey and calculations from measurements recorded in the field book for the purposes of this plan and that it complies with the relevant written law in relation to which it is lodged. J. D. Lutley Licensed Surveyor Date 10-2-
PLAN OF LOTS 227-239, 272-285, 4000, 9000, 9001, ROADS & EASEMENTS		
DISTRICT..... CANNING	FIELD BOOK 94952	SURVEY FIRM P G S HOPE & PARTNERS PTY LTD 11/24 THOROGOOD STREET VICTORIA PARK WA 6100 Ph 9470 1229 Fax 9470 1280 Email pgs@inet.net.au
FILE.....	TOWNSITE.....	
LOCAL AUTHORITY..... CITY OF SOUTH PERTH	LOCALITY..... WATERFORD	

FOR HEADING SEE SHEET

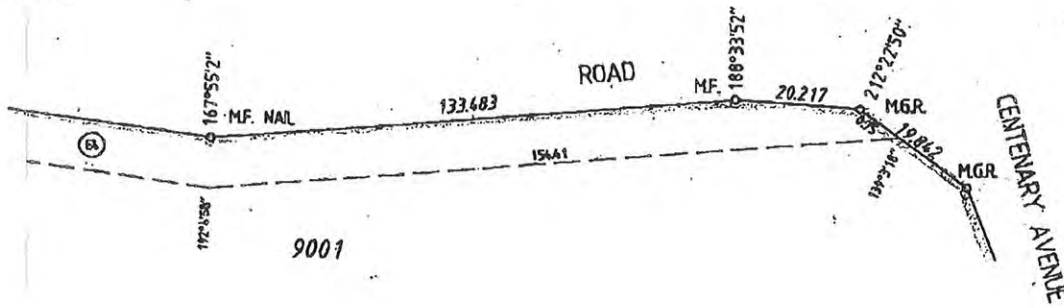


SEE SHEET 1

EASEMENTS  
EMENT  
SCALE



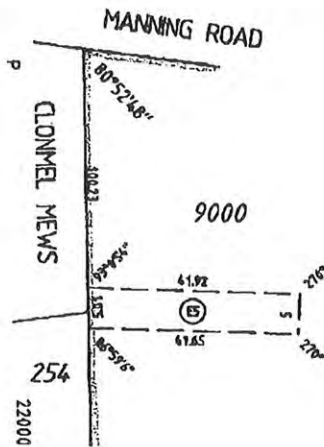
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(E1) EASEMENT  
ENLARGEMENT  
NOT TO SCALE



(E5) EASEMENT  
ENLARGEMENT  
NOT TO SCALE



SCALE NOT TO SCALE

ALL DISTANCES  
ARE IN METRES

*J. D. Luty* 10-2-05  
Licensed Surveyor Date

APPROVED BY  
WESTERN AUSTRALIAN PLANNING COMMISSION

FILE 118831

DELEGATED UNDER S20 WAPC ACT 1985

DATE 8-7-2005

SHEET 3 OF 5

EDITION 1 VERSION 3



Department of  
Land Information

DEPOSITED PLAN

44883

FOR HEADING SEE SHEET

## INTERESTS AND NOTIFICATION

SUBJECT	PURPOSE	STATUTORY REFERENCE	ORIGIN	LAND BU
(E1)	EASEMENT		DOC ( A204584 )	LOTS 4000
(E2)	EASEMENT		DOC ( C225053 )	LOTS 9000
(E3)	EASEMENT		DOC ( E874859 )	LOT 9
(E4)	EASEMENT		DOC ( H480522 )	LOTS 9000
(E5)	EASEMENT		DOC ( H281804 )	LOT 9
(X)	MEMORIAL	SEC 56(1) HERITAGE OF W.A. ACT 1990	DOC ( 1080093 )	LOTS 9000, 90
(5)	EASEMENT (DRAINAGE)	SEC 27A OF THE T.P. & D. ACT. REG 5	THIS PLAN	LOTS 227, 272-274 &
(6)	EASEMENT (SEWERAGE)	SEC 27A OF THE T.P. & D. ACT. REG 6.	THIS PLAN	LOTS 27
LOT 4000	RESERVE FOR RECREATION NOTIFICATION	VEST IN CROWN UNDER SEC 20A OF THE T.P. & D. ACT SECTION 70A OF THE T.L.A.	THIS PLAN DOC ( J356147 )	LOTS 227-239

E SHEET 1



## NOTIFICATIONS

LAND BURDENED	BENEFIT TO	COMMENTS
LOTS 4000 & 9001	CITY OF SOUTH PERTH	SEE NOTE 'Z'
LOTS 9000 & 9001	SEE DOCUMENT	SEE NOTE 'Z'
LOT 9001	SEE DOCUMENT	SEE NOTE 'Z'
LOTS 9000 & 9001	SEE DOCUMENT	SEE NOTE 'Z'
LOT 9000	WATER CORPORATION	
LOTS 9000, 9001 & 4000	HERITAGE COUNCIL OF W.A.	
LOTS 227, 232-239, 272-274 & 277-283	CITY OF SOUTH PERTH	
LOTS 276-281	WATER CORPORATION	
LOTS 227-239 & 272-285		CITY OF SOUTH PERTH

NOTE 'Z'

THE EASEMENT DIMENSIONS AND POSITION ON THIS PLAN IS AN INTERPRETATION. SEE ORIGINAL DOCUMENT.

## SCALE

ALL DISTANCES  
ARE IN METRES

*J. D. Lacey* 10-2-05  
 Licensed Surveyor Date

APPROVED BY  
WESTERN AUSTRALIAN PLANNING COMMISSION

FILE 118831

DELEGATED UNDER S.20 WAPC ACT 1985

DATE 8-7-2005

SHEET 4 OF 5

EDITION 1 VERSION 3

Department of  
Land Information

DEPOSITED PLAN

44883

WESTERN



AUSTRALIA

REGISTER NUMBER <b>9000/DP44883</b>	
DUPLICATE EDITION <b>1</b>	DATE DUPLICATE ISSUED <b>29/7/2005</b>

# RECORD OF CERTIFICATE OF TITLE

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*RG Roberts*

REGISTRAR OF TITLES



## LAND DESCRIPTION:

LOT 9000 ON DEPOSITED PLAN 44883

## REGISTERED PROPRIETOR: (FIRST SCHEDULE)

TRUSTEES OF THE CHRISTIAN BROTHERS IN WESTERN AUSTRALIA INC OF 53 REDMOND STREET,  
MANNING

(AF J356146 ) REGISTERED 11 JULY 2005

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

1. C225053 EASEMENT TO METROPOLITAN WATER SUPPLY, SEWERAGE AND DRAINAGE BOARD. SEE DEPOSITED PLAN 44883. REGISTERED 29.9.1981.
2. H281804 EASEMENT TO WATER CORPORATION. SEE DEPOSITED PLAN 44883. REGISTERED 16.11.1999.
3. H480522 EASEMENT TO WATER CORPORATION. SEE DEPOSITED PLAN 44883. REGISTERED 22.6.2000.
4. H896290 LEASE TO MARR MOODITJ FOUNDATION INC OF 295 MANNING ROAD, WATERFORD EXPIRES: SEE LEASE. AS TO PORTION ONLY. REGISTERED 12.10.2001.
5. \*H933669 CAVEAT BY THE LOTTERIES COMMISSION AS TO PORTION ONLY. LODGED 21.11.2001.
6. \*1080093 MEMORIAL. HERITAGE OF WESTERN AUSTRALIA ACT 1990. AS TO PORTION ONLY. SEE DEPOSITED PLAN 44883. LODGED 19.4.2002.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.

\* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.  
Lot as described in the land description may be a lot or location.

-----END OF CERTIFICATE OF 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: DP44883.  
PREVIOUS TITLE: 2222-237, 2205-650.  
PROPERTY STREET ADDRESS: NO STREET ADDRESS INFORMATION AVAILABLE.  
LOCAL GOVERNMENT AREA: CITY OF SOUTH PERTH.

<div style="border: 1px solid black; padding: 5px; display: inline-block;"> <b>SPECIAL SURVEY AREA SUBDIVISION</b> </div>		<b>IN ORDER FOR DEALINGS</b>	
<p>LOT</p> <p>FORMER PI/TENURE</p> <p>ON PLAN / DIAGRAM</p> <p>TITLE</p>	<p>227-239, 272-274, 282-285 &amp; 9001</p> <p>277-279</p> <p>275, 276, 280, 281 &amp; 4000</p> <p>9000</p>	<p>Pt LOT 501</p> <p>Pt LOT 17</p> <p>Pt LOT 17</p> <p>Pt LOT 17</p> <p>Pt LOT 501</p> <p>Pt LOT 17</p>	<p>DP 30878</p> <p>P 3383121</p> <p>P 3383121</p> <p>P 3383121</p> <p>DP 30878</p> <p>DP 30878</p>
		<p>2222 - 238</p> <p>2205 - 650</p> <p>2222 - 238</p> <p>2205 - 650</p> <p>2222 - 237</p>	

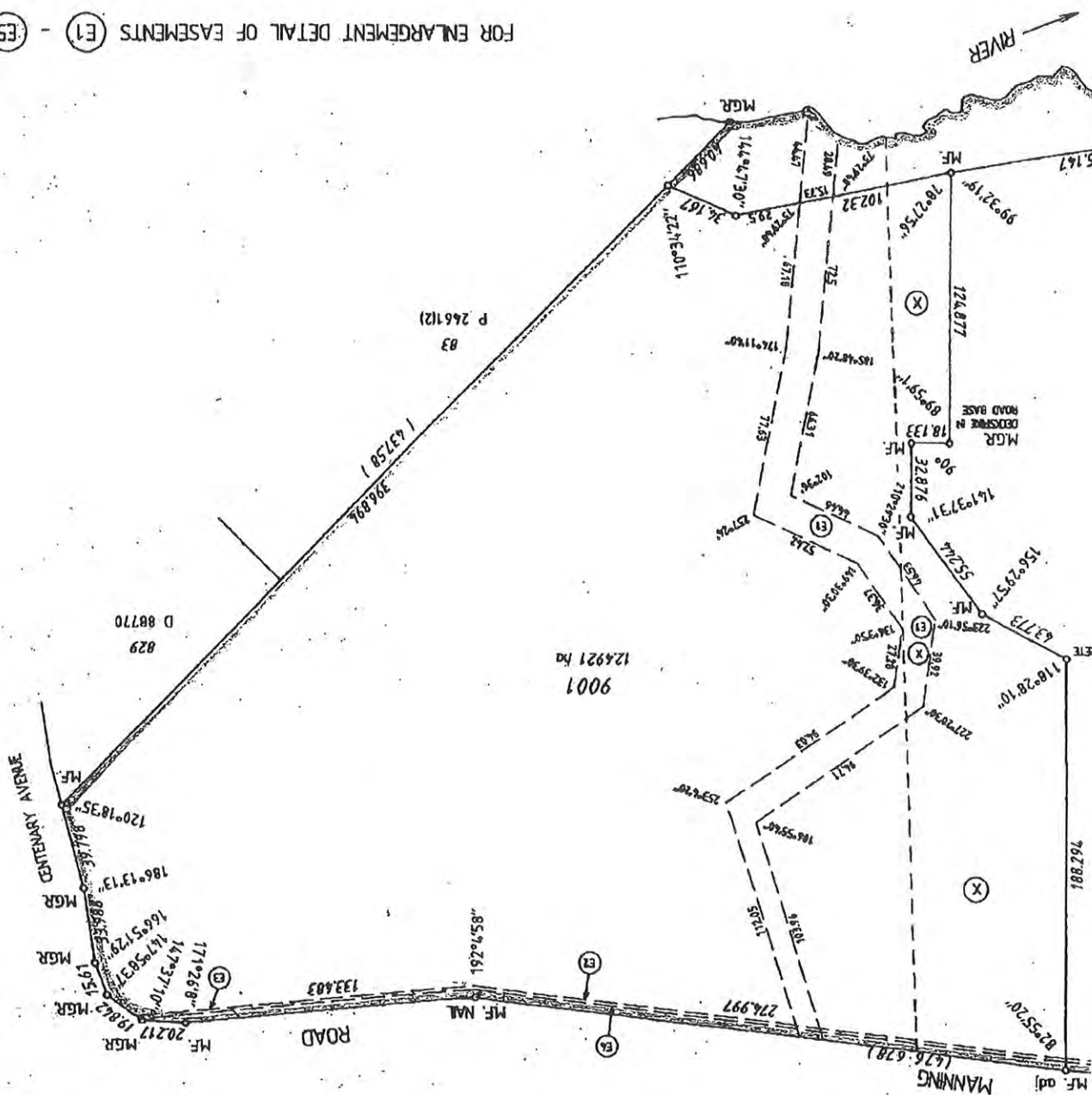
<p><b>DEPARTMENT OF LAND INFORMATION</b></p> <p><b>DEPOSITED PLAN</b></p>		<p><b>44883</b></p>	
<p>DATE 11.07.2005</p> <p>APPROVED REG 26A (4)</p> <p>FOR DEPOSITION OF PLANS &amp; SURVEYS / AUTHORIZED LAND OFFICER</p>		<p>DATE 11.7.05</p> <p>APPROVED BY <i>J. Blomquist</i></p> <p>FOR DEPOSITION OF PLANS &amp; SURVEYS / AUTHORIZED LAND OFFICER</p>	

<p><b>TYPE OF VALIDATION</b></p>		<p><b>LOADED</b></p>	
<p>FULL AUDIT</p> <p>LEGAL COMPONENT</p> <p>DOCKET 46217</p> <p>CORRECTED 11.4.05</p> <p>ASC</p> <p>FAC 162-2005</p>		<p>ASSESS NO. 446732</p> <p>FREE PAID \$1662</p> <p>DATE 18.2.05</p>	
<p>APPROVED BY</p> <p>WESTERN AUSTRALIAN PLANNING COMMISSION</p> <p>118831</p>		<p>FILE</p> <p>DELEGATED UNDER S20 WAPC ACT 1985</p> <p>8-7-2005</p>	

**SPECIAL  
SURVEY AREA  
SUBDIVISION**

FOR ENLARGEMENT DETAIL OF EASEMENTS (E1) - (E5) SEE SHEET 3



DP 44883 (01)

FOR HEADING SEE SHEET

## INTERESTS AND NOTIFICATION

SUBJECT	PURPOSE	STATUTORY REFERENCE	ORIGIN	LAND BU
(E1)	EASEMENT		DOC ( A204584 )	LOTS 4000
(E2)	EASEMENT		DOC ( C225053 )	LOTS 9000
(E3)	EASEMENT		DOC ( E874859 )	LOT 9
(E4)	EASEMENT		DOC ( H480522 )	LOTS 9000
(E5)	EASEMENT		DOC ( H281804 )	LOT 9
(X)	MEMORIAL	SEC 56(1) HERITAGE OF W.A. ACT 1990	DOC ( I080093 )	LOTS 9000, 90
(5)	EASEMENT (DRAINAGE)	SEC 27A OF THE T.P. & D. ACT. REG 5	THIS PLAN	LOTS 227, 272-274 &
(6)	EASEMENT (SEWERAGE)	SEC 27A OF THE T.P. & D. ACT. REG 6.	THIS PLAN	LOTS 27
LOT 4000	RESERVE FOR RECREATION NOTIFICATION	VEST IN CROWN UNDER SEC 20A OF THE T.P. & D. ACT SECTION 70A OF THE T.L.A.	THIS PLAN DOC ( J356147 )	LOTS 227-239

E SHEET 1



## NOTIFICATIONS

LAND BURDENED	BENEFIT TO	COMMENTS
LOTS 4000 & 9001	CITY OF SOUTH PERTH	SEE NOTE 'Z'
LOTS 9000 & 9001	SEE DOCUMENT	SEE NOTE 'Z'
LOT 9001	SEE DOCUMENT	SEE NOTE 'Z'
LOTS 9000 & 9001	SEE DOCUMENT	SEE NOTE 'Z'
LOT 9000	WATER CORPORATION	
LOTS 9000, 9001 & 4000	HERITAGE COUNCIL OF W.A.	
LOTS 227, 232-239, 272-274 & 277-283	CITY OF SOUTH PERTH	
LOTS 276-281	WATER CORPORATION	
LOTS 227-239 & 272-285		CITY OF SOUTH PERTH

NOTE 'Z'

THE EASEMENT DIMENSIONS AND POSITION ON THIS PLAN IS AN INTERPRETATION. SEE ORIGINAL DOCUMENT.

## SCALE

ALL DISTANCES  
ARE IN METRES

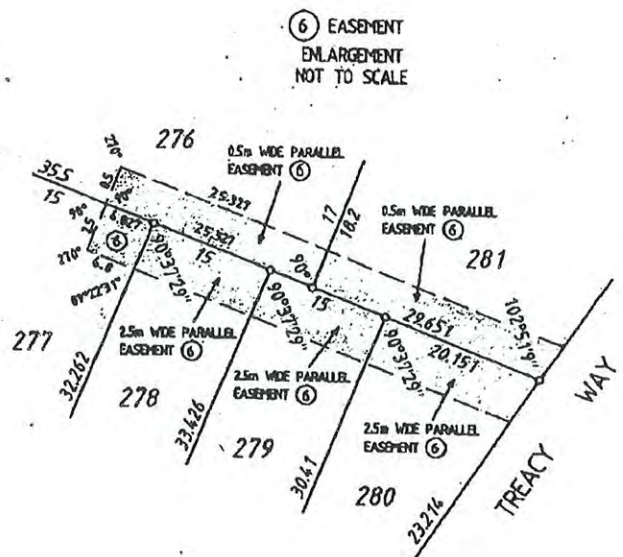
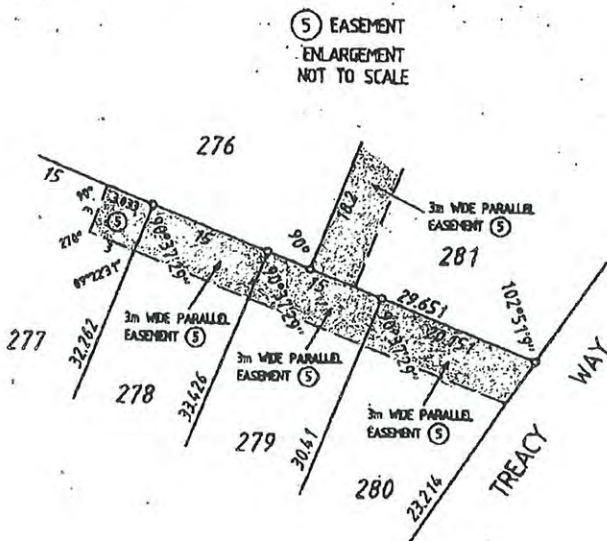
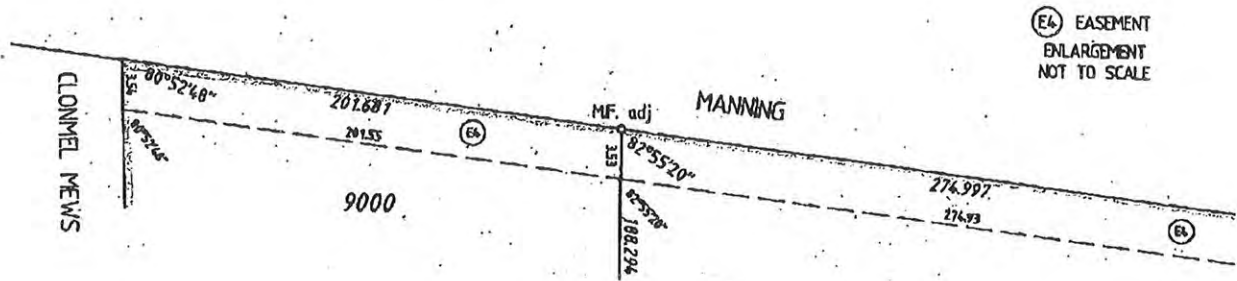
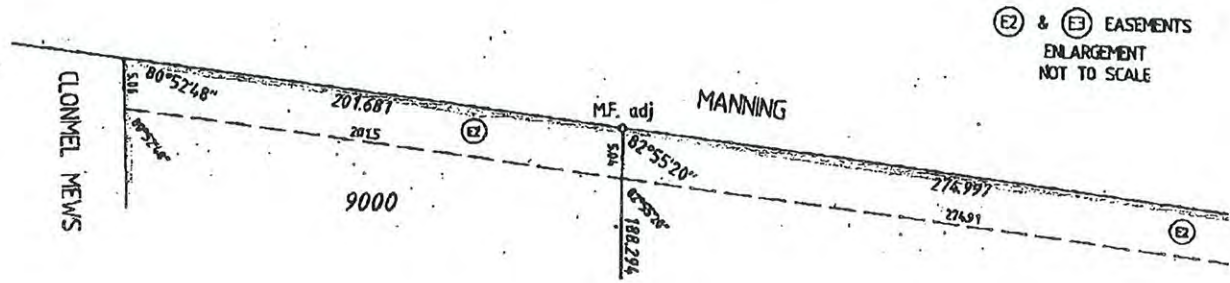
<i>J. D. Lacey</i> 10-2-05 Licensed Surveyor Date	
APPROVED BY WESTERN AUSTRALIAN PLANNING COMMISSION	
FILE 118831	
DELEGATED UNDER 8.20 WAPC ACT 1983 DATE 8-7-2005	
SHEET 4 OF 5	
EDITION 1	VERSION 3

