
**APPLICATION FOR A CLEARING PERMIT
(AREA PERMIT)**

**PORTIONS OF LOTS 101 and 9016,
MANDURAH ROAD, MADORA BAY**



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**APPLICATION FOR A CLEARING PERMIT (AREA PERMIT)
PORTION OF LOT 101 MANDURAH ROAD, MADORA BAY**

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EXECUTIVE SUMMARY

BH, JD and PR Perry (the landowners), have received subdivision approval for Stage 1 of their freehold landholding Lot 101 Mandurah Road and for Stages 7 – 9 of their freehold landholding Lot 9016 Mandurah Road, Madora Bay East (the site).

The site is situated approximately 8 km north of the Mandurah CBD in the locality of Madora within the City of Mandurah municipal boundary. Lot 101 is bounded to the north by the *Singleton Beach* residential development, to the west by Regional Open Space, to the south by Madora Beach Road and existing 'Old Madora Bay' and to the east by Mandurah Road. Lot 9016 is bounded to the south and west by existing *Madora Bay East* residential development, to the north by Madora Beach Road and in the east by Mandurah Road (refer to **Figure 1**).

The site is zoned 'Urban under the Peel Region Scheme and a combination of 'Residential R20' and 'Urban Development' under the City of Mandurah Town Planning Scheme No. 3. In September 2017, the landowner applied to the Western Australian Planning Commission (WAPC) for approval to subdivide a portion of the site.

Subdivision approval for *Madora Bay North* Stage 1 was granted by the WAPC in January 2018 (WAPC Ref. 155645). Subdivision approval for *Madora Bay East* Stages 7 – 9 had previously been granted by the WAPC in 23 January 2015 (WAPC Ref. 150302) and 22 December 2015 (WAPC Ref. 152627) (refer to **Appendix 2**).

The construction of *Madora Bay East* Stages 7-9 will require cut to fill earthworks that will result in an excess of 280,000 m³ of clean sandy fill that it is proposed will be exported to Stage 1 *Madora Bay North* (refer to **Figure 2**).

The proposal to export excess fill from Lot 9016 and its importation into Stage 1 will require the clearing approximately 12.385 ha of native vegetation that is in a predominantly *Completely Degraded - Degraded* condition. Under Schedule 5 of the *Environmental Protection Act 1986*, an Application for a Clearing Permit (Area Permit) is therefore required to be submitted to the Department of Water and Environmental Regulation (DWER) for assessment.

As shown on **Figure 2**, the