Department of  
Land Information

DEPOSITED PLAN

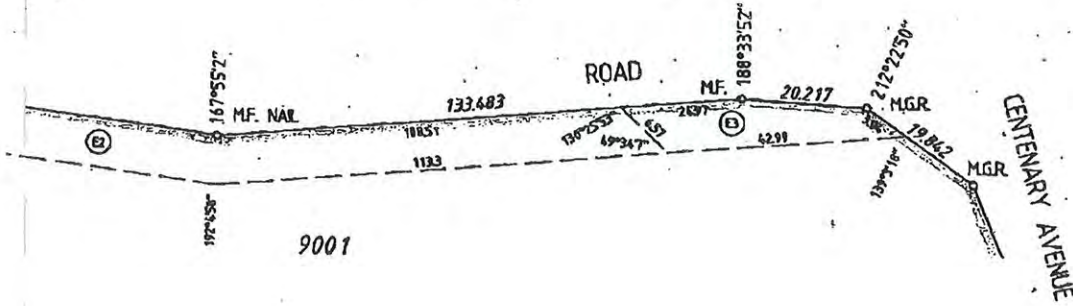
44883

FOR HEADING. SEE SHEE

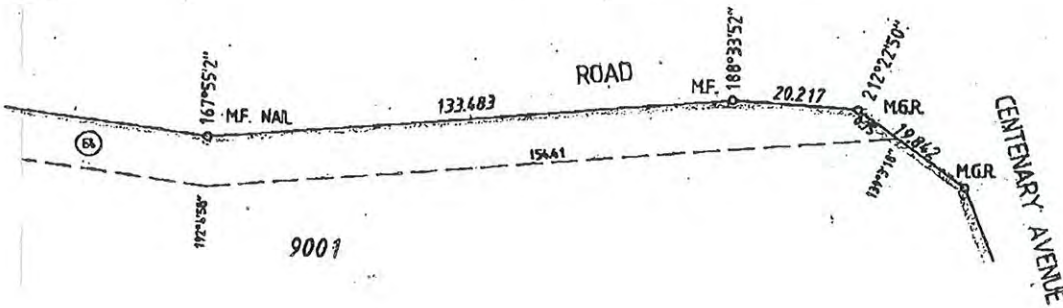


SEE SHEET 1

EASEMENTS  
EMENT  
SCALE



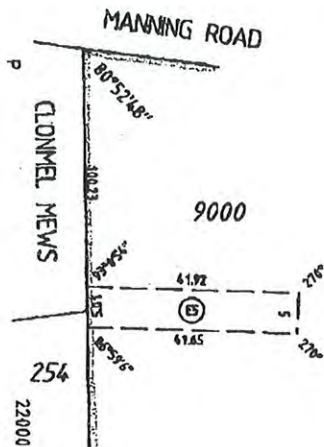
MENT  
MENT  
SCALE



(E1) EASEMENT  
ENLARGEMENT  
NOT TO SCALE



(E5) EASEMENT  
ENLARGEMENT  
NOT TO SCALE



SCALE NOT TO SCALE  
ALL DISTANCES  
ARE IN METRES

APPROVED BY WESTERN AUSTRALIAN PLANNING COMMISSION	
FILE 118831	DATE 8-7-2005
DELEGATED UNDER S20 WAPC ACT 1985	
DATE 8-7-2005	
SHEET 3 OF 5	EDITION 1 VERSION 3



Department of  
Land Information

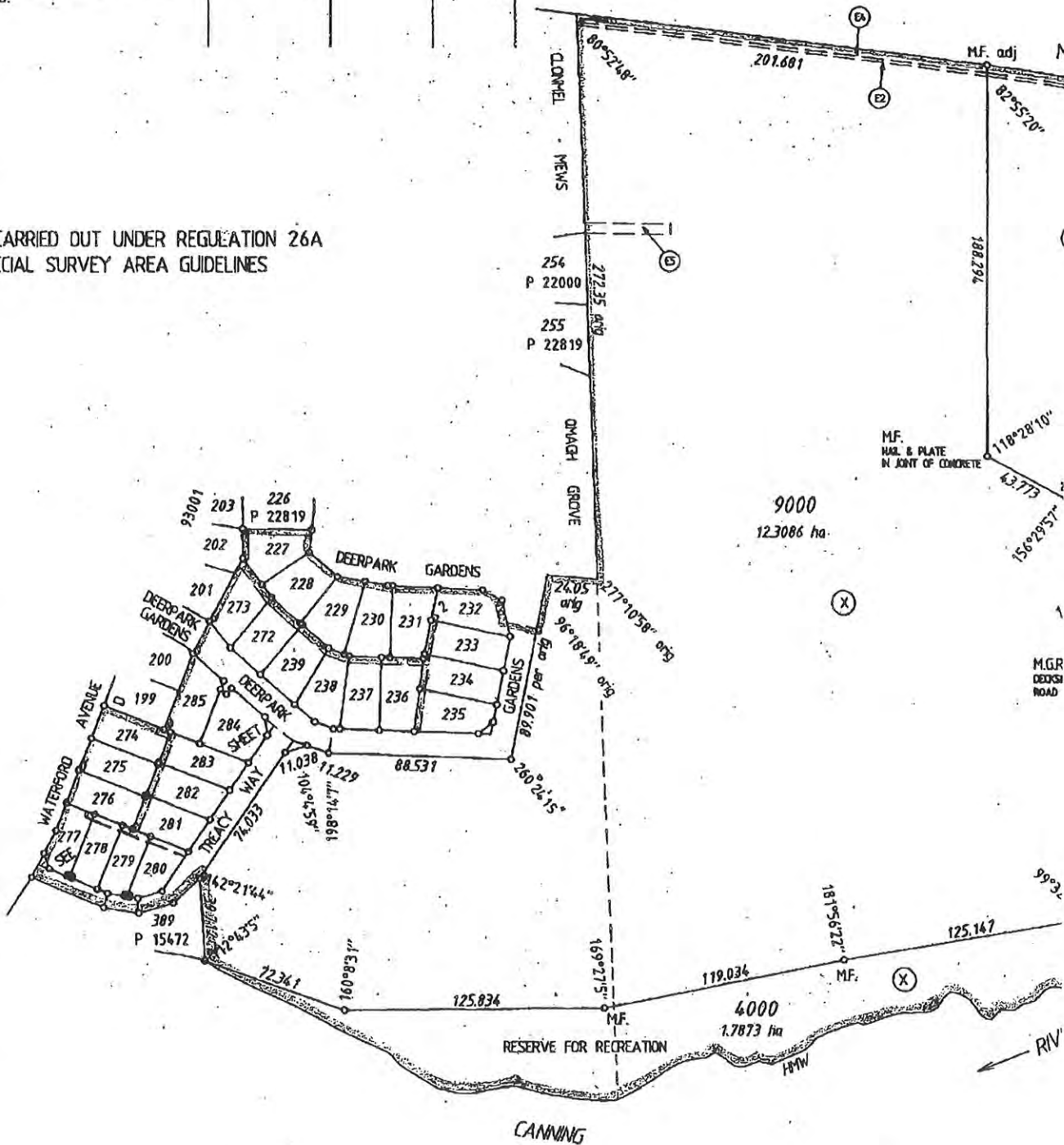
DEPOSITED PLAN

44883

2

ED/VER.	AMENDMENT	BY	SIGNATURE	DATE
1-2	REGULATION 6 SEWERAGE EASEMENTS IN LOTS 276 & 277 AMENDED.	Hope & Ptnrs	RLP	8-6-2005
1/3	SURVEY SHEET (ALSO SHOWING NON STANDARD MARKING) BEING SHEET 5 NOW LODGED.	OLI		11-7-2005

SURVEY CARRIED OUT UNDER REGULATION 26A  
SPECIAL SURVEY AREA GUIDELINES



FOR INTERESTS AND NOTIFICATIONS SEE SHEET 4

TYPE..... FREEHOLD		FORMER TENURE.....	SCALE..... 1 : 2000
PURPOSE..... SUBDIVISION		SEE TABLE	ALL DISTANCES ARE IN METRES
PLAN OF LOTS 227-239, 272-285, 4000, 9000, 9001, ROADS & EASEMENTS		ON INDEX BG34(2) 15.17, 15.18	SURVEYOR'S CERTIFICATE - Reg 54 I, J. D. LUTY, hereby state that this is a correct representation of the survey and / calculations from measurements recorded in the field book for the purposes of this plan and that it complies with the relevant written law(s) in relation to which it is lodged. J. D. Luty Licensed Surveyor 10-2- Date
DISTRICT..... CANNING	TOWNSITE.....	FIELD BOOK 94952	SURVEY FIRM P G S HOPE & PARTNERS PTY LTD 11/24 THOROGOOD STREET VICTORIA PARK WA 6100 Ph 9470 1229 Fax 9470 1290 Email pgs@net.net.au
FILE.....	LOCALITY..... WATERFORD		
LOCAL AUTHORITY..... CITY OF SOUTH PERTH			

WESTERN



AUSTRALIA

# **RECORD OF CERTIFICATE OF TITLE** **UNDER THE TRANSFER OF LAND ACT 1893**

REGISTER NUMBER <b>829/D88770</b>	
DUPLICATE EDITION <b>N/A</b>	DATE DUPLICATE ISSUED <b>N/A</b>

VOLUME  
**2048**FOLIO  
**180**

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

*RG Roberts*  
 REGISTRAR OF TITLES



## **LAND DESCRIPTION:**

LOT 829 ON DIAGRAM 88770

## **REGISTERED PROPRIETOR:** **(FIRST SCHEDULE)**

TRUSTEES OF THE CHRISTIAN BROTHERS IN WESTERN AUSTRALIA INC OF 53 REDMOND STREET,  
 MANNING

(T G048292 ) REGISTERED 6 DECEMBER 1995

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

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.  
 \* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.  
 Lot as described in the land description may be a lot or location.

-----END OF CERTIFICATE OF 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: 2048-180.  
 PREVIOUS TITLE: 1731-311.  
 PROPERTY STREET ADDRESS: LOT 829 MANNING RD, WATERFORD.  
 LOCAL GOVERNMENT AREA: CITY OF SOUTH PERTH.

ORIGINAL—NOT TO BE REMOVED FROM OFFICE OF TITLES

Application F931159

WESTERN

AUSTRALIA

REGISTER BOOK

VOL.

FOL.

Volume 1731 Folio 311



# CERTIFICATE OF TITLE

UNDER THE "TRANSFER OF LAND ACT, 1893" AS AMENDED

CT 2048

180



I certify that the person described in the First Schedule hereto is the registered proprietor of the undermentioned estate in the undermentioned land subject to the easements and encumbrances shown in the Second Schedule hereto.

*G Jack*  
REGISTRAR OF TITLES



Dated 18th July, 1995

## ESTATE AND LAND REFERRED TO

Estate in fee simple in portion of Canning Location 1 and being Lot 829 on Diagram 88770, delineated on the map in the Third Schedule hereto.

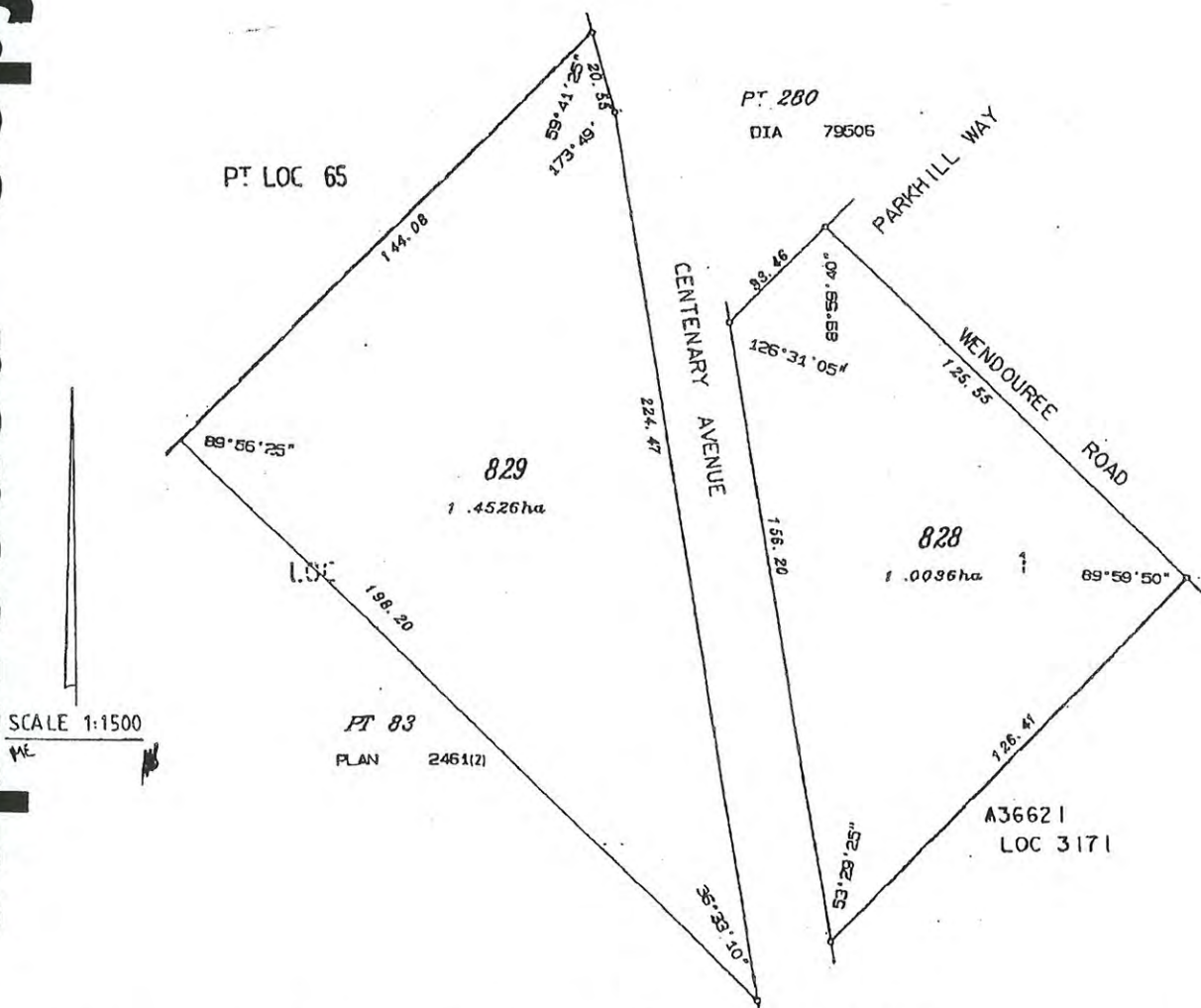
## FIRST SCHEDULE (continued overleaf)

~~Trustees of the Christian Brothers in Western Australia Inc. of 53 Redmond Street, Melbourne~~

## SECOND SCHEDULE (continued overleaf)

NIL

## THIRD SCHEDULE



NOTE: ENTRIES MAY BE AFFECTED BY SUBSEQUENT ENDORSEMENTS.

E67590/3/89-20M-L/4664

Superseded - Copy for Sketch Only

PERSONS ARE CAUTIONED AGAINST ALTERING OR ADDING TO THIS CERTIFICATE OR ANY NOTIFICATION HEREON

LT. 37

## FIRST SCHEDULE (continued)

**NOTE: ENTRIES MAY BE AFFECTED BY SUBSEQUENT ENDORSEMENTS**

REGISTERED PROPRIETOR

**Multiple Sclerosis Society of Western Australia (Inc)** of Parkhill Way, Wilson.

Trustees of The Christian Brothers in Western Australia Inc. of 53 Redmond Street, Manning.

## Transfer

## Transfer

F931161

G48292

18.7.95

6.12.95

15.24

11-21

SEAL

CERT.

CERT.

## SECOND SCHEDULE (continued)

NOTE: ENTRIES MAY BE AFFECTED BY SUBSEQUENT ENDORSEMENTS

INSTRUMENT

NUMBER

## PARTICULARS

REGISTERED

SEAL

CERT.  
OFFICER

**CANCELLATION**

NUMBER

REGISTERED  
OR LODGED

SEAL

CERT.

CERTIFICATE OF TITLE VOL.

FOL.

2048 180

WESTERN



AUSTRALIA

REGISTER NUMBER <b>83/P2461</b>	
DUPLICATE EDITION <b>N/A</b>	DATE DUPLICATE ISSUED <b>N/A</b>

**RECORD OF CERTIFICATE OF TITLE**  
UNDER THE TRANSFER OF LAND ACT 1893

VOLUME  
**2048**FOLIO  
**181**

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

*RG Roberts*  
REGISTRAR OF TITLES

**LAND DESCRIPTION:**

LOT 83 ON PLAN 2461

**REGISTERED PROPRIETOR:**  
(FIRST SCHEDULE)

TRUSTEES OF THE CHRISTIAN BROTHERS IN WESTERN AUSTRALIA INC OF 53 REDMOND STREET,  
MANNING

(A F931160 ) REGISTERED 18 JULY 1995

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

1. THE LAND THE SUBJECT OF THIS CERTIFICATE OF TITLE EXCLUDES ALL PORTIONS OF THE LOT DESCRIBED ABOVE EXCEPT THAT PORTION SHOWN IN THE SKETCH OF THE SUPERSEDED PAPER VERSION OF THIS TITLE. VOL 2048 FOL 181.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.  
\* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.  
Lot as described in the land description may be a lot or location.

-----END OF CERTIFICATE OF 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: 2048-181.  
PREVIOUS TITLE: 1731-311.  
PROPERTY STREET ADDRESS: LOT 83 MANNING RD, WATERFORD.  
LOCAL GOVERNMENT AREA: CITY OF SOUTH PERTH.

ORIGINAL—NOT TO BE REMOVED FROM OFFICE OF TITLES

Application F931160  
Volume 1731 Folio 311

WESTERN



AUSTRALIA

REGISTER BOOK  
VOL. FOL.CT 2048 181  

## CERTIFICATE OF TITLE

UNDER THE "TRANSFER OF LAND ACT, 1893" AS AMENDED

I certify that the person described in the First Schedule hereto is the registered proprietor of the undermentioned estate in the undermentioned land subject to the easements and encumbrances shown in the Second Schedule hereto.

*G. Jack*

REGISTRAR OF TITLES



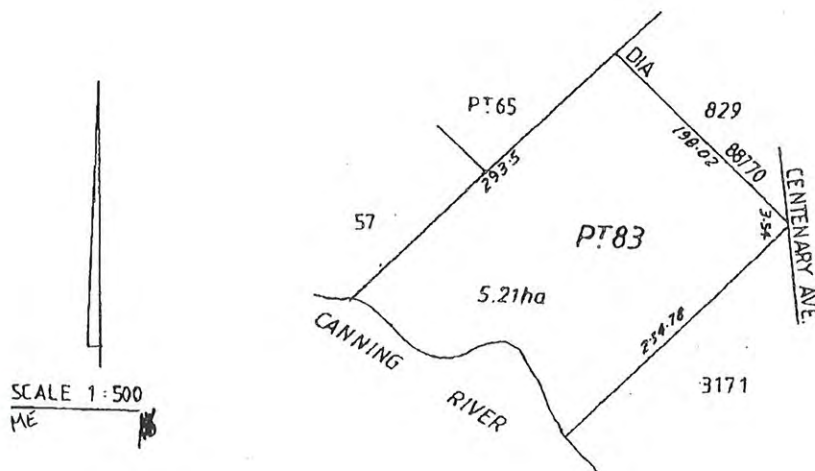
Dated 18th July, 1995

ESTATE AND LAND REFERRED TO

Estate in fee simple in portion of Canning Location 1 and being part of Lot 83 on Plan 2461 (Sheet 2), delineated on the map in the Third Schedule hereto.

FIRST SCHEDULE (continued overleaf)Trustees of the Christian Brothers in Western Australia Inc. of 53 Redmond Street, Manning.SECOND SCHEDULE (continued overleaf)

NIL

THIRD SCHEDULE

PERSONS ARE CAUTIONED AGAINST ALTERING OR ADDING TO THIS CERTIFICATE OR ANY NOTIFICATION HEREON

NOTE: ENTRIES MAY BE AFFECTED BY SUBSEQUENT ENDORSEMENTS.

E67590/3/89-20H-1/4654

Superseded - Copy for Sketch Only

Page 1 (of 2 pages) 2048  
VOL. 181 FOL.



# Appendix C

## Dial Before You Dig Information

**Dust and Asbestos Management Plan  
Cygnia Cove, Waterford**

**DIAL BEFORE YOU DIG W.A.**

ABN 92 095 817 066

**UNDERGROUND FACILITY LOCATION ENQUIRY**  
 Telephone 1100 should you dispute the information supplied  
*Do not dig without receiving all members' responses listed below*

Enquiry was made on 24/05/2006 at 10:20

**Caller**

Name : BROWN, SUZANNE  
 Company : ATA ENVIRONMENTAL  
 Address : 2 BULWER ST PERTH 6000  
 Phone : 08 93283488 Fax : 08 93283588  
 Email :  
 GGL : No Preferred Response : Fax

**Location of Works**

Lot NA, House No NA, MANNING RD  
 WATERFORD, on BOTH sides of the street  
 Easting : 0 Northing : 0

**Nearest Crossroads & Additional Directions**

CENTENARY AVE - LOTS 501, 829, PART LOT 83  
 NA

\* \* This information is only valid until 10/06/2006 \* \*

**Work Details** Source: Phone Op: KIM

Type of Work: DESIGN PURPOSES for General Contractors

**Map Directions Given**

Map Name : Street Smart

Page : 0 Grid Ref :

For further information, telephone the contacts listed.

MSD Map : 403	D 5	1:500 : Not Known
Grid : PH Perth		1:1000 : 29:36
		1:2000 : 15:18
		1:5000 : 06:08

Member	Plns	Dep Atch Contact	Phone
WESTERN POWER	20	2) REFER TO PLAN	
ALINTA	16	6) GAS ONE CALL OF	131352
WEST'N POWER F	07	10) REFER TO PLAN	
CURTIN UNIVERS	60	10) ROB MASSIE	92663376
AMCOM P/L	75	1) CORY WILLIAMS	0892446114
TELSTRA	50	1) CABLE LOCATIONS	1800806246
WATER CORP	01	5) CUSTOMER ADVICE	131395

**ADDITIONAL INFORMATION**

A

**WARNING**  
 Amcom in area  
 contact the above for details

-TCB-6-7-SMP

001/015

D2

Enquiry No. 200511:6279

**DISCLAIMER**

While taking all due care the operators of Dial Before You Dig WA-

- Provides this information for the enquirer's assistance only; and to the fullest extent permitted by law excludes all liability for damage or injury that is caused by or attributed to the information it provides.
- DBYD WA shall not be liable to the Caller or to any third party for any loss, damage, injury or liability whatsoever arising from any of the information provided to the Caller even in circumstances where negligence can be established.

**WARNING**

Refer to the Worksafe WA OSH Reg's 1996 (Reg. 3.21) for your Duty of Care. First locate the asset by hand digging.

**NEVER ASSUME DEPTH OR ALIGNMENT OF PIPES OR CABLES.**  
 Plans indicate asset presence only.  
 Any doubts, contact the utility listed.

**RECOMMENDED**

- Use this information within 14 days
- Make a new request if details change.
- If an enquiry has not been answered after 2 working days, please call this Service before digging.

**RECORD of RESPONSE**

To: SUZANNE BROWN

Fax: 08 93283588

Pages (Incl. this sheet)	Initials	Date Posted
15	[Signature]	

**HOW TO LODGE A REQUEST:-**  
 Internet - [www.dialbeforeyoudig.com.au](http://www.dialbeforeyoudig.com.au)  
 Fax - 1300 652 077 - form available  
 Phone - 1100 - from 8 a.m. to 5 p.m.

Be aware that not all underground service owners are members of DBYD WA. You must contact them (eg: the Local Council, MRWA, etc)

Protecting Your Privacy - see [www.dialbeforeyoudig.com.au](http://www.dialbeforeyoudig.com.au)



## LOCATION OF TELSTRA CABLES

Information on Telstra's telecommunication cables and conduits is supplied separately by TELSTRA using the Dial Before you Dig WA enquiry number that you have been given for this request

**You do not need to lodge a separate request.**

**TELSTRA** will forward your information to you within two working days of your request being made.

Where your enquiry has not been answered after two working days, please call Telstra on 1800 806 246 to discuss the status of the request.

### **On-Site Locations:**

On-site location of Telstra plant is your responsibility to arrange and pay for. On-site locations are performed by accredited contractors throughout Perth and most areas of the state.

Contact details of contractors who offer an on-site location service are included in the Telstra information sheets that are sent out with your Telstra service location plans.

**DO NOT COMMENCE DIGGING  
UNTIL YOU HAVE YOUR TELSTRA PLANS  
NEVER ASSUME DEPTH OR ALIGNMENT OF PIPES OR CABLES**

Revision 7

March 2005



## **INFORMATION SHEET**

The information provided on this cover sheet is to be used as a guide only. It does not remove the responsibility from the excavator/contractor to physically locate all services prior to excavation or any other construction activity.

Water Corporation pipes and services are in the following categories:

### **STRATEGIC ASSETS -**

**Water Trunk and Distribution Mains** (a main of 300 mm and larger in size), **Sewerage Pressure Mains and Drainage Pressure Mains** – If excavation is to be in close proximity to these mains, please phone 13 13 75 at least 48 hours (2 work days) prior to commencing work. **You may be required to obtain a "Clearance to Work" Permit, to ensure that you have met the requirements of the Water Corporation prior to commencing work.**

### **OTHER ASSETS -**

**Water Reticulation Mains and Property Services** – Water reticulation mains are present in most streets with property services connecting customers to the mains, and may be located by the presence of a water meter. Property services are not marked on plans, however their presence should be anticipated.

**Sewerage Gravity Mains, Sewer Property Services and Drainage Gravity Mains** – Present in most streets and may be found within property boundaries. Gravity mains may be located by the presence of an access chamber or manhole. Sewer property services are not marked on these plans, however their presence should be anticipated. See "Private Property" below for more information.

**DAMAGE** - Should a Water Corporation asset be damaged, please call the Water Corporation's emergency number 13 13 75. This number is available 24 hours a day.

**ASSISTANCE** - For assistance with the information on Water Corporation assets, supplied through the Dial Before You Dig service, please call 13 13 95 between 8.00 a.m. and 5.00 p.m. weekdays.

**ON - SITE LOCATIONS** - Should you be unsuccessful in locating a Water Corporation asset, please call 13 13 75 to arrange for a possible on-site location. This number is available 24 hours a day for ALL Western Australia.

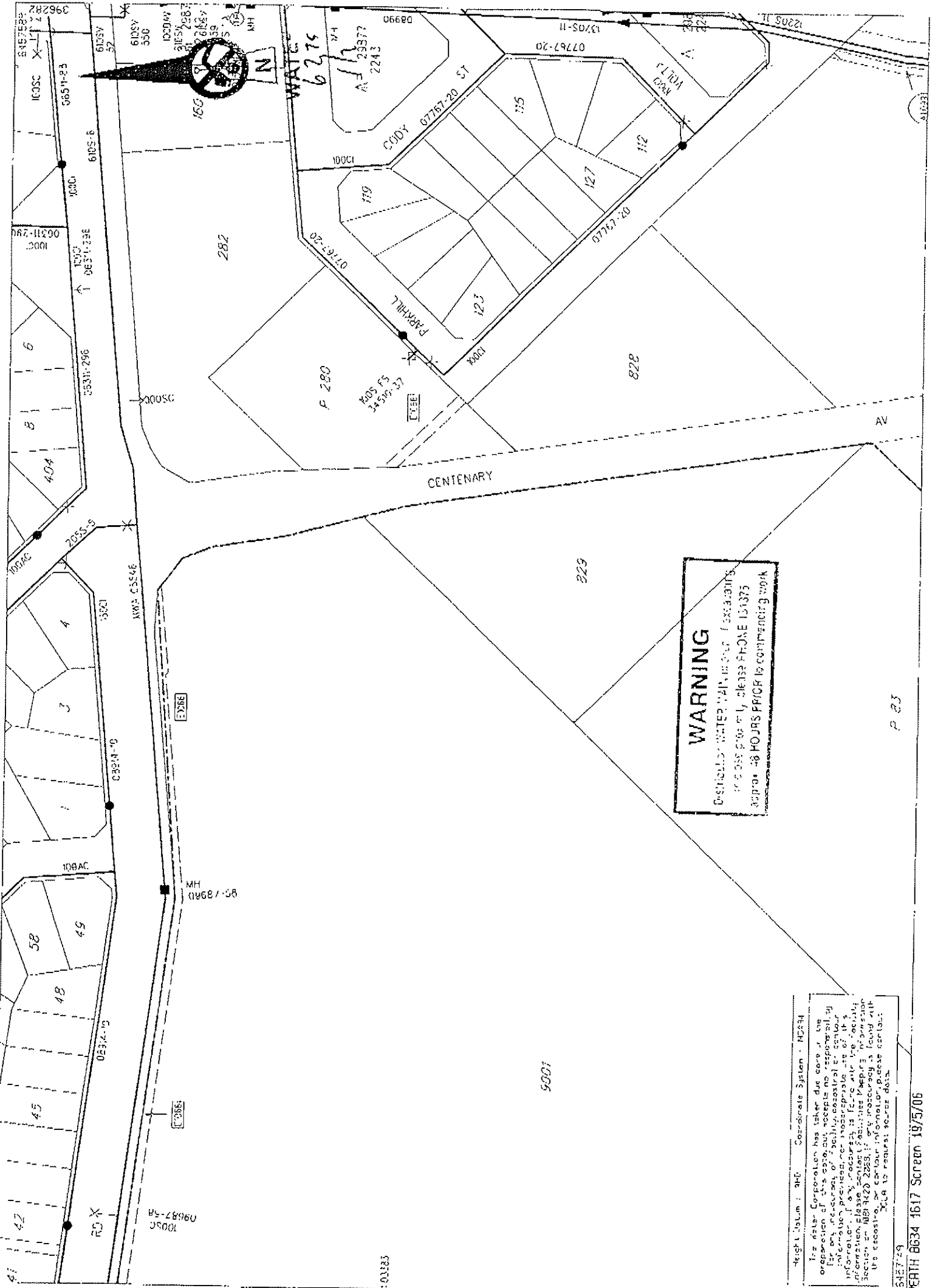
**NEVER ASSUME THE DEPTH OR ALIGNMENT OF PIPES OR CABLES**

## **PRIVATE PROPERTY**

Should you have made a request for information within private property, be aware that information through the Dial Before You Dig service is primarily structured to supply information about specific services in the road reserve. The information listed below may assist you. Should additional information be required about these private services, please contact 13 13 95 between 8.00 a.m. and 5.00 p.m. weekdays

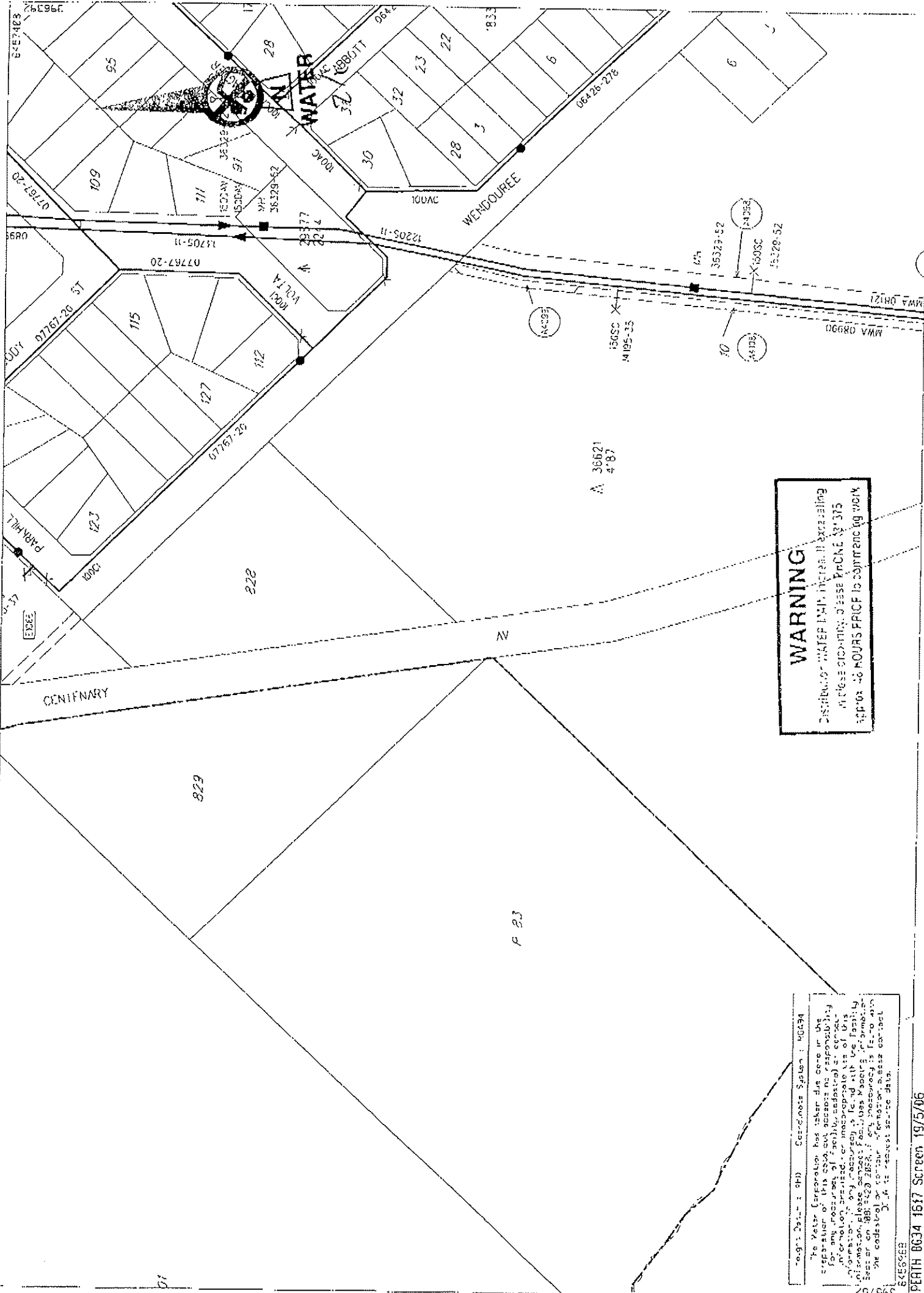
- A plan of your private property sewer may be available at cost from any Water Corporation Business Office or the Master Plumbers Association.
- Building Approval is required from the Corporation for New Buildings, Building Improvements, Parapet Walls, Retaining Walls and Swimming Pools.
- The service pipe between your water meter and house (or external tap) is your responsibility. It is recommended that you locate the pipe by hand digging.

**ENQUIRIES – PLEASE CONTACT 13 13 95 (8.00 - 5.00 weekdays)**

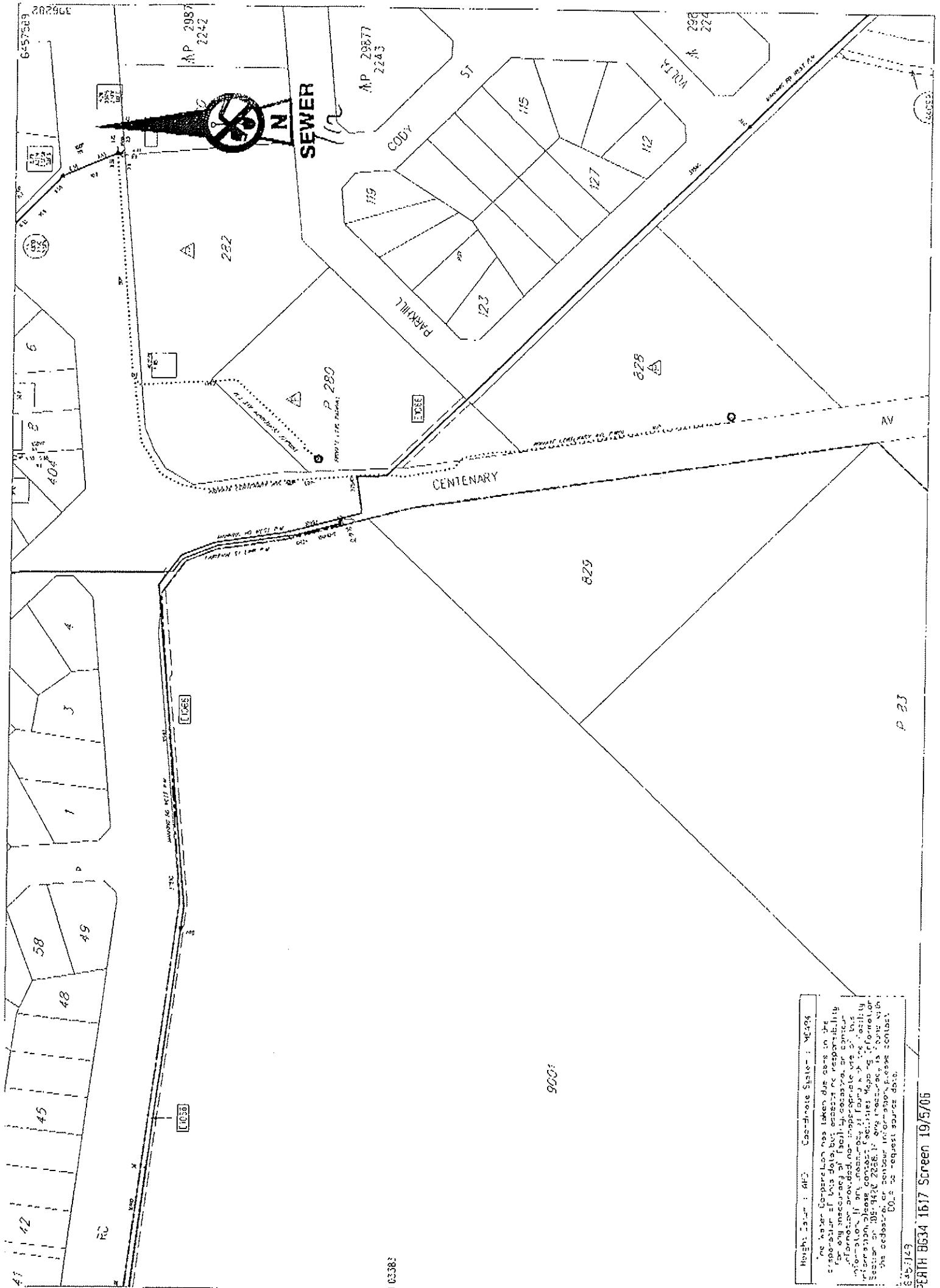


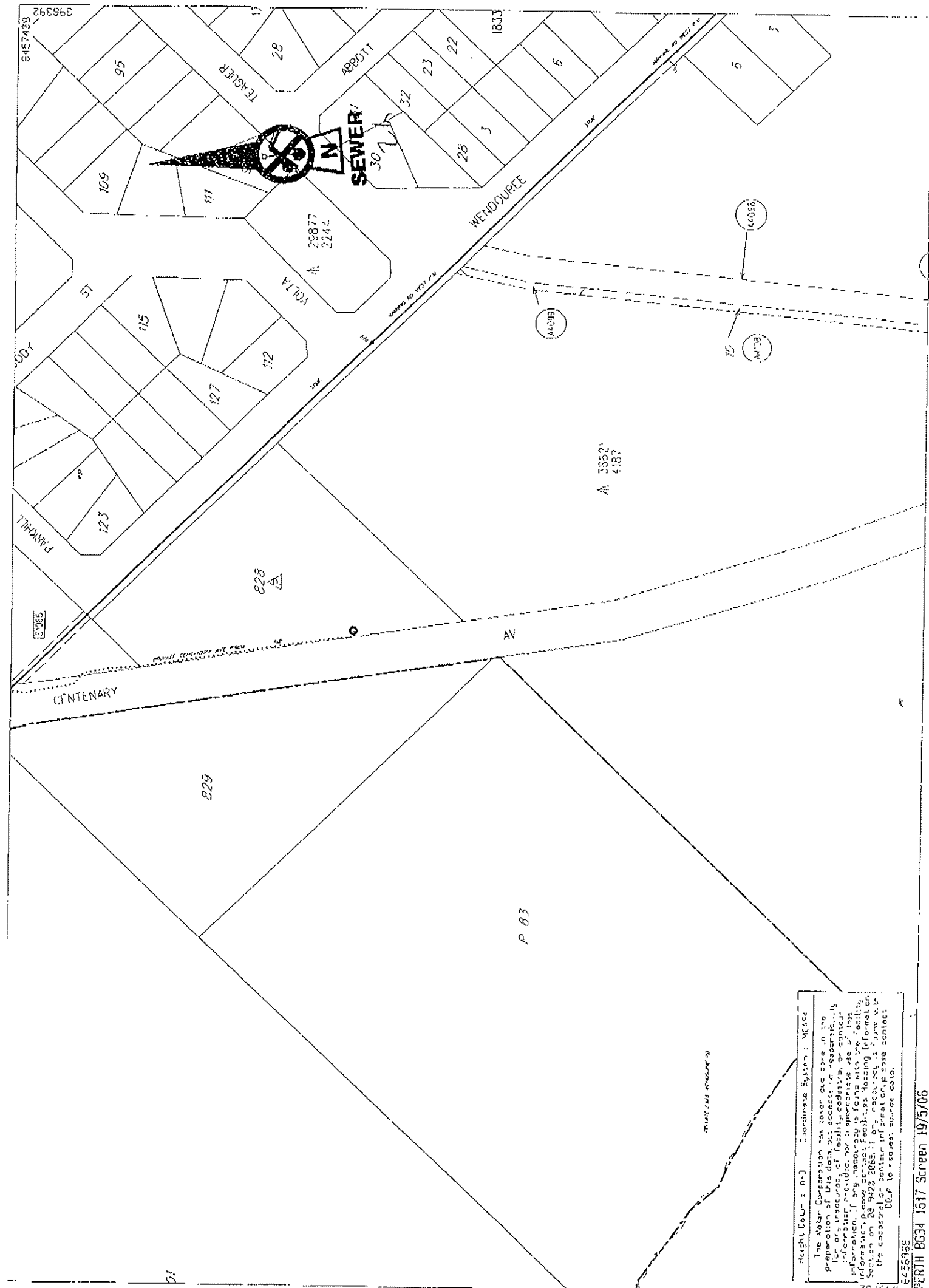
Project Data: 19/05/06 Coordinate System: MGA54  
 The Water Corporation has taken due care in the preparation of this data, but accepts no responsibility for its use. It is the user's responsibility to ensure that the data is used in accordance with the relevant legislation and standards. The data is provided for information only and should not be used for any purpose other than that for which it was prepared. For more information, please contact Perth Water Corporation, 100 St Georges Terrace, Perth, Western Australia 6000. The copyright in this data is held by the Water Corporation. It is requested that you acknowledge the source of the data.

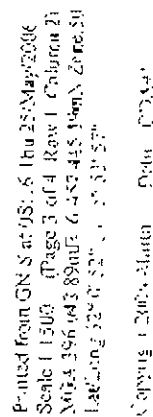
**WARNING**  
 DISTRIBUTE WATER MAIN, UNDER 1100mm, BY EXCAVATING  
 IN THESE SIGHTING OF THESE PIPES NO. 375  
 1500x 40 HOURS PRIOR TO COMMENCING WORK



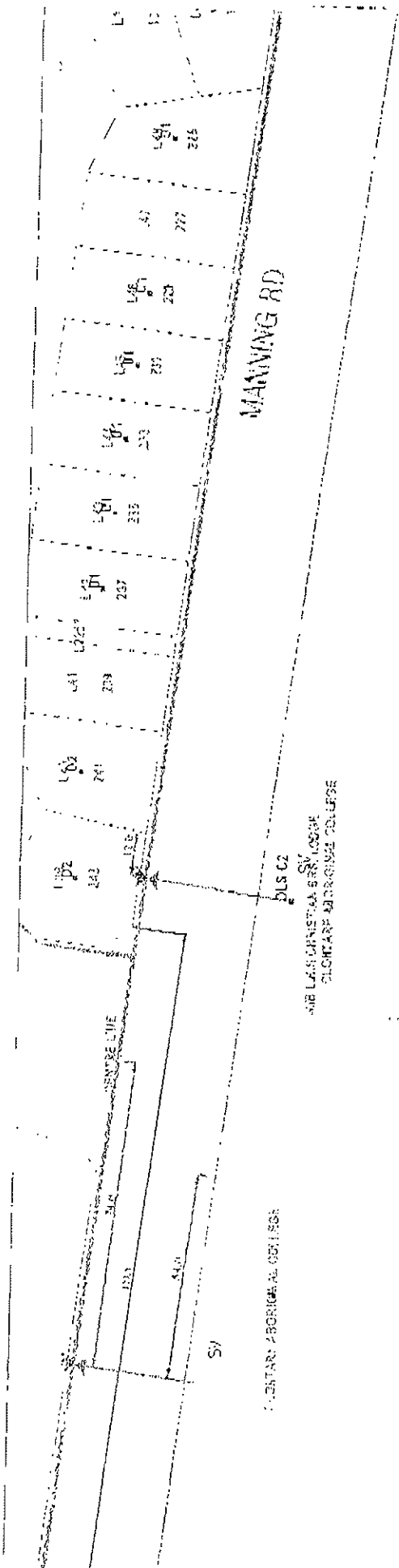
Hughes, James : AHO  
 Coast-to-coast Station : WCPC-98  
 "no water Corporation has taken the steps in the  
 preparation of this data, but we have no responsibility  
 for any inaccuracies in facilities, accuracy, or reliability  
 information provided, nor responsibility for the  
 information, if any, contained in any other facility  
 information, please contact facilities Dept. 2, Portland  
 Section at 100-1420-2288. If any information is found with  
 this section, or contain information, please contact  
 100-1420-2288 to request source data.  
 100-1420-2288



[illegible]



NFS

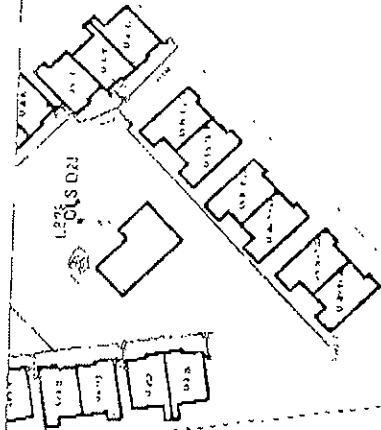


Printed from GIS at 08:15 Thu 25 May 2006  
 Scale 1:1500 Page 1 of 4 Row 1 Column 1  
 NGA 395.613.59mE 6.45244319mN Zone 59  
 Manning 327.0 317.112 317.41"

Copyright 2006 Amity Custom GIS

Category: CD-ROM

WENDOUR



25157  
15

152

Printed from GNIS at 28-17 The 25157/25158  
Scale 1:1500 Page 4 of 4 Row 2 Column 2  
MGA 396043 89mE 6.457142 91mN Zone 50  
EastLong 396043 115 23 50  
Copyright 2006 A map Datum 2145 04



# MAINS AND SERVICES INFORMATION SHEET

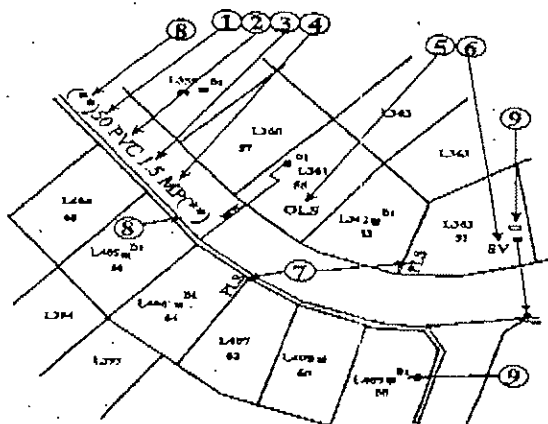
ANS-FB-08200

(May 2006)

The information on this sheet is to be used as a guide only and does not absolve third parties' duty of care obligations to take additional care if the proposed work has the potential to have an impact on gas pipes and safety of people.

## Gas Main and Service Identification

For general mains and services enquires call 9499 5272 between 7:30am to 4:00pm weekdays. After hours/weekends call 13 13 52.



### LEGEND

1. Pipe Diameter (mm)
2. Pipe Material:  
CI = Cast Iron  
GI = Galvanised Iron  
ST = Steel  
PE = PolyEthylene  
PVC = PVC
3. Alignment (in metres from property line)
4. Pressure in main (eg MP = Medium Pressure)
5. Off Line Service to Meter Position (indicates service is not straight line connection)
6. Service Valve to Meter Position (Note: Service Valves may be "Buried")
7. Pre-Laid Service laid in Common Trench
8. Main Status  
AB = Abandoned Mains  
CT = Mains in Common Trench  
PROP = Proposed Mains
9. Customer Connection  
D1 = Domestic  
C1 = Commercial

## Requirements for Working near Alinta's Gas Pipelines

No gas pipes (including abandoned gas pipes) shall be cut, altered or removed without APPROVAL from Alinta (generally attendance by Alinta personnel prior to and during work is required) -- call Alinta Engineering Services on 9499 5166.

In general, all work that may impact upon the Alinta gas distribution network should be carefully planned and advised to Alinta well in advance of commencement (typically 2 weeks). This includes excavation of gas pipelines, crossings of pipelines by other facilities (roads, drains, power cables etc), road works and road widening, or structural installations. In particular,.....

1. **High Pressure Pipelines (HP, PEHP > 110mm Diameter, City HP, Fremantle HP)**  
No excavation is permitted within 15m of these pipelines without permission. Additional requirements are also applicable to any work within 15m of a high-pressure pipeline; contact Alinta tel: 9499 5272 for "Additional Information".

Alinta Asset Management	PO Box 3006 SUCCESS WA 6964	Ph: 9499 5272 Fax: 9499 5250	Email: dialb4udig@alinta.net.au
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You are required to ascertain the location of any high pressure pipeline, in relation to your proposed work by:

- locating a straight line between two high pressure warning signs; and
- assessing the distance from this line to your proposed work area.

If this distance is assessed to be 15m or less, an approved locator will be required to locate the pipeline and may require stand-by supervision, during your work. Alinta will be able to advise you of the attendance requirements.

2. **Medium (MP), Medium-Low (MLP), Low (LP) and other Pipeline Pressures**

These pipelines (or mains) are installed in most streets throughout the Perth metropolitan and country centres. They will normally have service lines connecting the main to individual consumer meter boxes. These services are not marked on plans, however their presence should be anticipated. Main valves, regulator sets and test points also exist at intervals along these pipelines. Where work may impact upon these pipelines contact Alinta as per item 1 above.

3. **Gas Services and Meters**

If a gas meter box is installed on a property, an underground service will run from the meter position to the main in the street. Since 1996, all gas meter boxes include a sticker showing the service details. If no sticker is attached then care must be exercised when excavating.

## Minimum Safe Work Practices

**PLAN** - The Alinta One Call plan attached, should always be on site and referred to for the duration of work.

**POTHOLE** - Using the Alinta One Call plan, all gas pipes should be exposed (including any deviation in the direction of a gas pipe) by hand digging using a shovel. Where the proposed work is parallel to a gas pipe, pothole every 5m along the route. No digging shall be done over high-pressure gas pipes without permission from Alinta (see item 1 above).

**PROTECT** - Supervise and monitor the trenching or boring machine operator when near a gas pipe. Where a gas pipe is required to be exposed, adequate protection of the pipe is required to prevent potential pipe damage. In particular, gas pipes shall not be unsupported for greater than 2m in length and/or left unprotected without supervision, unless previously approved by Alinta Asset Management--Engineering Services.

**PROCEED** - Only when all checks have been completed, proceed with care.

## Emergencies Involving Gas Pipelines

In the event of damage to a gas pipeline, extinguish all sources of ignition and keep the area clear of bystanders.

Call the Alinta's Emergency Number : 13 13 52

Any attempt to repair the gas main or service may result in prosecution under the *Energy Operators (Powers) Act 1979*.



# Alinta

## GNIS SYMBOLS SHEET

### GAS NETWORKS

	HP High Pressure
	FHP Fremantle High Pressure
	PEHP Polyethylene High Pressure
	CHP City Block High Pressure

	VMP Liquid Petroleum Pressure
	MP Medium Pressure
	AMP Albany Pressure
	MLP Medium-Low Pressure

	LP Low Pressure
	Service Line
	Scratch Line (Design)
	AB Adandoned Line
	AB Adandoned Line Sold

### PROPOSED GAS MAINS ALL PRESSURES

	Standard
	Common Trenching
	Relay

### DUCT & SLEEVES

	Duct
	Sleeve

### OTHER PIPELINES

	Dampier to Bunbury Natural Gas Pipeline (DBNGP)
	Parmelia Gas Pipeline (PGP)
	Oil Pipeline

### GATE STATIONS

	Gate Station		Proposed Gate Station
	LPG Tank Station		
	Gas Plant		

### REGULATOR SETS

	High Pressure		Medium Pressure
	Fremantle High Pressure		Medium-Low Pressure
	City Block High Pressure		Proposed Regulator

### FITTINGS

	Gas Syphon		Expansion Joint
	Reducer		Flange
	Change Node		Tapping Band
	Coupling		Main Cross
	Stopple		Proposed Fitting




### VALVES

	High Pressure Valve
	High Pressure Service Valve
	Main Line Valve
	Service Valve
	Proposed Valve

### TEST POINTS

	Test Point
	Odorant Sampling Point
	Pressure Monitoring Point

### FEATURES

SC	Side Elevation (See Card)	PLS	Pre-Laid Service
	See Detail		Obstacle
SV	Service Valve	NC	Pipe Not Connected
OLS	Off Line Service		Pipe Location Sign

### PROTECTION DEVICES

	Anode		Impressed Current Ground Bed
	Potential Monitoring		Foreign Structure Monitoring
	Earthing		Insulation Joint
	Earthing with Mitigation		Insulation Joint with Mitigation

### REPORTED LEAKS

	Class 1
	Class 2
	Class 3
	Class 4

### LEAKS REPAIRED

	Main Joint Repair		Valve Leak Repair
	Main Crack Repair		Standpipe Repair
	Service Leak Repair		
	Tapping Band Leak		

### METERS

	Gas Meter Domestic
	Gas Meter Commercial
	Gas Meter Industrial
	Meter Set
	Scanned Images



## Western Power

### INFORMATION SHEET

The information provided on this cover sheet is to be used as a guide only. It is mandatory for the excavator/contractor to physically locate all services prior to excavation

Western Power Electrical Cables are in the following categories:-

- Transmission (66kV and/or 132kV) If these cables are indicated on the map, and are affected by your works, you must call System Services Network Officer (TEL: 9411 7413) 48 hours prior to works.
- Other types of cables include Pilot Cables, High Voltage Cables (11 to 22 kV), Low Voltage Cables (440V) and Streetlight Cables (240V). Due care and proper clearances need to be observed near the vicinity of these works.
- Should you require Western Power to protect/support the cable/s at your excavation site please contact our Networks Customer Service Centre Tel 9411 7338. There will be a fee for this service. Reasonable notice is required.

In the advent that you discover a cable NOT shown on your map, contact the person named on the Western Power, Dial Before You Dig Map.

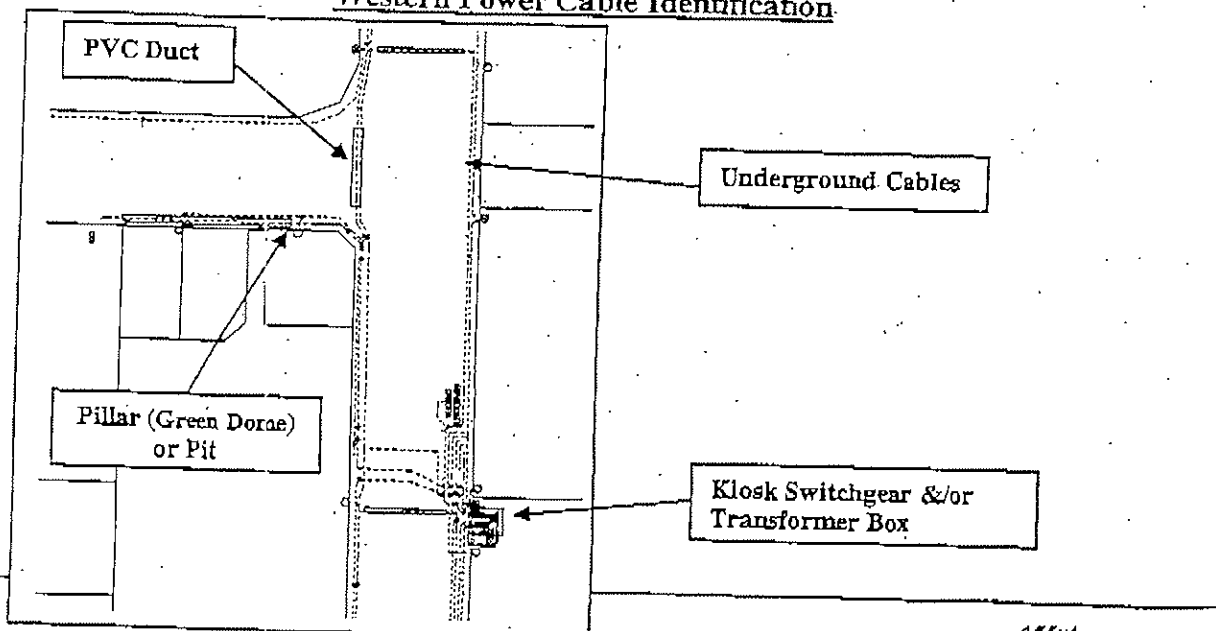
The standard alignment for underground assets is 0.0- 0.6m from the property boundary. Areas not aligned to this standard will be indicated on the maps provided.

In the event of damage to a Western Power Underground Cable  
Call Western Power Faults and Emergencies: 13 13 51

### PLEASE NOTE

If you require information for Overhead Power lines and clearances call 13 13 53

### Western Power Cable Identification



281  
25  
4886



122  
20  
4936

123  
22  
4937

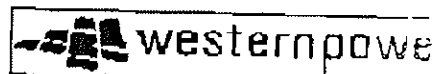
WENDOUREE RD

829

828  
1  
4870

Lot 501 Not Found

Lot 83



Depth of cover, if known is indicative only.  
It cannot be guaranteed as ground level  
may have changed since installation.

Exposure by hand is MANDATORY

For Map Clarification Call

**RODNEY**

Telephone:

**9326 4861**

Monday to Friday : 8.00am - 4.30 pm

TCB-6-7-  
SIMP

**amcom**  
keeping it so simple!

43 King Edward Road  
Osborne Park WA 6017  
Ph: (08) 9244 6000  
Fax: (08) 9244 6001  
dbyd@amcom.com.au

**DIAL BEFORE YOU DIG!**

**LOCATION NOTICE OF TELECOMMUNICATIONS SERVICES**

QUOTE REF. NO. 200511:6279

DATE: May 31, 2006

ATTENTION: Suzanne Brown  
COMPANY: ATA Environmental  
FAX NO: 00893283588  
PHONE NO: 0893283488

Dear Suzanne,

Thank you for your request dated May 24, 2006, regarding the location of telecommunication services in the area of Manning Rd , Waterford

**YES - We can confirm that AMCOM has fibre-optic services in the vicinity.**

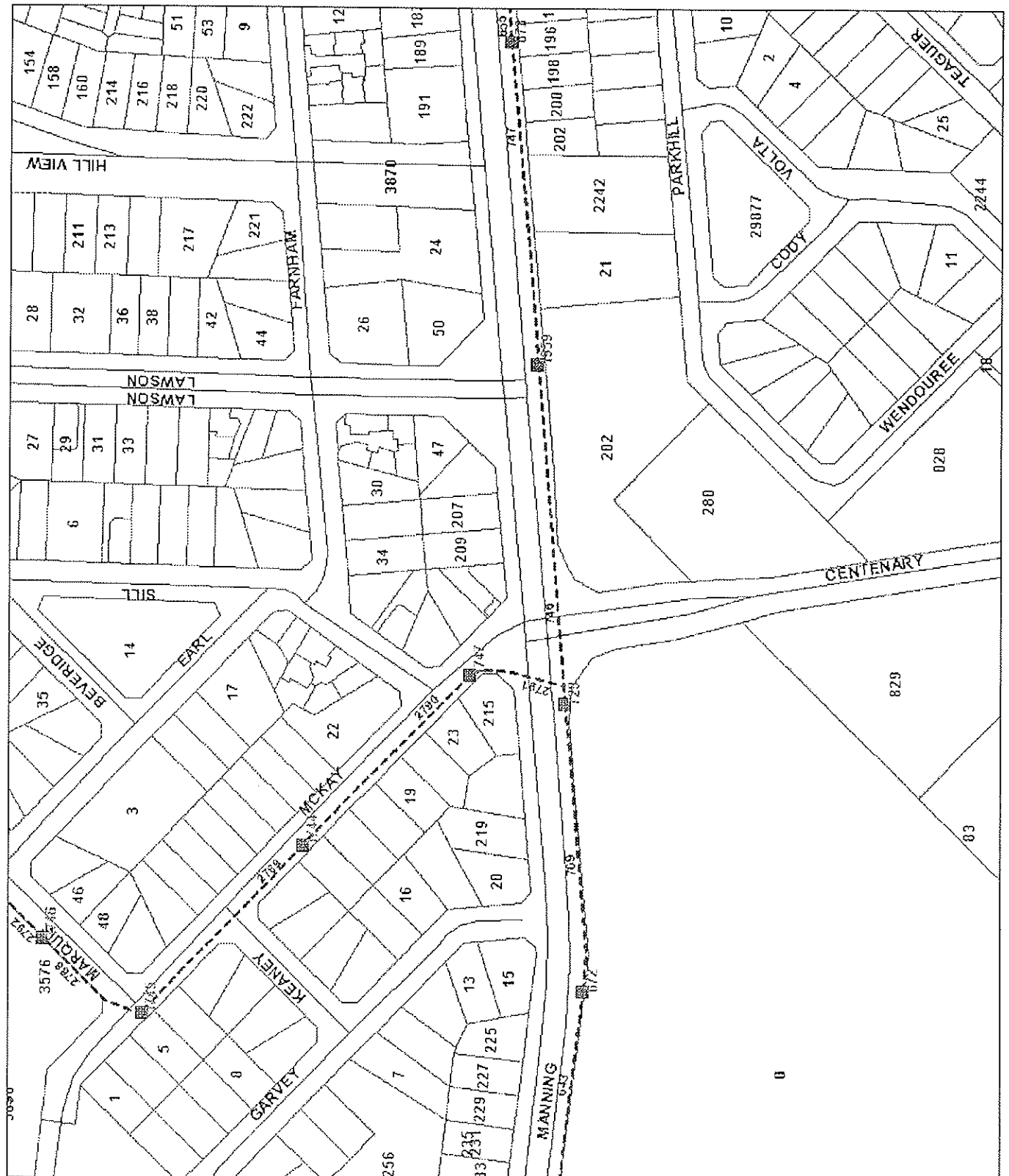
Please find attached a faxed copy of the services plan for the location of the works. Please note that these plans have a life of 14 days, as future works may affect your enquiry.

Yours faithfully

Cory Williams

Please note that the attached plans are to be treated as a guide only, and AMCOM bears no responsibility for the accuracy of the said plans. If machinery is being used in the area, pot-holing to locate services is mandatory.

**EMERGENCY CONTACT: 1800 262 663**



<p><b>Legend</b></p> <ul style="list-style-type: none"> <li> Pits</li> <li> Links</li> <li> Street Names</li> <li> Streets</li> <li> Cadastral</li> <li> House No</li> <li> New Pits</li> <li> New Links</li> </ul> <p><b>Quote Ref.</b></p>	
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## **CAUTION OPTICAL FIBRE WORKING IN THE VICINITY OF AMCOM PLANT**

All Constructors have a Duty of Care when working in the vicinity of underground plant.  
The processes for complying with this Duty of Care while working in the vicinity of Amcom plant are :

### **□ LOCATION OF EXISTING AMCOM PLANT**

It is the Constructors responsibility to;

- Design to minimise impact to, and for protection of Amcom plant
- Request the location of Amcom plant before construction begins.

Amcom plant locations can be provided through the following options;

#### **1. Provision of plans**

- All enquiries for plant locations are to be made through the Dial Before You Dig Service Dial 1100.
- The Constructor is to provide details of the desired location. Amcom will provide copies of plans of all known Amcom plant in the requested area.
- Amcom will forward this information to the Constructor within two working days. Where the enquiry has not been answered after two working days please phone Amcom Telecommunications on (08) 9244 6114
- This service is provided free of charge via Facsimile, Mail, Email or Collection from the Amcom Telecommunications Office at 43 King Edward Road, Osborne Park, WA 6017 weekdays during normal office hours.
- On receipt of plans the Constructor is responsible for potholing and physical exposure of the Amcom plant to confirm its actual location.

NOTE – Plans are provided free of charge up to a 1km radius. Larger Plans may incur a cost.  
For plan interpretation call (08) 9244 6114

**DO NOT COMMENCE DIGGING UNTIL AMCOM HAS RESPONDED**  
**NEVER ASSUME DEPTH OF PLANT**

#### **2. On-site Location**

Location	Onsite Locations Contact	Phone	Mobile	Fax
Perth	WH Locations	(08) 9256 2779	0411 746 657 - Boyd 0417 177 566 - Mike 0417 936 656 - Nigel	(08) 9256 2745
Darwin	Anywair Electrics	(08) 8988 1658	0418 890 071	(08) 8988 4654
Adelaide	Chris Tatchell	(08) 8224 0552	0410 022 530	(08) 8333 1338

**If any of the above numbers are un-contactable and your call is urgent please phone the Amcom Helpdesk**

**1800 262 663**

- For all work within 2.5 metres of nominal location the Constructor is required to prove the actual location of the plant by potholing and exposing before commencing work.
- Potholing to expose and locate Amcom plant is required before work commences at least every 3 metres where the Constructors works are parallel to the Amcom Plant.
- The Constructor is responsible for all plant damages when works commence without Amcom plans or by failure to follow advice and/or instructions from Amcom.

NOTE – No machinery shall be used within 1 metre of Amcom plant until the actual location has been determined by potholing using hand tools.

NOTE – No heavy earthworking machinery shall be used within 5 metres of Amcom plant until the actual location has been determined by potholing using hand tools.

#### **3. Remote or on-site advice**

- Amcom may provide either remote (phone) or on-site engineering advice at its discretion to assist the Constructor in deciding where and how they should pothole to expose the Amcom plant.

43 King Edward Rd  
Osborne Park WA 6017

**www.amcom.com.au**  
info@amcom.com.au

Phone: +61 8 9244 6000  
Fax: +61 8 9244 6001



NOTE – On-site meetings may incur a cost to the Constructor.

## **CAUTION OPTICAL FIBRE CLEARANCES FOR NEW WORK IN THE VICINITY OF AMCOM PLANT**

These figures represent the minimum clear cover to be maintained over Amcom Plant.  
Please note that **actual** cover over existing plant might be greater or less than recommended figures.  
Exact alignment and depths cannot be given with certainty as such levels can change over time.

<b>Footpath and Verge Areas</b>	450mm
<b>Roadways</b>	600mm

These figures represent the minimum clearance between construction activity and **actual** location of Amcom plant.

<b>Jackhammers / Pneumatic breakers</b>	Not within 2.5m of <b>actual</b> location.
<b>Vibrating plate or Wacker Packer compactors</b>	Not within 500mm of <b>actual</b> location.
<b>Heavy vehicle traffic</b>	Not to be driven across Amcom plant with less than 600mm cover. The Constructor is to check the depth by potholing using hand tools.
<b>Mechanical excavators</b>	Not within 1m of <b>actual</b> location. The Constructor is to pothole and expose plant using hand tools.

Amcom access pits must remain accessible and at ground level at all times.

**NOTE – If these clearances and specifications cannot be maintained, see below.**

### **□ RESOLUTION OF POINTS OF CONFLICT**

- Should plant location and potholing reveal points of conflict between the Constructors planned works and Amcom's' existing plant the constructor should contact the Amcom Infrastructure section for advice and to discuss possible solutions. The contact names are;

Cory Williams  
Phone: (08) 9244 6114  
Fax: (08) 9244 6001

OR

Ross McCallum  
Phone: (08) 9244 6000  
Fax: (08) 9244 6001

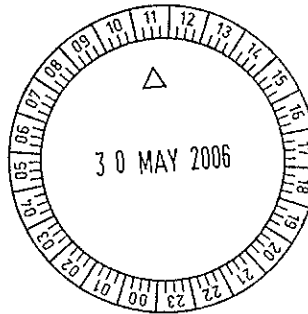
- Where relocation or protection of Amcom Plant is part of an agreed solution the costs of these works will be the responsibility of the Constructor. Amcom will provide an estimated cost for works. Work by Amcom will not commence until a Purchase Order or signed Fee For Service docket is received.

### **□ ASSESSMENT OF RISK AND PROTECTIVE ACTIONS**

- Where protective works are required around existing Amcom plant the details will be worked out on a case by case basis. Protective works are the responsibility of the Constructor.

**All damage to Amcom's network must be reported immediately by dialling**

**1800 262 663**



TCB-6-7-ASD  
SIMP

## Plant Location Details



Telstra Corporation Limited  
ACN 051 775 556, ABN 33 051 775 556

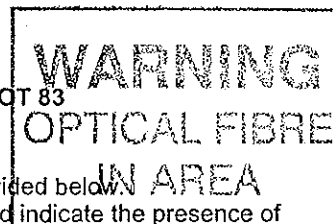
To: SUZANNE, BROWN	From: Telstra, Network Integrity
Company: ATA ENVIRONMENTAL	Sequence No: 200511:6279
Address: 2 BULWER ST	Date: 26/05/2006
PERTH, 6000	District: PS
Phone: 08 93283488	Send Type: Registered Post - 2xA0
Fax Number: 0893283588	Niac Alert: Yes
Email:	NIAC Priority: 1 - IEN & Direct Buried CAN & CAN Fibre alone in a conduit nest ie no copper cable in the conduit nest.

The following sketch/plan(s) is/are provided from Telstra's records in response to your request to show the approximate location of Telstra's installations within the vicinity of:

Location: **MANNING RD  
WATERFORD,**

Side of Street: **B**

Intersection: **CENTENARY AVE - LOTS 501, 829, PART LOT 83**



### IMPORTANT:

- Please read and understand all the information and disclaimers provided below.
- Sketches and Plans provided by Telstra are circuit diagrams only and indicate the presence of telecommunications plant in the general vicinity of the geographical area shown; exact ground cover and alignments cannot be given with any certainty and cover may alter over time. Telecommunications plant seldom follow straight lines and careful on site investigation is essential to uncover and reveal its exact position.
- Due to the nature of Telstra plant and the age of some cables and records, it is impossible to ascertain the location of all Telstra plant. The accuracy and/or completeness of the information can not be guaranteed and, accordingly Telstra plans are intended to be indicative only.

### "DUTY OF CARE"

When working in the vicinity of telecommunications plant you have a legal "Duty of Care" that must be observed. The following points must be considered:-

1. It is the responsibility of the owner and any consultant engaged by the owner, including an architect, consulting engineer, developer, and head contractor to design for minimal impact and protection of Telstra plant. Telstra will provide free plans and sketches showing the presence of its network to assist at this design stage.
2. It is the owner's (or constructor's) responsibility to:-
  - a) Request plans of Telstra plant for a particular location at a reasonable time before construction begins.
  - b) Visually locate Telstra plant by hand digging (pot-holing) where construction activities may damage or interfere with Telstra plant (see "Essential Precautions and Approach Distances" section for more information).
  - c) Contact Telstra's Network Integrity Group (see below for details) if Telstra plant is wholly or partly located near planned construction activities.

### DAMAGE:

**ANY DAMAGE TO TELSTRA'S NETWORK MUST BE REPORTED TO 132203 IMMEDIATELY.**

- The owner is responsible for all plant damage when works commence prior to obtaining Telstra plans, or failure to follow agreed instructions.
- Telstra reserves all rights to recover compensation for loss or damage to its cable network or other property including consequential losses.

### CONCERNING TELSTRA PLANS:

- Phone 1100 - Dial Before You Dig for free plans of Telstra plant locations. Please give at least 2 business days notice.
- Telstra plans and information provided are valid for 60 days from the date of issue.
- Telstra retains copyright in all plans and details provided in conjunction with your request. These plans and or details should be disposed of by shredding or any other secure disposal method after use.
- Telstra plans or other details are provided for the use of the applicant, its servants, or agents, and shall not be used for any unauthorised purpose.
- Please contact the Network Integrity Help Desk (see below for details) immediately should you locate Telstra

**Fax:** (08) 9221 4158 24 hours per day 7 days a week

## NOTE:

If Telstra relocation or protection works are part of the agreed solution, then payment to Telstra for the cost of this work shall be the responsibility of the principal developer or constructor. The principal developer or constructor will be required to provide Telstra with the details of their proposed work showing how Telstra's plant is to be accommodated and these details must be approved by the Regional Network Integrity Manager prior to the commencement of site works.

## RURAL LANDOWNERS - IMPORTANT INFORMATION


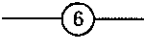

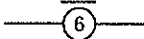

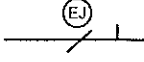
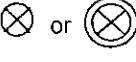

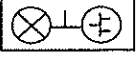
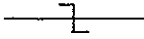

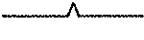
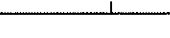

Where Telstra owned cable crosses agricultural land, Telstra will provide a one off free on-site electronic cable location. Please note that the exact location of cables can only be verified by visual proving by pot holing, which is not covered by this service. The Network Integrity Helpdesk Officer will provide assistance in determining whether a free on-site location is required. Please ring the Network Integrity Helpdesk Officer as listed above.

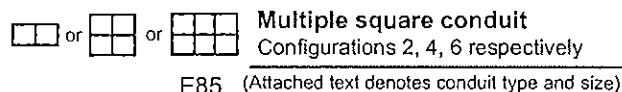
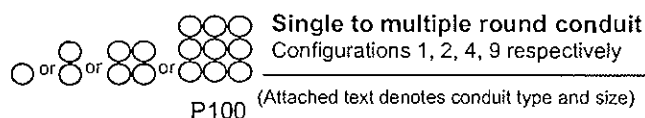
## PRIVACY NOTE

Your information has been provided to Telstra by DBYD to enable Telstra to respond to your DBYD request. Telstra keeps your information in accordance with its privacy statement entitled "Protecting Your Privacy" which can be obtained from Telstra either by calling 1800 039 059 or visiting our website at [www.telstra.com.au/privacy](http://www.telstra.com.au/privacy)

## A GUIDE TO READING PLANS

Telstra Corporation Limited  
ABN 33 051 775 556

	Exchange (major cable present)		Cable jointing pit (number indicating pit type)
	Footway access chamber (can vary from 1-lid to 12-lid)		Buried cable jointing pit (number indicating pit type)
	Roadway access chamber		Elevated cable joint (above ground joint on buried cable)
	Pillar/cabinet (above the ground / free standing)		Cable loop (direct buried)
	Above ground complex equipment housing (eg RIM)		Telstra Plant in shared utility trench
	Optical fibre cable direct buried		Aerial Cable (above ground)
	Direct buried cable		



### Some examples of conduit type and size:

A - Asbestos cement, P - PVC / plastic, C - Concrete,  
GI - Galvanised iron, E - Earthenware.

Conduit sizes *nominal* range from 20mm to 100mm.

P50	50mm PVC conduit
P100	100mm PVC conduit
A100	100mm asbestos cement conduit
E 85	85mm square earthenware conduit

Plant Locator. Accreditation is an initiative taken by Telstra towards the establishment and maintenance of competency standards. However, performance and the advice given will always depend on the nature of the individual engagement.

4. Each Accredited Plant Locator has been issued with a certificate which confirms the Accreditation. Each year Telstra will reassess the accreditation and where appropriate will issue a letter confirming the accreditation for the next calendar year. You have the right to request the organisation you engage to show evidence of this certificate and its currency.
5. The Accredited Plant Locator is required to service each engagement with the personal attendance of at least one accredited employee who has satisfactorily completed a Telstra approved employee accreditation training course. These people will carry a certification card issued by Telstra.
6. Neither the Accredited Plant Locator nor any of its employees are an employee or agent for Telstra and Telstra is not liable for any damage or loss caused by the Accredited Plant Locator or its employees.
7. This list contains the current names and contact details of Accredited Plant Locators who service your area, however, these details are subject to change.

#### Accredited Plant Locaters for Perth South Metropolitan Area

Name and Address	Contact Details	Ask for:
All Service Locations, Busselton.	Ph: 9752 4360 Mob: 0419 902 707	Tania Park
Award Irrigation, Duncraig - <u>North and South of the River</u>	Ph: 9242 2113 Fax: 9246 1818 Mobile: 0411 878 895 or 0413 941 539	Tim Daws or David Ha
CDS Cable Detection Services - Metro	Ph 08 9390 2888 Mob 0439 968 539	Christie Merema (Offic Chris Hazzard
Cable Locates & Consulting, Singleton - <u>Metro and Southwest</u>	Ph: 9537 3030 Fax: 9537 3691 Mob: 0409 115 517	Mark Dentice
Coddington Contractors, Hillarys	Ph: 9402 2423 Fax: 9402 2425 Mob: 0414 330 265	Roy Coddington
Dwight Holdings, Wangara.	Ph: 9302 4375 Fax: 9302 4066 Mob: 0419 951 362	Jeff Alderton
Envirosafe Directional Drilling Pty Ltd, Wangara.	Ph: 9302 4055 or 9302 1171	Shane McQuoid or Ali Tombs
Farley Contracting, Mandurah – <u>Rockingham to Serpentine to Harvey to Mandurah</u>	Ph: 9581 5418 Fax: 9586 2882 Mob: 0417 975 694	Trevor Farley, Brenton Christopher Farley
Gate Trenching and Communications Pty Ltd - The Vines	Ph: 08 92927 4003 Fax: 08 9297 3037 Mob: 0427 929 740	Kevin Gate
Interlec (WA) Pty Ltd, Oakford - <u>Western Australia</u>	Ph: 9418 7800 Fax: 9418 7833 Mob: 0417 686 178	Paul Martens
Jim McKenzie Pty Ltd, Northam - <u>Western Australia</u>	Ph: 9622 5565 Fax: 9622 3972 Mob: 0417 173 944	Jim McKenzie
JWA Locating Service	Ph: (08) 9295 2677 Mobile: 0419 935 215 Fax Number: (08) 9295 2003	Jim Archibald
MJB Nominees, Kalgoorlie – <u>Western Australia</u>	Ph: 9091 7678 Fax: 9022 7504 Mob: 0408 955 457	Michael Balderson
MP Electrolocation, Mosman Park - <u>Western Australia</u>	Ph: 9335 7728	Brian Shearsmith

Sequence Number: 200511:6279; Map Number: 2 MAPS PLOTTED 1xLOCAL 1xMAIN CABLES;  
Map Reference: CANN 41; Comment: CB 26/5/6

WARNING - Due to the nature of Telstra underground plant and the age of some cables and records, it is impossible to ascertain the exact location of all Telstra plant from Telstra's plans. The accuracy and/or completeness of the information provided can not be guaranteed as property boundaries, depths and other natural landscape features may change over time, and accordingly the plans are indicative only. Telstra does not warrant or hold out that its plans are accurate and accepts no responsibility for any inaccuracy shown on the plans.

It is your responsibility to locate Telstra's underground plant by careful hand pot-holing prior to any excavation in the vicinity and to exercise due care during that excavation.

Please read and understand the information provided in the duty of care statement attached with the Telstra plans. TELSTRA WILL SEEK COMPENSATION FOR LOSS CAUSED BY DAMAGE TO ITS PLANT.

Telstra plans and information provided are valid for 60 days from the date of issue. If this timeframe has elapsed, please reapply for plans.

# Appendix D

## Site Classification Assessment Chart and Management Procedures

Dust and Asbestos Management Plan  
Cygnia Cove, Waterford

**NOTE:**

The following information has been taken from the Department of Environmental Protection (now the Department of Environment & Conservation (DEC)) 1996 guidelines “*Land development sites and impacts on air quality – A guideline for the prevention of dust and smoke pollution from land development sites in Western Australia*”. In particular:

- Section 4: ‘Procedures for assessment and management of dust lift-off potential’
- Section 5: ‘Contractor’s responsibility’
- Appendix 1: ‘Site Classification Assessment Chart’
- Appendix 2: ‘Site Assessment Details’
- Appendix 3: ‘Notes relating to ‘Site Classification Assessment Chart’.

All reference to the former DEP has been changed to the DEC.

## **Section 4      Procedures for assessment and management of dust lift-off potential**

### **Site classifications — Threshold scores**

Based on the total score obtained from the “SITE CLASSIFICATION ASSESSMENT CHART” and notwithstanding any allowance for special site conditions during the dry period, (refer to Note 4) the following Site Classification will apply:

Site Classification 1 — under 199;

Site Classification 2 — 200 to 399;

Site Classification 3 — 400 to 799, and

Site Classification 4 — over 800.

**Note:**

- Unique sites may need special assessment.
- It is essential that any contracts for construction work on site include the relevant contingency arrangements appropriate for the site classification.

### **4.1      Classification 1 (score under 199, considered negligible risk)**

Provisions:

- None required.

Contingency arrangements:

- None required.

#### **4.2 Classification 2 (score between 200 and 399, considered low risk)**

##### **Provisions:**

- The developer shall supply a contingency plan to the local government, which shall detail the activities to be undertaken should dust impacts occur.

##### **Contingency arrangements:**

- Include an allowance for water-cart operation, wind fencing and surface stabilisation during the construction period for the purposes of dust suppression.
- All areas of disturbed land should be stabilised to ensure that the disturbed area exposed at any time is kept to a practical minimum.

#### **4.3 Classification 3 (score between 400 and 799, considered medium risk)**

##### **Provisions:**

- Appropriate wind fencing of a length specified in the air quality management programme needs to be stored on site or available within one hour of being required by the engineer for the developer/local government/DEC.
- All areas of disturbed land should be stabilised to ensure that the disturbed area exposed at any time is kept to a practical minimum to prevent exceedence of the maximum acceptable dust level.
- The engineer for the developer shall maintain close control of works with dust creating potential (for example, allowable length of open trenching).
- After all siteworks are completed, and before the contractor has vacated the site, the developer should ensure that the entire site is stable. The developer then retains responsibility for site stability until change of ownership/control takes place. After the change of ownership/control has taken place, the new owner or controlling party will inherit responsibility for site stabilisation.

##### **Contingency arrangements:**

- Suitable water-carts in good working condition and of not less than 10,000 litres capacity per 7.5 hectares of disturbed site, or other suitable alternatives, shall be available to commence watering on the site within 18 hours of being required to do so by the engineer for the developer/local government/DEC.
- Surface stabilisation equipment shall be available to commence operation on site within 48 hours of being required to do so by the engineer for the developer/local government/DEC and with sufficient capacity to cover the disturbed site area within a further 48 hours.
- Wind fencing shall be erected within 18 hours of the contractor being required to do so by the engineer for the developer/local government/DEC. Dust generating works on the site shall cease in the interim.

- If dust-related complaints are generated due to activities on the site, the developer may be required by the local government or an authorised DEC officer to distribute advisory notices to adjoining land occupiers within 48 hours. The notices shall include the name of the developer, engineer for the developer, contractor/s and the contract period. The notices shall also contain contact telephone numbers.
- If dust-related complaints are generated due to material which has been excavated for trenching, the developer shall ensure this material is stabilised within 48 hours of being requested to do so by the engineer for the developer, local government or an authorised DEC officer.
- Include an allowance for water-cart operation, wind fencing and surface stabilisation during the construction period for the purposes of dust and wind-borne material suppression.
- Include an allowance for surface stabilisation for the purposes of dust and wind-borne material suppression to be maintained after the construction period and until change of ownership/control takes place.

#### **4.4 Classification 4 (score over 800, considered high risk)**

##### **Provisions:**

- Advisory notices shall be issued to adjoining land occupiers, the local government and the DEC at least 48 hours before site works commence. The notices shall include the name of the developer, engineer for the developer, contractor/s and the contract period. The notices shall also contain contact telephone numbers and procedures.
- Fencing to the extent and in locations agreed to by the developer and local government shall be erected before any part of the site surface is disturbed.  
**Note: This provision does not necessarily mean that the total site boundary is to be fenced. The fence is to be installed to an extent which will protect adjacent land uses and in most cases should be erected on the edge of the area which will be disturbed rather than on the site boundary.**
- An amount of wind fencing of a length specified in the air quality management programme needs to be stored on site or available within one hour of being required by the engineer for the developer/local government/DEC.
- The nominated wind fencing is to remain in position until the disturbed surface is stable.
- Surface stabilisation is to be applied to the disturbed area of each section of the site upon completion of the works in that section.

- The engineer for the developer shall maintain strict control of works with dust-creating potential. Material which has been excavated for trenching shall be stabilised if the trench is to be left exposed for longer than 72 hours.
- After all siteworks are completed, and before the contractor has vacated the site, the developer should ensure that the entire site is stable. The developer then retains responsibility for site stability until change of ownership/control takes place. After the change of ownership/control has taken place, the new owner or controlling party will inherit responsibility for site stabilisation.

Contingency arrangements:

- Suitable water-carts in good working condition and of not less than 10,000 litres capacity per 5 hectares of disturbed site, or an appropriate alternative, shall be available to commence immediate watering on the site.
- Surface stabilisation equipment shall be available to commence operation on site within 48 hours of being required to do so by the engineer for the developer/local government/DEC and with sufficient capacity to cover the disturbed site area within a further 48 hours.
- Additional wind fencing shall be erected within 18 hours of the contractor being required to do so by the engineer for the developer/local government/DEC. Dust generating works on the site shall cease in the interim.
- Include an allowance for water-cart operation, wind fencing and surface stabilisation during the construction period for the purposes of dust and wind-borne material suppression.
- Include an allowance for surface stabilisation for the purposes of dust and wind-borne material suppression to be maintained after the construction period and until change of ownership/control takes place.

## **5. Contractor's responsibility**

The "Site Classification" rating for a particular site should be considered as an aid to deciding the appropriate measures which should be taken to contain dust and wind-borne material generated by a land development site to maximum acceptable limits.

Notwithstanding the allocated "Site Classification" given to a site, if, during the actual construction work, the suggested dust suppression measures are found to be insufficient, the responsibility for carrying out the necessary measures to achieve an appropriate level of dust suppression rests with the contractor. The DEC or relevant local government, however, reserves the right to take enforcement action for any unsatisfactory dust control against the engineer for the developer, the developer and/or the contractor.

**Appendix 1.****Site Classification Assessment Chart**

Sheet 1

for dust and wind-borne material

**Part A. Nature of site**

Item	Score options				Allocated score
1. Nuisance potential of soil, when disturbed	very low.....1	low.....2	medium.....4	high.....6	
2. Topography and protection provided by undisturbed vegetation	sheltered and screened.....1	medium screening.....6	little screening.....12	exposed and wind prone.....18	
3. Area of site disturbed by the works	less than 1ha.....1	between 1 and 5ha.....3	between 5 and 10ha.....6	more than 10ha.....9	
4. Type of work being done	roads or shallow trenches.....1	roads, drains and medium depth sewers.....3	roads, drains, sewers and partial earthworks.....6	bulk earthworks and deep trenches.....9	
Total score for Part A					

**Part B. Proximity of site to other land uses**

Item	Score options				Allocated score
1. Distance of other land uses from site	more than 1km.....1	between 1km and 500m.....6	between 100m and 500m.....12	less than 100m.....18	
2. Effect of prevailing winds (at time of construction) on other land uses	not affected.....1	isolated land uses affected by one wind direction.....6	dense land uses affected by one wind direction.....9	dense/sensitive land uses, highly affected by prevailing winds...12	
Total score for Part B					

**SITE CLASSIFICATION SCORE (A x B) =**

## Appendix 1.

## Site Assessment Details

### Sheet 2

Engineer for the developer

Site detail

Local government

Location of works (use AMG grid  
reference from Metropolitan Street  
Directory and nearest main street)

Project name/stage

Description of works

Contract dates (starting/completion  
dates and duration in weeks)

Score from assessment chart

Special considerations

(refer to Appendix 1, Note 4)

### Comments at completion of construction:

(to include details of dust-related problems and provisions and contingency arrangements which were actually carried out)

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(copy of the completed sheet to be returned to the Department of Environmental Protection)

## **Appendix 1.**

### **Notes relating to “Site Classification Assessment Chart”**

#### **Sheet 3**

The following notes relate to the “Site Classification Assessment Chart”.

- (1) The site assessment chart is used to differentiate between Classifications 1, 2, 3 and 4, as defined within these guidelines. Classifications 2 and 3 are subject to Note 4, below.
- (2) Sites may be divided into two or more classifications depending mainly on the proximity of existing land uses.
- (3) In assessing the relevant score level, the “effect of prevailing winds” must be carefully considered. While houses, commercial areas, market gardens, schools and factories have high sensitivity ratings, roads, parks and recreational areas have lower sensitivity ratings.
- (4) Construction during dry period (October 1- March 31).
  - (a) Where other land uses are within 100 metres of the site:
    - (i) sites assessed as Class 3 will automatically become Class 4, and
    - (ii) sites assessed as Class 2 will automatically become Class 3.
  - (b) Where other land uses are situated between 100 metres and 500 metres from the site, an on-site re-evaluation of Class 3 sites shall be conducted by the engineer for the developer, the local government or the DEP to determine the extent of additional Class 4 requirements considered necessary (if any).

Appendix E  
Bureau of Meteorology Monthly Data  
for Perth Metropolitan Area

Dust and Asbestos Management Plan  
Cygnia Cove, Waterford



Australian Government  
Bureau of Meteorology

## Perth Metro Climatic Averages

Observations are taken, as appropriate, from official Perth Metro observing sites at Perth Gardens, West Perth (Old Observatory), East Perth and Mt Lawley, and from Perth Airport

ELEMENT	UNIT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	RECORDS COMMENCE
Mean Daily Maximum Temperature	°C	30.6	31.2	29.3	25.9	22.3	19.1	18.3	18.5	20.0	22.7	26.1	28.7	<b>24.4</b>	1993
Mean Daily Minimum Temperature	°C	17.8	18.0	16.5	13.9	11.0	8.9	8.0	8.1	9.4	11.1	14.1	16.2	<b>12.8</b>	1993
Mean Daily Temperature (Max+Min)/2	°C	24.2	24.6	22.9	19.9	16.7	14.0	13.1	13.3	14.7	16.9	20.1	22.4	<b>18.6</b>	1993
Mean Temperature - 9AM	°C	24.1	24.0	22.1	19.3	15.9	13.0	12.0	12.8	15.1	17.6	20.9	22.9	<b>18.3</b>	1993
Mean Temperature - 3PM	°C	28.8	29.5	27.7	24.6	21.4	18.1	17.2	17.5	18.6	21.0	24.1	26.6	<b>22.9</b>	1993
Temperature 40°C or greater	days	0.8	1.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	<b>3.0</b>	1993
Temperature 32°C or greater	days	11.9	11.8	8.5	1.8	0.2	0.0	0.0	0.0	0.0	0.7	4.0	7.3	<b>46.4</b>	1993
Temperature 30°C or greater	days	15.7	17.0	12.6	4.3	0.7	0.0	0.0	0.0	0.1	1.8	6.6	10.8	<b>69.6</b>	1993
Temperature 5°C or lower	days	0.0	0.0	0.0	0.1	1.9	5.5	7.9	7.1	2.6	0.9	0.1	0.0	<b>26.1</b>	1993
Temperature 2°C or lower	days	0.0	0.0	0.0	0.0	0.0	0.5	2.8	0.7	0.4	0.0	0.0	0.0	<b>4.4</b>	1993
Mean Relative Humidity - 9AM	%	49	51	56	63	72	79	80	76	68	58	52	49	<b>63</b>	1993
Mean Relative Humidity - 3PM	%	40	38	40	46	51	58	57	55	54	47	45	41	<b>48</b>	1993
Mean MSL Pressure - 9AM	hPa	1013.6	1013.9	1016.6	1018.7	1019.0	1018.9	1019.8	1020.3	1019.6	1018.1	1016.1	1014.5	<b>1017.4</b>	1938
Mean MSL Pressure - 3PM	hPa	1011.4	1011.5	1014.2	1016.5	1016.9	1017.0	1018.0	1018.4	1017.7	1016.2	1014.2	1012.6	<b>1015.4</b>	1938
Mean MSL Pressure - 9AM & 3PM	hPa	1012.5	1012.7	1015.4	1017.6	1018.0	1018.0	1018.9	1019.4	1018.7	1017.2	1015.2	1013.6	<b>1016.4</b>	1938
Thunder Heard	days	1.0	1.0	1.0	1.1	1.8	2.3	1.9	1.4	0.8	0.7	1.2	0.9	<b>15.1</b>	1944
Hail Observed	days	0.0	0.0	0.1	0.0	0.1	0.3	0.3	0.3	0.2	0.1	0.0	1.4	<b>2.8</b>	1944
Frost Observed	days	0.0	0.0	0.0	0.0	0.1	0.4	0.7	0.6	0.2	0.0	0.0	0.0	<b>2.0</b>	1944
Fog Observed	days	0.5	0.4	0.9	1.4	1.9	1.8	2.0	1.4	1.4	1.5	0.9	0.4	<b>14.5</b>	1944
Mean Daily Sunshine Hours	hrs	11.7	11.1	9.4	8.1	6.7	5.7	6.1	7.1	7.7	9.6	10.7	11.7	<b>8.8</b>	1993
Mean Daily Evaporation	mm	10.2	9.7	7.8	5.1	3.1	2.2	2.1	2.6	3.6	5.2	7.4	9.0	<b>5.7</b>	1981
Mean Rainfall	mm	9	12	20	44	120	179	171	135	81	53	22	13	<b>859</b>	1876
Median Rainfall	mm	4	5	12	37	119	173	167	136	77	48	18	9	<b>849</b>	1876
Cumulative Rainfall	mm	9	21	41	85	205	384	555	690	771	824	846	859	<b>859</b>	1876
Mean Rain Days	days	2	2	5	7	12	17	17	16	15	9	6	4	<b>112</b>	1876
Cumulative Rain Days	days	2	4	9	16	28	45	62	78	93	102	108	112	<b>112</b>	1876

Commonwealth Bureau of Meteorology, Climate and Consultancy Section WA, January 2006



Australian Government  
Bureau of Meteorology

## Perth Metro Climatic Extremes

Observations are taken, as appropriate, from official Perth Metro observing sites at Perth Gardens, West Perth (Old Observatory), East Perth and Mt Lawley

ELEMENT	UNIT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	RECORDS COMMENCE
Highest Temperature Date	°C	45.8 31/1991	46.2 23/1991	42.3 05/1990	37.6 09/1910	34.3 01/2002	28.1 05/1975	26.3 *	27.8 21/1940	32.7 30/1918	37.3 29/1967	40.3 **	42.3 31/1968	<b>46.2</b> 23-Feb-1991	1897
Lowest Maximum Temperature Date	°C	19.7 19/1939	19.0 17/1914	16.4 27/1968	13.6 16/1919	11.5 23/1995	8.8 26/1956	10.5 09/1906	9.9 05/1951	11.4 17/1917	11.9 08/1932	15.8 02/1919	14.9 17/1952	<b>8.8</b> 26-Jun-1956	1897
Highest Minimum Temperature Date	°C	27.8 21/1989	29.3 ***	28.3 02/1934	24.4 02/1913	20.8 01/1983	18.7 12/1988	16.1 12/1898	16.6 13/1976	19.5 08/1916	22.2 29/1979	25.1 24/1920	27.1 18/1979	<b>29.3</b> ***	1897
Lowest Temperature Date	°C	8.9 25/2001	8.7 01/1902	7.6 24/2001	4.1 20/1914	1.3 11/1914	1.2 ****	0.0 †	1.3 21/2000	1.5 Ø	2.2 06/1994	5.0 18/2004	8.4 02/2002	<b>0.0</b> †	1897
Highest Mean Maximum Temperature Year	°C	34.4 1962	35.1 1985	31.8 1978	28.2 1978/1999	24.0 2003	20.6 1983	19.9 1976/1977	20.3 1902	22.6 1987	25.8 1969	27.7 1920	31.7 1931	<b>25.2</b> 1978	1897
Lowest Mean Maximum Temperature Year	°C	26.3 1939	26.5 1926	24.4 1927	21.0 1968	18.7 1931/1956	15.9 1898	16.0 1960	16.3 1932	16.8 1915	18.8 1924	21.5 1971	23.7 2005	<b>21.8</b> 1917	1897
Highest Mean Minimum Temperature Year	°C	20.9 1978	22.7 1985	20 1988	17.3 1978	13.8 1972	12.8 1964	11.4 1921	11.5 1977/1983	12.4 1988	14.2 1969	16.9 1982	19.6 1977	<b>14.9</b> 1988	1897
Lowest Mean Minimum Temperature Year	°C	15.6 3 years	15.6 1931	13.5 1900	11.6 1914	8.8 2000	6.9 2001	5.3 1997	6.9 1956/2001	8.0 2004	9.3 1910	11.9 1954	13.9 2005	<b>12.0</b> 1908/2001	1897
Highest Mean Daily Sunshine Hours Year	hrs	12.6 1974	12.0 3 years	10.6 2001	9.3 1920	7.9 2000	7.3 2001	7.5 1918	8.4 1902	8.8 Many	10.9 2000	11.9 2002	12.6 2000	<b>9.1</b> 1994	1898
Lowest Mean Daily Sunshine Hours Year	hrs	8.3 1920	7.7 1955	5.5 1927	4.4 1926	3.4 1905	2.9 1945	3.2 1926	4.2 1945	4.9 1907	5.5 1898	5.1 1965	8.0 1925	<b>6.9</b> 1923/1965	1898
Highest Daily Rainfall Date	mm	104.0 22/2000	120.6 09/1992	77.0 09/1934	69.6 17/2002	76.2 17/1942	99.1 10/1920	95.0 29/1987	73.9 14/1945	51.8 14/1984	68.2 18/1995	39.1 29/1956	46.7 03/1951	<b>120.6</b> 9-Feb-1992	1876
Highest Monthly Rainfall Year	mm	139.0 2000	166.3 1955	145.2 1934	148.8 1926	308.1 1879	476.1 1945	425.1 1958	318.3 1945	199.1 1923	199.9 1890	73.2 1984	80.7 1951	<b>1338.8</b> 1945	1876
Lowest Monthly Rainfall Year	mm	0.0 11 years	0.0 17 years	0.0 6 years	0.0 3 years	14.1 1964	54.9 1877	61.5 1876	11.8 1902	8.7 1916	1.0 1969	0.0 1891	0.0 5 years	<b>508.7</b> 1940	1876
Highest Number of Rain Days Year	days	8 1916/90	8 3 years	10 1915	19 1926	25 1921	27 1918/70	29 1946	29 1955	26 1915	22 1898	14 3 years	14 1913/44	<b>167</b> 1926	1876
Least Number of Rain Days Year	days	0 11 years	0 17 years	0 6 years	0 3 years	5 1913	9 1893/1976	6 1918	4 1902/78	4 1877	1 1969	0 1891	0 5 years	<b>87</b> 1969	1876
Maximum Wind Gust	kn	48	61	61	70	64	69	74	84	61	63	55	55	<b>84</b>	1942
	km/h	89	113	113	130	119	128	137	156	113	117	102	102	<b>156</b>	
Direction	compass	SW	NNE	N	NNW	NW	W	W	W	NW	WNW	NW	NW	W	
Time	WST	15:45	15:15	15:25	16:55	06:45	06:35	04:45	05:15	10:25	03:25	12:45	14:45	05:15	
Date		06/1950	20/1977	27/1960	04/1978	30/1962	25/1947	18/1964	22/1963	07/1973	30/1950	11/1946	06/1944	22-Aug-1963	

\* 17 & 18-Jul-1976, \*\* 24-Nov-1913 & 11-Nov-2003, \*\*\* 8-Feb-1933 & 3 Feb-1962, \*\*\*\* 19-Jun-2003 & 2-Jun-2004, † 15-Jul-1997 & 27-Jul-1998 Ø 1 Sept & 10 Sept-2005

Commonwealth Bureau of Meteorology, Climate and Consultancy Section WA, January 2006

# Wind Frequency analysis using available data between Jan 1994 and Sep 2006 for

## Perth Metro

Site Number 009225 • Locality: Mount Lawley • Opened Feb 1993 • Still Open • Latitude 31°55'09"S • Longitude 115°52'22"E • Elevation 24.9m

Page 1 of 10

Values are percentage frequencies; \* indicates the range has occurred but with a frequency of less than 0.5%.

### 12 am January

Calm 8		A total of 390 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	1	1	3	5	14	3	2	1	30
11-20		*	14	12	23	5	1	*	55
21-30		*	2	3	1	1	*		7
>30									
All	1	2	18	20	38	9	3	1	100

### 12 am February

Calm 10		A total of 367 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	1	1	4	5	17	3	2	1	35
11-20		1	16	7	21	3	1	*	49
21-30		*	3	2		1			6
>30									
All	1	2	23	15	38	7	3	1	100

### 12 am March

Calm 18		A total of 399 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	2	1	6	6	14	2	2	1	34
11-20	*	2	15	6	14	4	1	*	42
21-30		*	2	3	1	1			6
>30									
All	2	4	23	14	29	8	3	1	100

### 12 am April

Calm 26		A total of 388 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	4	4	7	6	17	2	1	1	43
11-20	1	2	13	5	6	1	1	*	30
21-30			1	*	*	*			2
>30									
All	5	6	21	11	23	3	3	1	100

### 12 am May

Calm 37		A total of 400 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	8	8	12	4	6	1	2	2	42
11-20	3	3	4	2	2	2	3	1	19
21-30		1				*	*	1	2
>30									
All	11	11	16	6	8	3	5	4	100

### 12 am June

Calm 34		A total of 390 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	11	12	7	4	3	2	3	3	45
11-20	4	3	1	*	*	2	5	1	17
21-30	*	*			*	1	1	1	3
>30								*	*
All	16	15	8	5	4	4	9	5	100

### 12 am July

Calm 30		A total of 400 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	10	13	6	3	6	2	4	1	44
11-20	5	2	2	*	*	3	5	4	20
21-30		1			*	2	2	1	6
>30									
All	14	16	8	3	6	7	11	6	100

### 12 am August

Calm 34		A total of 402 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	11	8	5	5	5	2	3	2	41
11-20	4	1	2	1	3	3	5	1	21
21-30	*		*			1	1	1	4
>30								*	*
All	16	9	7	6	8	6	9	4	100

### 12 am September

Calm 27		A total of 387 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	6	4	5	4	15	3	5	2	44
11-20	2	1	2	2	6	4	7	1	25
21-30					1	1	2	1	4
>30								*	*
All	8	5	7	6	21	8	13	4	100

### 12 am October

Calm 18		A total of 369 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	3	2	2	6	21	4	1	1	41
11-20	1	*	6	7	16	3	2	3	38
21-30			1		*	1	1	1	4
>30									
All	4	3	9	13	37	8	5	4	100



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## 12 am November

Calm 10		A total of 358 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	2	1	3	8	16	3	3	1	37
11-20	1	*	9	8	20	7	2	2	48
21-30		1	2	1	*	*	*	*	5
>30						*			*
All	3	2	14	17	36	11	5	3	100

## 12 am December

Calm 7		A total of 372 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	1	2	2	3	14	2	3	1	28
11-20		2	12	9	27	5	1	1	57
21-30		*	3	2	2				7
>30									
All	1	4	17	14	43	8	4	3	100

## 3 am January

Calm 11		A total of 389 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	2	2	6	5	8	2	2	*	27
11-20		1	25	10	17	3	1		56
21-30			3	2	*	1	*		6
>30									
All	2	3	34	17	25	6	3	*	100

## 3 am February

Calm 15		A total of 366 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	2	3	7	5	8	1	2	1	28
11-20	*	1	26	10	14	2	1	*	55
21-30			2	1		*			3
>30									
All	2	4	35	16	21	4	3	1	100

## 3 am March

Calm 20		A total of 395 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	2	3	8	6	10	1	1	1	32
11-20		3	22	9	6	4	1	1	45
21-30			2	1	1				3
>30									
All	2	6	32	16	17	5	2	1	100

## 3 am April

Calm 29		A total of 389 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	3	7	12	6	10	2	2	1	42
11-20	*	5	12	2	6	1	1	*	28
21-30			1		*		*		1
>30									
All	3	12	26	8	16	3	3	1	100

## 3 am May

Calm 31		A total of 398 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	8	17	12	5	5	1	1	1	50
11-20	1	6	4	1		1	2	2	17
21-30	1	*					1	1	3
>30									
All	10	23	16	6	5	2	4	4	100

## 3 am June

Calm 28		A total of 388 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	10	18	8	3	3	3	3	1	49
11-20	4	4	2		*	2	4	2	19
21-30	*	*				1	2	1	4
>30									
All	15	22	10	3	3	6	9	4	100

## 3 am July

Calm 28		A total of 400 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	11	14	9	3	3	*	3	1	45
11-20	4	4	2	1	2	4	3	1	21
21-30	1	*				1	3	1	6
>30						*			*
All	16	19	10	4	5	6	9	3	100

## 3 am August

Calm 29		A total of 402 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	11	12	9	3	5	2	3	1	46
11-20	3	2	2	*	2	3	6	2	21
21-30	*	*			*	1	1	*	4
>30						*			*
All	15	15	11	3	7	6	10	3	100



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## 3 am September

Calm 28		A total of 388 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	6	9	7	5	8	4	4	1	44
11-20	2	2	3	1	4	4	4	2	22
21-30					*	2	2	1	5
>30							*	*	1
All	9	11	11	6	12	10	10	4	100

## 3 am October

Calm 22		A total of 370 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	3	4	5	7	13	2	3	1	38
11-20	1	2	14	4	10	3	2	1	36
21-30			1			2	1		4
>30								*	*
All	4	6	20	11	22	7	6	2	100

## 3 am November

Calm 14		A total of 358 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	2	3	6	7	9	3	2	1	33
11-20	1	3	21	8	11	4	3	1	51
21-30			1	1		*	*		2
>30						*			*
All	3	5	28	16	20	8	5	2	100

## 3 am December

Calm 9		A total of 372 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	1	2	5	5	12	2	3	2	32
11-20	*	3	22	9	17	2	1	1	54
21-30		*	2	*	1	1	*		4
>30									
All	1	5	29	14	29	5	4	3	100

## 6 am January

Calm 10		A total of 390 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	2	3	6	8	7	2	2	*	29
11-20	*	2	28	10	12	2	1		55
21-30			4	*	*	1			5
>30									
All	2	4	39	18	19	5	3	*	100

## 6 am February

Calm 15		A total of 367 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	1	4	9	5	7	1	2	*	29
11-20	1	3	29	9	9	2	1	1	53
21-30		*	1	1		*			2
>30									
All	1	8	39	15	16	3	2	1	100

## 6 am March

Calm 19		A total of 399 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	3	5	11	7	8	1	1	1	36
11-20	*	3	26	5	7	1	1	*	42
21-30			1	1	*	*			2
>30									
All	3	8	39	12	15	2	1	1	100

## 6 am April

Calm 27		A total of 388 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	5	11	15	6	5	1	1	1	46
11-20	1	5	13	1	4	1	1	*	26
21-30		1	*				*		1
>30									
All	6	17	28	8	9	2	2	1	100

## 6 am May

Calm 26		A total of 402 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	7	17	18	3	3	1	1	*	50
11-20	3	5	6	1	1	*	2	2	21
21-30	*					*	1	1	2
>30							*		*
All	10	23	24	3	4	2	4	3	100

## 6 am June

Calm 27		A total of 388 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	9	19	11	4	3	2	1	1	49
11-20	3	4	1	*	2	2	5	2	19
21-30	*	1				1	2	1	4
>30		*							*
All	12	24	12	4	4	4	8	4	100



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### 6 am July

Calm 24		A total of 400 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	9	20	10	3	4	2	4	2	52
11-20	5	4	1		2	2	4	2	19
21-30	1	1	*			1	3	1	6
>30									
All	14	25	11	3	6	5	10	4	100

### 6 am August

Calm 24		A total of 402 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	10	17	7	2	4	1	2	2	47
11-20	3	4	4	1	3	2	6	2	26
21-30		*			1	*	1	1	3
>30							*		*
All	13	21	11	3	8	4	10	4	100

### 6 am September

Calm 26		A total of 386 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	6	13	10	5	6	2	3	1	46
11-20	3	3	3	*	3	4	5	1	22
21-30	*				1	1	3	1	6
>30						*			*
All	9	16	13	5	10	7	12	3	100

### 6 am October

Calm 23		A total of 371 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	5	6	11	5	9	1	2	2	41
11-20	2	2	12	3	7	4	2	1	33
21-30		*	1	*		1	*	*	3
>30									
All	7	9	24	8	16	6	4	3	100

### 6 am November

Calm 13		A total of 357 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	3	4	10	5	9	1	3	2	37
11-20	1	1	26	5	8	3	2	1	47
21-30	*	1	1		*		1		3
>30									
All	4	6	37	10	18	4	6	2	100

### 6 am December

Calm 10		A total of 372 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	1	2	9	9	10	1	2	1	35
11-20	*	4	21	9	13	2	2	*	50
21-30		1	4		*	1			5
>30									
All	1	7	34	17	23	4	4	1	100

### 9 am January

Calm		A total of 390 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	3	2	4	3	5	2	1	1	20
11-20	1	6	29	11	12	3	3	2	66
21-30	*	3	5	2	1	2			14
>30									
All	4	11	38	16	18	7	4	3	100

### 9 am February

Calm		A total of 366 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	1	2	6	4	5	2	1	1	20
11-20	1	11	26	9	9	5	2	1	63
21-30		3	9	2	2	1	*		16
>30			*						*
All	2	16	41	14	16	7	3	1	100

### 9 am March

Calm 1		A total of 403 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	2	4	9	5	5	1	1	*	27
11-20	1	11	26	6	9	4	2	1	59
21-30		4	5	1	1	*	*		13
>30									
All	2	19	40	13	15	5	3	1	100

### 9 am April

Calm 3		A total of 387 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	5	11	15	6	5	1	1	2	44
11-20	3	10	21	3	5	1	2	1	46
21-30		2	3		*	1	*	*	7
>30									
All	7	23	39	9	10	2	3	3	100



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### 9 am May

Calm 5		A total of 402 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	7	15	17	6	3		1	1	51
11-20	6	14	10	2	2	*	3	2	39
21-30	*	1	1				1	1	4
>30	*						*	*	*
All	14	30	28	8	5	*	5	4	100

### 9 am June

Calm 4		A total of 389 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	9	22	16	4	3	1	3	1	58
11-20	6	12	3	1	2	2	5	1	33
21-30	1	1			*	1	2	1	5
>30									
All	15	35	19	5	5	3	11	3	100

### 9 am July

Calm 7		A total of 401 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	9	22	10	5	2	1	3	1	53
11-20	9	10	2	1	2	3	4	1	33
21-30	*	1			*	1	3	1	6
>30								*	*
All	19	33	12	6	4	5	10	3	100

### 9 am August

Calm 3		A total of 400 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	10	17	12	4	2	1	2	2	49
11-20	9	11	5	3	5	2	5	3	41
21-30		1	1		1	3	2	*	8
>30									
All	18	29	18	7	8	6	8	5	100

### 9 am September

Calm 2		A total of 387 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	6	9	10	4	5	*	1	2	37
11-20	6	9	9	4	7	2	8	2	48
21-30	1	1	1		1	4	5	2	13
>30									
All	13	19	20	7	13	7	14	6	100

### 9 am October

Calm		A total of 370 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All	
1-10	3	5	7	6	4	1	1	1	28	
11-20	3	5	14	9	13	4	4	4	55	
21-30	*	3	5	1	2	2	2	2	17	
>30										
All	6	13	27	16	18	6	6	7	100	

### 9 am November

Calm *		A total of 358 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	2	1	4	3	4	1	3	1	18
11-20	3	6	27	8	12	5	5	3	69
21-30	*	4	2	*	1	2	1	1	12
>30								*	*
All	5	11	33	11	16	8	9	6	100

### 9 am December

Calm *		A total of 372 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	3	*	4	3	6	3	1	*	19
11-20	2	5	22	10	13	5	4	1	62
21-30	*	5	5	1	3	2	1	*	18
>30									
All	5	10	31	14	22	9	6	2	100

### 12 pm January

Calm		A total of 390 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All	
1-10	1	2	3	2	5	2	1	1	16	
11-20		5	16	12	10	12	10	1	67	
21-30	*	1	2	2	5	6	1	1	17	
>30										
All	2	7	21	15	20	20	12	2	100	

### 12 pm February

Calm		A total of 367 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All	
1-10	1	1	4	2	4	2	1	1	15	
11-20	1	9	20	9	12	12	9	2	74	
21-30	*		2	1	1	5	1	*	11	
>30				*					*	
All	2	10	26	13	16	19	11	3	100	



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### 12 pm March

Calm		A total of 399 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	1	2	4	4	5	2	2	1	19
11-20	2	11	19	7	10	10	9	2	70
21-30	*	1	3	1	1	3	1	*	11
>30									
All	3	13	26	12	16	15	12	3	100

### 12 pm April

Calm *		A total of 390 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	3	4	4	3	5	6	2	2	28
11-20	3	11	14	5	10	6	9	3	62
21-30	1	2	3		1	1	1	2	9
>30									
All	6	16	21	8	16	14	12	6	100

### 12 pm May

Calm		A total of 399 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	5	6	7	4	2	2	2	2	30
11-20	10	17	10	3	6	2	6	6	58
21-30	1	2	1		*	2	3	2	12
>30									
All	16	24	18	7	8	6	12	10	100

### 12 pm June

Calm 1		A total of 390 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	7	9	4	3	3	1	2	3	30
11-20	17	13	4	1	5	4	7	4	54
21-30	3	3			1	2	4	2	15
>30									
All	27	24	8	4	8	7	13	9	100

### 12 pm July

Calm *		A total of 402 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	7	5	4	3	2	1	1	3	26
11-20	16	13	7	3	6	3	7	5	59
21-30	1	2			1	3	4	3	15
>30							*	*	1
All	24	19	11	6	9	7	13	11	100

### 12 pm August

Calm		A total of 401 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	4	3	3	5	4	2	2	2	25
11-20	11	8	6	2	7	7	8	6	56
21-30	3	2	1	*	1	2	4	3	18
>30						*			*
All	18	14	9	7	13	12	14	12	100

### 12 pm September

Calm		A total of 383 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	3	2	3	4	3	2	2	2	22
11-20	5	5	5	2	8	13	11	5	56
21-30	1	1	1	*	3	5	7	3	21
>30					*	*	*	1	2
All	9	8	9	6	14	20	21	12	100

### 12 pm October

Calm *		A total of 369 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	1	2	2	4	3	2	1	1	17
11-20	3	3	10	5	14	15	10	3	63
21-30	*	1	2	*	3	5	5	3	19
>30							*	*	1
All	4	6	14	10	20	22	17	8	100

### 12 pm November

Calm		A total of 353 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	2	2	4	3	2	2	*	1	15
11-20	1	3	12	9	10	14	14	3	66
21-30		1	2	*	3	6	4	3	19
>30						*			*
All	3	6	18	12	14	22	18	7	100

### 12 pm December

Calm		A total of 370 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	*	1	2	2	2	*	1		8
11-20	1	4	14	10	12	17	13	2	72
21-30	*	1	4	1	2	10	2	1	20
>30									
All	2	6	19	12	16	27	16	3	100



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## 3 pm January

Calm		A total of 392 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10		*	*	1	1	*	*		2
11-20	*	2	7	7	7	16	9	1	50
21-30			2	3	13	27	4		48
>30						1			1
All	*	2	9	11	21	43	13	1	100

## 3 pm February

Calm		A total of 365 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	*	*	1	1	*			*	2
11-20		2	10	7	9	26	9	1	64
21-30		*	2	2	7	21	1		33
>30						1			1
All	*	3	13	10	16	47	10	1	100

## 3 pm March

Calm		A total of 402 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	*	1	3	2	2	1	1	*	12
11-20	*	2	11	9	8	20	10	1	63
21-30		*	2	2	2	18	1	*	25
>30									
All	1	4	16	14	12	39	13	2	100

## 3 pm April

Calm *		A total of 389 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	1	1	5	2	3	1	2	1	16
11-20	*	4	11	5	8	25	14	4	72
21-30		*	1	1	2	7	1	1	12
>30									
All	1	6	17	7	14	34	17	5	100

## 3 pm May

Calm *		A total of 401 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	3	4	6	3	5	3	4	1	30
11-20	4	7	10	2	7	11	11	7	59
21-30	1	*	1		*	3	2	4	11
>30									
All	8	11	17	5	12	17	18	12	100

## 3 pm June

Calm		A total of 389 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	5	4	4	2	5	3	5	3	30
11-20	9	11	5	1	4	9	12	6	57
21-30	1	1	1			2	5	3	12
>30								*	*
All	15	15	9	3	9	15	22	12	100

## 3 pm July

Calm *		A total of 403 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	5	4	4	3	3	4	3	3	30
11-20	9	7	5	2	5	9	9	8	56
21-30	1	*			*	4	4	3	13
>30			*				*	*	1
All	15	12	10	5	9	17	17	15	100

## 3 pm August

Calm *		A total of 401 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	1	2	2	2	2	3	4	2	18
11-20	4	5	5	1	5	16	15	12	63
21-30		*		*	2	5	5	5	18
>30									
All	5	7	7	4	9	24	24	18	100

## 3 pm September

Calm		A total of 385 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	*	1	2	1	*	1	1	1	7
11-20	1	4	3	3	9	20	24	6	70
21-30		1		*	3	10	5	4	24
>30									
All	1	5	4	4	12	31	31	11	100

## 3 pm October

Calm		A total of 372 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10		1	*	1	*	*		*	3
11-20	*	2	7	3	8	19	13	4	57
21-30	*	*	1	1	10	17	5	4	39
>30					*	*	*		1
All	1	4	9	5	19	37	18	8	100



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### 3 pm November

Calm		A total of 358 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10		*	1	1	*	*	*		3
11-20		1	7	4	7	17	12	3	50
21-30			1	2	14	22	6	2	46
>30						1	*		1
All		1	9	7	22	39	18	4	100

### 3 pm December

Calm		A total of 370 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10			1	*	*		1		2
11-20		1	9	7	6	18	8	1	49
21-30			1	1	12	31	2	*	48
>30			*			1			1
All		1	11	8	18	49	11	1	100

### 6 pm January

Calm		A total of 391 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10			*	*	1	1	1	1	3
11-20		1	5	3	10	25	4	1	49
21-30		*	2	2	13	31	*		48
>30									
All		1	7	5	24	57	5	1	100

### 6 pm February

Calm *		A total of 365 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10		*	1		*	1	*	*	3
11-20		1	7	4	9	30	2	1	54
21-30			2	4	9	27			42
>30						1			1
All		1	10	8	18	59	2	1	100

### 6 pm March

Calm 1		A total of 400 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	1	1	2	1	3	4	2	*	13
11-20		1	11	7	12	35	4	1	70
21-30		*	*	2	3	11			17
>30									
All	1	2	13	10	17	49	6	1	100

### 6 pm April

Calm 2		A total of 390 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10		2	7	3	5	13	4	1	35
11-20	*	2	9	3	12	27	3	2	59
21-30			*	*	1	2	*	*	3
>30									
All	*	3	16	7	18	42	8	4	100

### 6 pm May

Calm 15		A total of 399 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	4	3	10	6	9	11	6	5	54
11-20	1	2	3	1	7	7	4	4	28
21-30			1	*		1	1	1	3
>30								*	*
All	6	4	14	7	15	19	11	10	100

### 6 pm June

Calm 26		A total of 390 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	7	6	6	5	7	5	6	6	47
11-20	4	1	1		3	6	5	1	22
21-30	*	1			*	1	2	1	5
>30									
All	11	7	7	5	11	12	13	8	100

### 6 pm July

Calm 19		A total of 402 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	7	4	9	3	6	7	6	6	50
11-20	2	1	1	*	4	6	5	4	25
21-30	*					1	2	1	5
>30						*		*	1
All	10	6	10	3	10	15	14	12	100

### 6 pm August

Calm 7		A total of 399 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	5	3	5	2	4	14	8	4	42
11-20	2	1	3	2	7	15	8	9	45
21-30	*				1	2	1	2	6
>30									
All	7	4	7	3	12	30	17	14	100



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## 6 pm September

Calm 1		A total of 387 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	1	1	3	1	2	6	8	3	24
11-20	1	1	3	2	13	32	11	5	66
21-30	1			*	2	2	2	2	9
>30					*	*			1
All	2	2	6	3	17	40	21	10	100

## 6 pm October

Calm		A total of 372 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	1	1	1	1	*	3	2	1	9
11-20		1	5	4	18	34	9	4	75
21-30			*	1	6	7	1	1	16
>30							*		*
All	1	2	6	6	24	44	12	6	100

## 6 pm November

Calm		A total of 358 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10			*	1	*	*	1		3
11-20			6	4	11	30	9	3	63
21-30			*	1	12	20	*	1	34
>30									
All			6	5	23	50	10	4	100

## 6 pm December

Calm		A total of 370 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10			*		*	1	1		2
11-20		1	6	4	8	22	6		47
21-30			2	2	14	32	1		51
>30						*			*
All		1	9	6	22	55	7		100

## 9 pm January

Calm 2		A total of 390 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	1	*	1	4	7	4	3	*	20
11-20		*	3	7	42	12	2	*	66
21-30		*	1	3	4	3	*		12
>30									
All	1	1	5	14	54	19	5	1	100

## 9 pm February

Calm 4		A total of 364 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	1		1	4	9	6	4	*	25
11-20		1	5	7	38	9	1	*	62
21-30			2	2	2	3	*		9
>30				*					*
All	1	1	8	14	49	18	5	1	100

## 9 pm March

Calm 10		A total of 399 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	1	1	5	7	13	6	1	*	33
11-20	*	*	7	7	31	8	1	*	53
21-30			*	1	1	1			4
>30									
All	1	1	12	15	44	15	2	1	100

## 9 pm April

Calm 16		A total of 386 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	2	2	7	9	19	3	2	1	46
11-20	1	1	5	4	23	3	1	1	37
21-30			1		*	*	*		2
>30									
All	2	3	13	12	41	6	3	2	100

## 9 pm May

Calm 31		A total of 399 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	6	5	10	8	10	1	3	2	45
11-20	2	1	2	1	8	1	3	2	21
21-30			*		*	*	*	1	3
>30			*						*
All	9	7	12	9	19	2	6	5	100

## 9 pm June

Calm 38		A total of 389 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	8	8	6	5	7	2	2	2	40
11-20	5	3	1		1	2	4	2	18
21-30		*				1	2	1	4
>30									
All	12	11	7	5	8	5	8	5	100



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## 9 pm July

Calm 30		A total of 404 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	9	5	9	4	8	2	3	2	44
11-20	6	1	1	*	2	4	4	2	21
21-30	*				*	1	2	*	4
>30								*	*
All	16	6	11	5	11	7	10	5	100

## 9 pm December

Calm 1		A total of 372 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	1		2	3	7	4	2	1	20
11-20	1	1	5	6	40	15	3		71
21-30			1	1	4	2			8
>30									
All	1	1	7	11	51	22	6	1	100

## 9 pm August

Calm 26		A total of 402 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	8	4	3	7	14	3	4	1	46
11-20	3	*	1	2	6	2	4	4	24
21-30	*				*	1	1	1	4
>30									
All	12	4	4	10	21	7	9	6	100

## 9 pm September

Calm 19		A total of 386 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	4	2	2	5	15	4	6	3	41
11-20	2	*	1	2	16	6	5	1	34
21-30					1	2	2	1	6
>30									
All	5	2	3	7	32	12	13	6	100

## 9 pm October

Calm 6		A total of 371 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	2	1	1	3	10	7	4	2	30
11-20	1	*	3	7	39	5	3	3	60
21-30					2		1	1	4
>30									
All	3	1	3	10	51	12	8	5	100

## 9 pm November

Calm 2		A total of 358 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	1	1	1	3	9	5	4	1	25
11-20	*		3	7	41	11	3	3	68
21-30			*	1	3	1	*		6
>30									
All	1	1	4	11	53	17	8	4	100



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## Summer

Calm 4		A total of 9019 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	1	1	3	3	6	2	2	1	19
11-20	*	3	16	8	16	11	4	1	58
21-30	*	1	3	2	4	9	1	*	18
>30			*	*		*			*
All	1	5	22	13	26	21	6	1	100

## Autumn

Calm 13		A total of 9503 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	3	6	9	5	7	3	2	1	36
11-20	2	5	12	4	8	7	4	2	44
21-30	*	1	1	1	1	2	1	1	7
>30	*		*				*	*	*
All	5	11	22	9	16	12	7	4	100

## Winter

Calm 18		A total of 9534 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	8	10	7	4	5	3	3	2	42
11-20	6	5	3	1	3	5	6	4	33
21-30	1	1	*	*	*	2	3	1	7
>30		*	*			*	*	*	*
All	15	16	10	5	8	9	12	7	100

## Spring

Calm 9		A total of 8911 observations analysed							
km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	3	3	4	4	7	2	3	1	27
11-20	2	2	9	5	13	11	7	3	51
21-30	*	1	1	*	3	5	2	1	13
>30					*	*	*	*	*
All	4	6	14	9	22	18	12	6	100



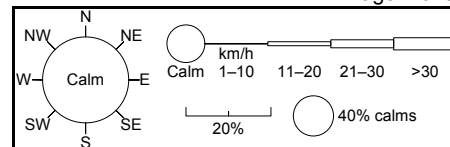
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12 am January 390 observations 	12 am February 367 observations 	12 am March 399 observations 
12 am April 388 observations 	12 am May 400 observations 	12 am June 390 observations 
12 am July 400 observations 	12 am August 402 observations 	12 am September 387 observations 
12 am October 369 observations 	12 am November 358 observations 	12 am December 372 observations 



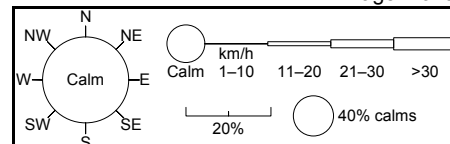
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3 am January 389 observations 	3 am February 366 observations 	3 am March 395 observations 
3 am April 389 observations 	3 am May 398 observations 	3 am June 388 observations 
3 am July 400 observations 	3 am August 402 observations 	3 am September 388 observations 
3 am October 370 observations 	3 am November 358 observations 	3 am December 372 observations 



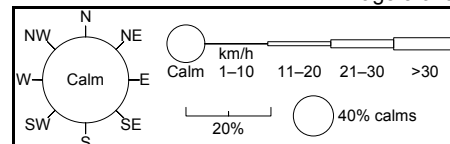
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# Wind Roses using data between Jan 1994 and Sep 2006 for Perth Metro

Site Number 009225 • Locality: Mount Lawley • Opened Feb 1993 • Still Open  
Latitude 31°55'09"S • Longitude 115°52'22"E • Elevation 24.9m

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6 am January 390 observations 	6 am February 367 observations 	6 am March 399 observations 
6 am April 388 observations 	6 am May 402 observations 	6 am June 388 observations 
6 am July 400 observations 	6 am August 402 observations 	6 am September 386 observations 
6 am October 371 observations 	6 am November 357 observations 	6 am December 372 observations 



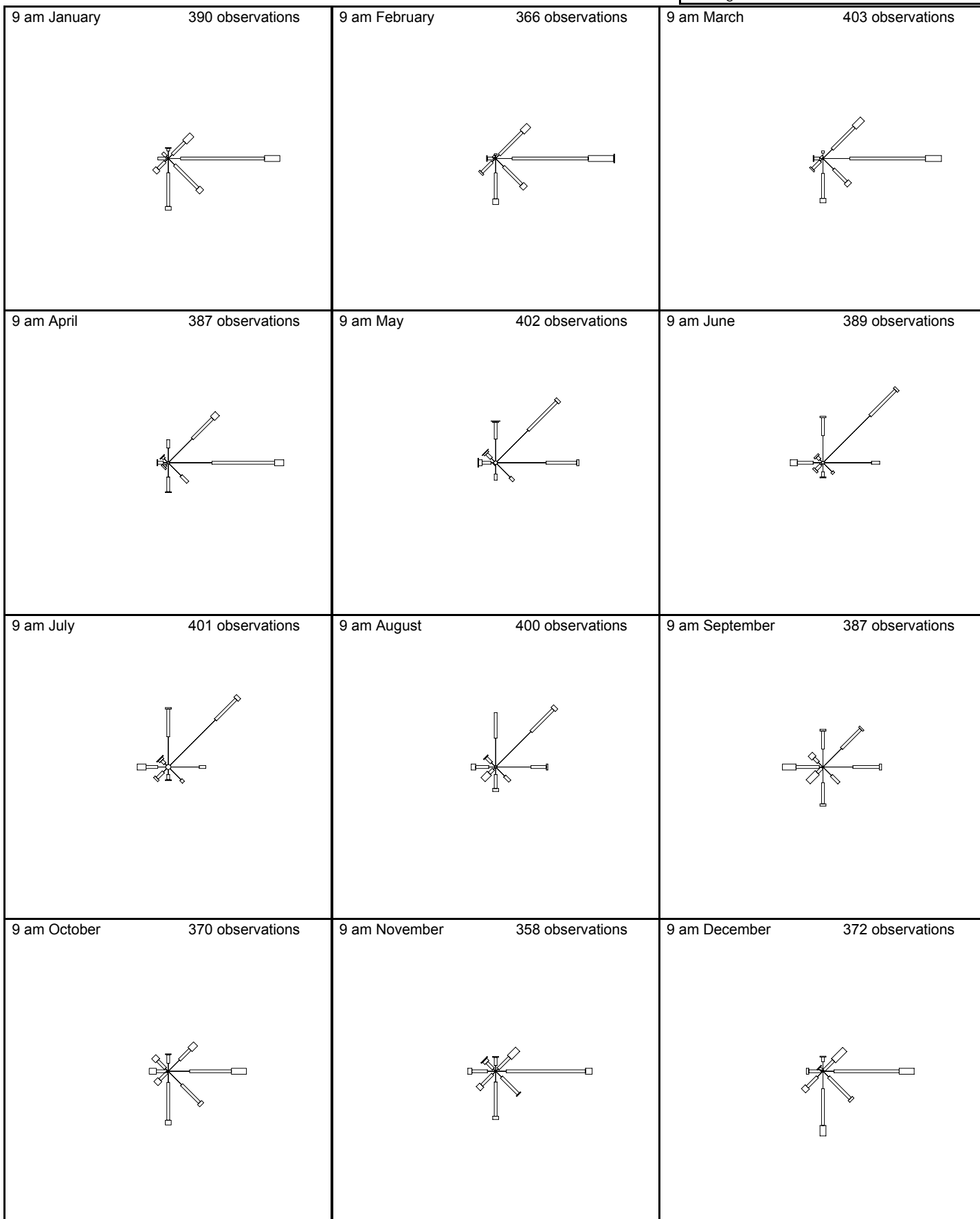
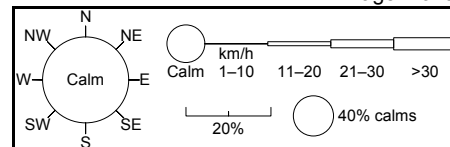
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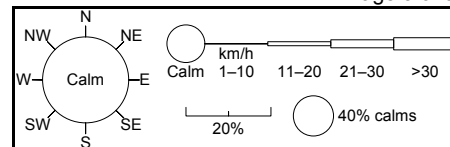
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12 pm January 390 observations 	12 pm February 367 observations 	12 pm March 399 observations 
12 pm April 390 observations 	12 pm May 399 observations 	12 pm June 390 observations 
12 pm July 402 observations 	12 pm August 401 observations 	12 pm September 383 observations 
12 pm October 369 observations 	12 pm November 353 observations 	12 pm December 370 observations 



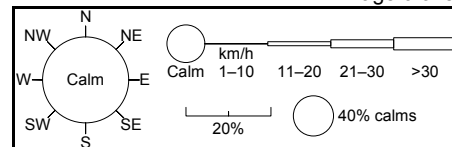
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3 pm January 392 observations 	3 pm February 365 observations 	3 pm March 402 observations 
3 pm April 389 observations 	3 pm May 401 observations 	3 pm June 389 observations 
3 pm July 403 observations 	3 pm August 401 observations 	3 pm September 385 observations 
3 pm October 372 observations 	3 pm November 358 observations 	3 pm December 370 observations 



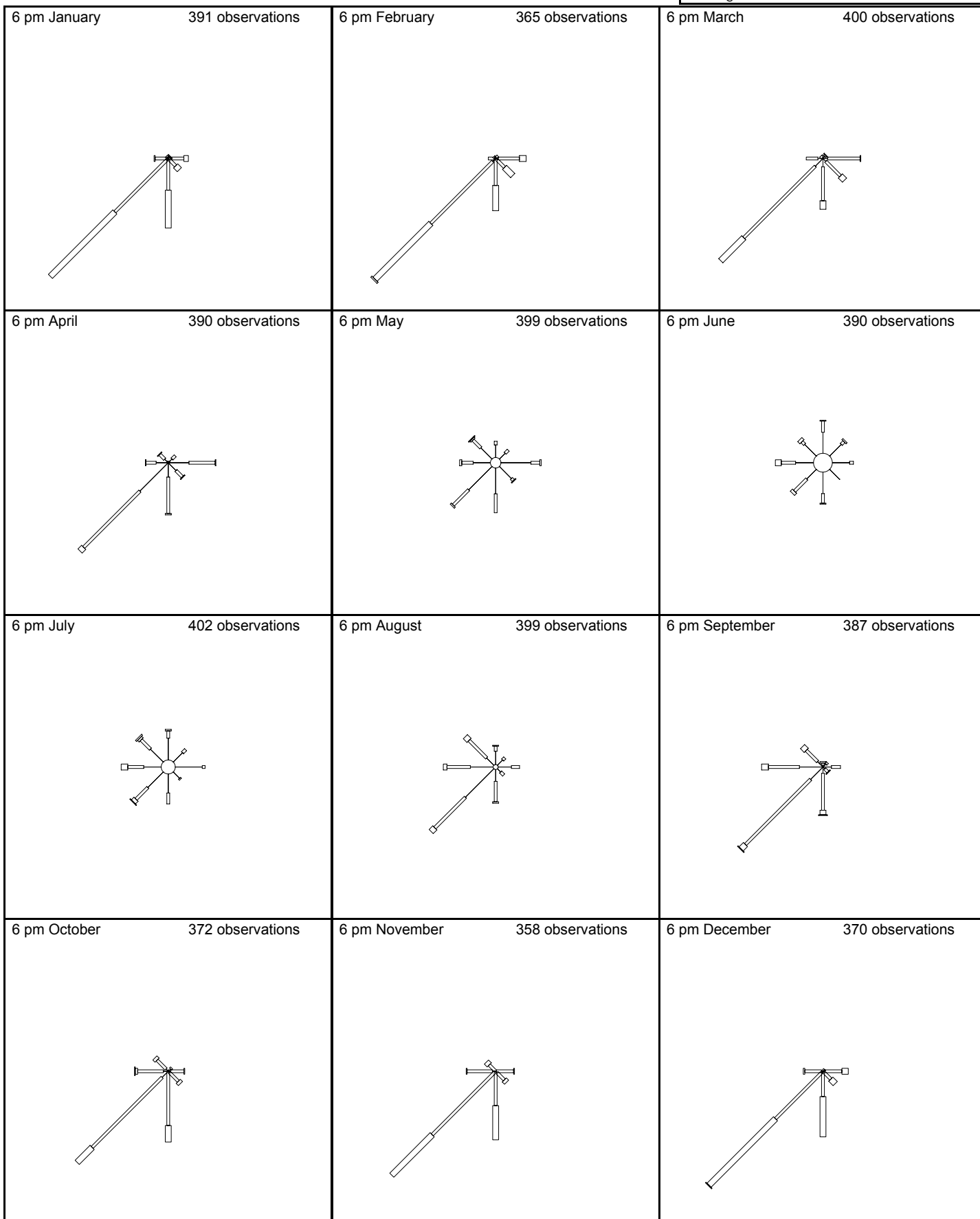
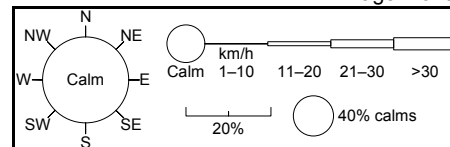
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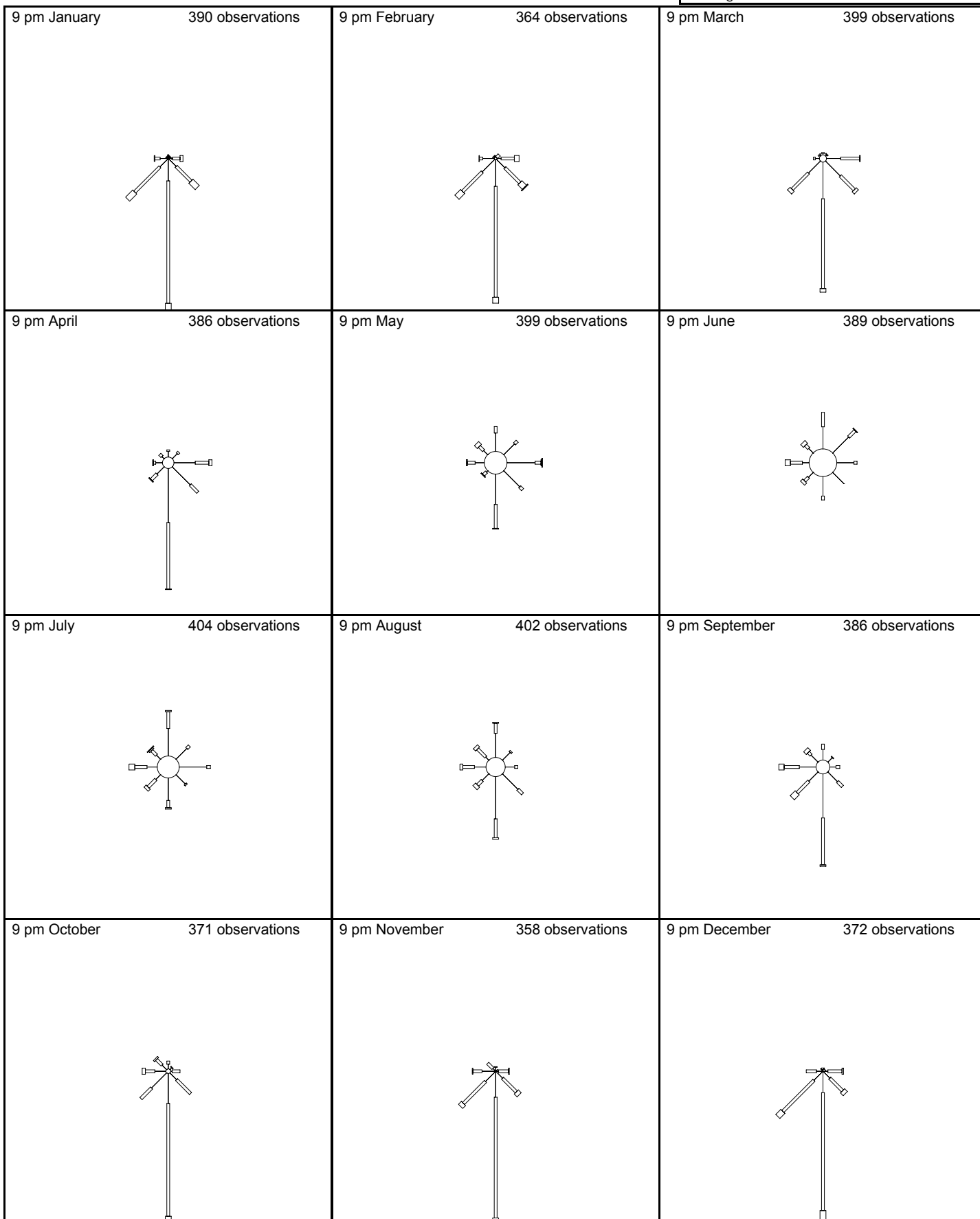
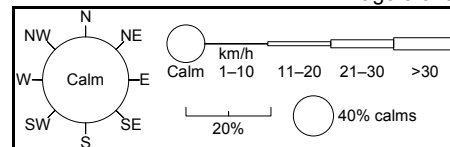
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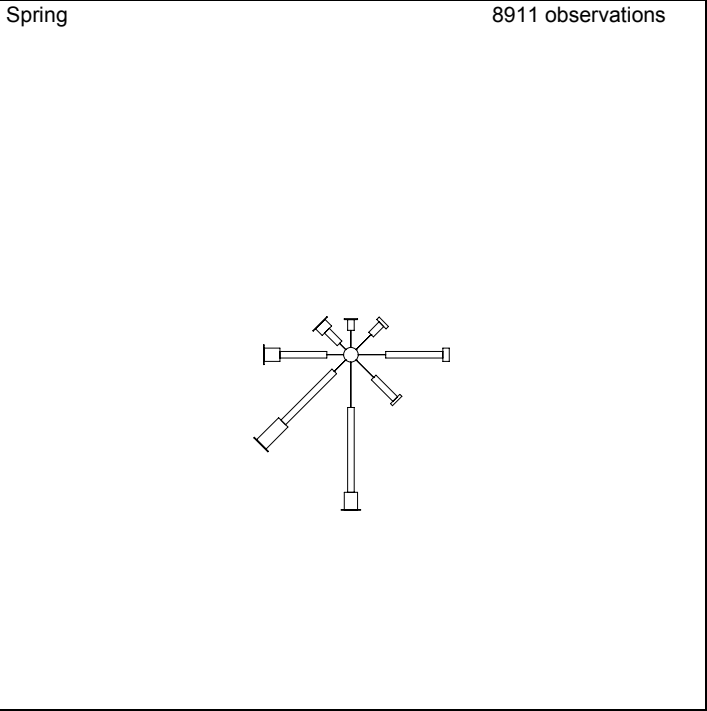
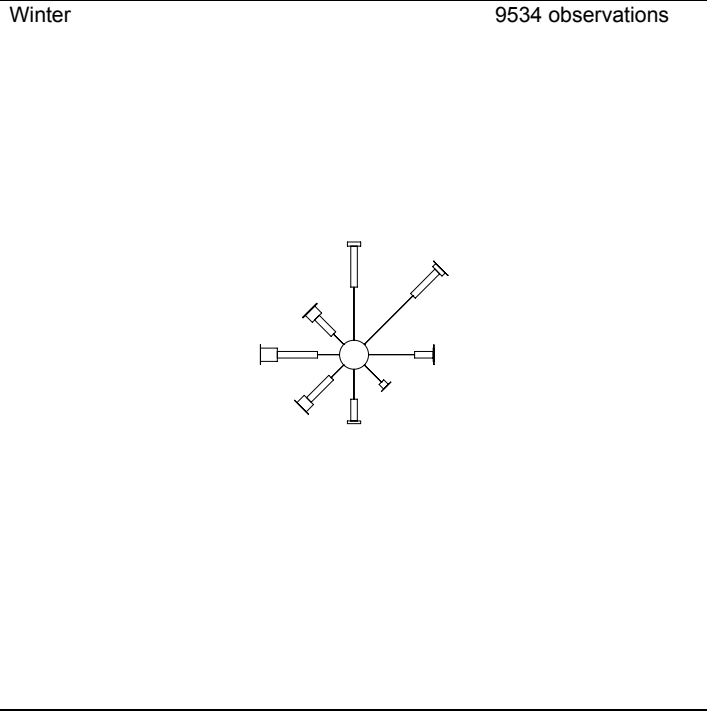
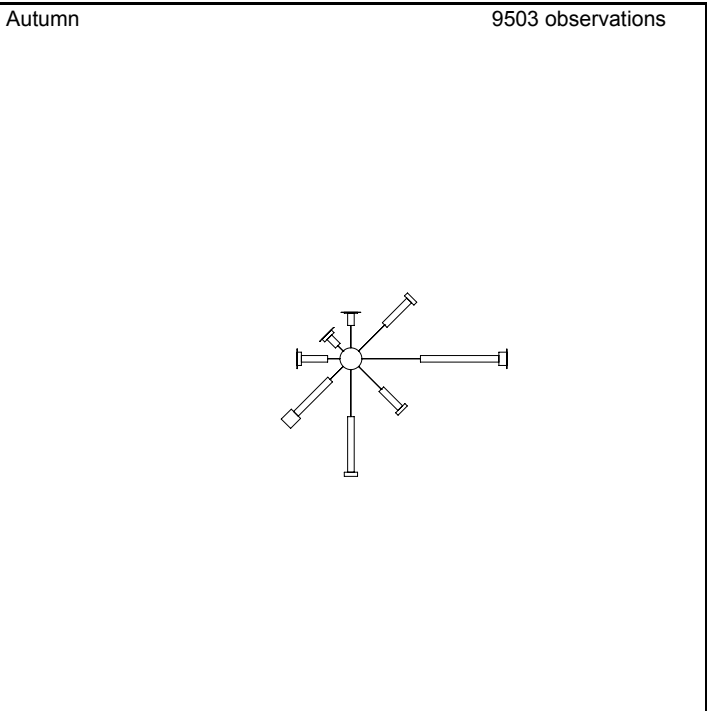
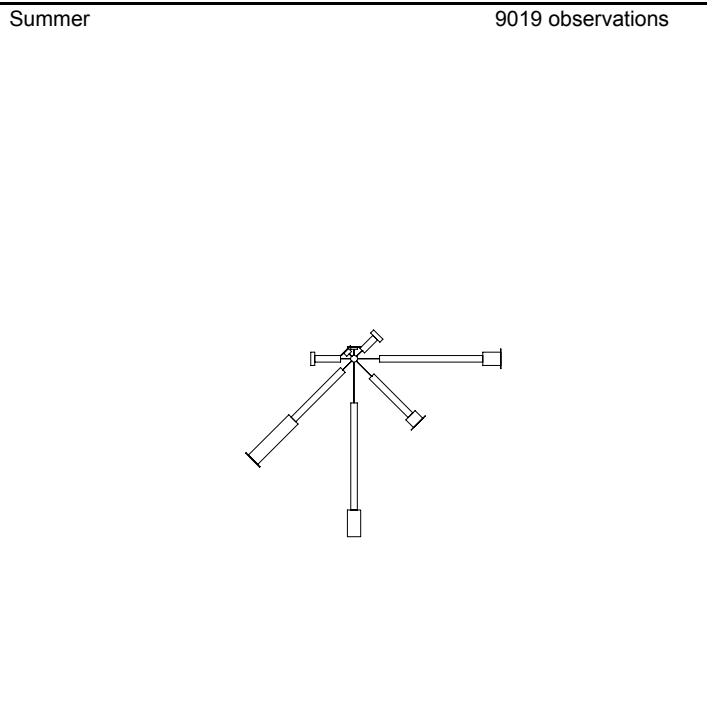
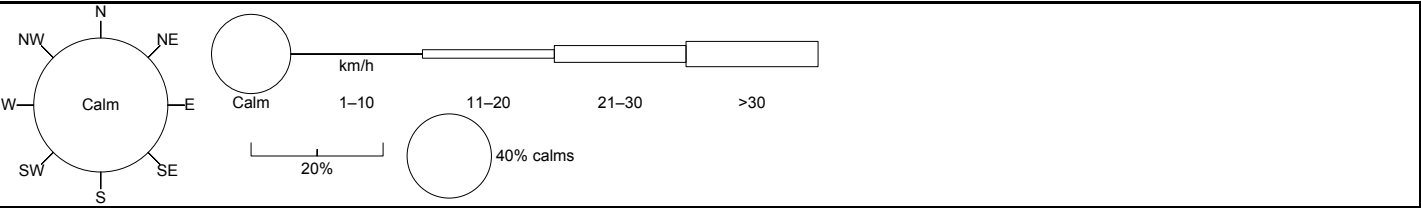
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Wind Roses using data between Jan 1994 and Sep 2006 for

Perth Metro

Site Number 009225 • Locality: Mount Lawley • Opened Feb 1993 • Still Open • Latitude 31°55'09"S • Longitude 115°52'22"E • Elevation 24.9m



# Wind Frequency Analyses and Wind Roses

The included set of wind frequency analysis tables or wind roses show the frequency with which winds of various strengths have been observed coming from various directions. These notes should help you to use the information.

## Data

Wind speed and direction are measured by a number of means. In some cases, they are only estimated. To find out exactly which method has been used, a search of the appropriate station history file would be required. Wind measurement is particularly sensitive to changes in site, exposure and instrumentation. Observations from a site may differ significantly from the conditions in the surrounding area, and past records are not always directly comparable with current measurements. The data are collected by the National Climate Centre in the Bureau of Meteorology's Melbourne head office. They are stored in ADAM (the Australian Data Archive for Meteorology), an extensive computer database of meteorological observations. As the observations are stored, basic checks are performed. Any observations that fail these tests (specifically, any whose quality flag is poorer than "4 - estimated, medium certainty") are excluded from the frequency analyses that follow.

## Analysis

The data are collated in a number of ways, depending on the nature of your request. To group by hour, the observations are assigned to the closest standard three-hour reporting time. For example, all observations between 7:30 am and 10:30 am local standard time are labeled "9 am". If a seasonal grouping has been requested, then "autumn" is March, April and May, "winter" is June, July and August, "spring" is September, October and November, and "summer" is December, January and February. The observations are then grouped by speed. The exact number of speed ranges and their size depends on your request. When the speed ranges are labelled, "1 - 10" is used for all speeds greater than 0 but less than or equal to 10. "11 - 20" means greater than 10 but less than or equal to 20. The data are then grouped by direction; into 8 or 16 bins as requested. When doing this, observations that fall on bin boundaries are split equally between the two bins. For example, when grouping into 8 bins, a direction of "NE" covers all observations with directions strictly between NNE and ENE; "E" covers from ENE to ESE. If the direction is exactly ENE (67.5°), then it will be placed half in the "NE" bin and half in the "E" one.

## Tables

If you have requested wind frequency tables, you will get a separate table for each time group. Each table shows the time to which it applies, and the total number of observations used at that time. The percentage frequency with which calm conditions (that is, no wind) are observed are displayed at the top left of the table. The rest of the table is laid out with directions across and speeds down. To find the frequency with which winds of a given speed and direction occur, follow down the appropriate direction column and across the speed row until they intersect. The value printed there is the frequency you require. For example, a value of "14" indicates that this speed/direction group occur about 14% of the time. "\*" indicates the range has occurred but less than 0.5% of the time. The last column, labeled "All", gives the frequency of each speed range regardless of direction. Similarly, the last row gives the frequency of each direction, regardless of speed.

## Roses

Wind Roses seek to make the data in a wind frequency table easier to digest. Although not ideal for quantitative work, they are good for providing a quick visual impression of the wind regime. Like the tables, there is one wind rose for each time group that you requested. Each rose consist of a central circle, surrounded by branches, each made up of a number of petals. The circle represents the frequency of calm conditions. The size of the circle is proportional to the number of calms; a scale is given in the legend at the top of the page. Each branch represents the wind coming from that direction. North is to the top, and the other directions are shown in the legend. In each case, the wind is blowing from that direction toward the calms circle. Each petal corresponds to a speed range from that direction. The length of the petal is proportional to the frequency of that wind; the scale is shown in the legend. The thickness of the petal is used to indicate which speed range it represents.

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## **More Information**

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Appendix F  
Copy of DEC Letter, Dust and Air Quality  
Management for ANI Bradken

Dust and Asbestos Management Plan  
Cygnia Cove, Waterford



Department of  
Environment

Your ref:

Our ref: RS001/11

Enquiries: Rachael Mercy

Direct tel: 9222 7086

Department for Planning and Infrastructure  
469 Wellington St  
PERTH WA 6000

ATTENTION: ANDREW TREVOR

DUST AND AIR QUALITY MANAGEMENT COMPONENT OF ENVIRONMENTAL  
MANAGEMENT PLAN, ANI BRADKEN

Further to correspondence forwarded to you on 2 April 2004 regarding the Department of Environment (DoE) review of the Environmental Management Plan for the ANI Bradken site, the Air Quality Management Branch (AQMB) has considered the above report prepared by ENV Consultants. The Department provided the following comments direct to ENV on this report:

- The Dust and Air Quality Management Plan (DAQMP) addresses the remediation and post-remediation phases of the works. Issues related to the demolition of buildings are explicitly excluded from the scope of the DAQMP.
- The core objective of the Plan is to ensure that dust emissions from the works are as low as reasonably achievable. The procedures outlined in the DAQMP are consistent with this objective, and if followed are expected to represent reasonable best practice in dust management.
- The DAQMP does not appear to be a scope of works for the remediation or monitoring work: - details of instruments, personnel or data-processing are not included. DoE expects that instrument, personnel and details of monitoring protocols will be consistent with relevant Australian Standards and good laboratory practice. Monitoring data must be presented together with documentation assuring the quality of the monitoring data. NATA accreditation is preferred.
- Characteristics of the site such as trees, structures and the railway corridor may make it difficult to locate monitoring stations to the requirements of the relevant Australian Standards. However, the proposed monitoring sites appear to be the best practicable locations considering the nearby sensitive receptors at residences to the north-north-east, the beach reserves to the west and the Fremantle Village to the east-southeast. AQMB will confirm the appropriateness of the sites before monitoring commences in light of a site inspection and available meteorological data.
- Selected contaminants of concern are appropriate, and relevant standards and operating goals generally satisfactory. However, with regard to heavy metals, we understand that the approach of deriving ambient limits that are 10% of occupational limits is now outdated. As part of the Midland remediation, the Department of Health (DoH) provided DoE with the guidelines listed below that are considered to be also applicable to the South Beach remediation. It is understood that the Management Plan for this site has been forwarded to the DoH for their advice.

Westralia Square  
Level 8 141 St Georges Terrace  
Perth Western Australia 6000  
PO Box K822 Perth Western Australia 6842  
Telephone (08) 9222 7000 Facsimile (08) 9322 1598  
E-mail [info@environ.wa.gov.au](mailto:info@environ.wa.gov.au)  
[www.environ.wa.gov.au](http://www.environ.wa.gov.au)



Hyatt Centre  
Level 2 3 Plain Street  
East Perth Western Australia 6004  
PO Box 6740 Hay Street East Perth Western Australia 6892  
Telephone (08) 9278 0300 Facsimile (08) 9278 0301  
National Relay Service (Australian  
Communication Exchange) 132 544  
E-mail [correspondence@wrc.wa.gov.au](mailto:correspondence@wrc.wa.gov.au)  
[www.wrc.wa.gov.au](http://www.wrc.wa.gov.au)

Metal	Derived Criteria ( $\mu\text{g}/\text{m}^3/24\text{hr}$ )
Arsenic	0.8
Cadmium	0.2
Chromium	1.0
Lead	1.3
Zinc	350

- These limits should be communicated to ENV and ENV should consult with DoH to derive a suitable criterion for Manganese.
- The proponent intends to collect two weeks of background air quality data prior to the commencement of works. This monitoring period may overlap with the demolition of buildings on site, in which case the data will not truly reflect the background air quality. AQMB accepts the practical difficulties raised by scheduling monitoring and site works, however every practicable effort should be made to ensure that contributions from the building demolition works are minimised. The possible contribution of building demolition on the background measurement must be considered when assessing any observed impacts of the remediation works on ambient air quality.
- The quality of monitoring data is largely subject to the qualifications and skill of the monitoring personnel. Selection of sub-contractors to complete the monitoring work should explicitly address the need to comply with all relevant Australian Standards and standard laboratory protocols. DoE expects that initial submission of monitoring data will provide summary details of personnel, equipment and procedures to assure data quality.
- While some petroleum hydrocarbons and polycyclic aromatic hydrocarbons (PAHs) were observed in surface samples on the site, these contaminants are confined to the surface in specific areas. Therefore these contaminants are not considered relevant to the general site works. AQMB agrees that monitoring for these species is not required, however monitoring for organic compounds will be required if odour complaints are received in relation to the works or if further contaminated areas are identified.
- While the site investigation suggests that asbestos will not be an issue for the bulk of the site works, monitoring should be undertaken for asbestos fibres for two weeks at the ambient monitoring stations, to confirm that it is not an issue and to allay community concerns. Cessation of monitoring is to be approved by DoH and DoE.
- AQMB recommends that monitoring plans are communicated to relevant stakeholders before work begins.

ENV have recently submitted Version 2 of the Dust and Air Quality Management Plan for this site. In accordance with the established protocol, the AQMB will review the report and the DoE will respond to the Department for Planning and Infrastructure as to whether or not it is considered satisfactory.

Yours faithfully

*Mark Skellern*

62 R A D SIPPE  
A/DIRECTOR  
ENVIRONMENTAL IMPACT ASSESSMENT

12 May 2004

Cc AQMB – Michael Bell  
ENV Consultants – Peter Alderson  
LWQB – Rebecca Moen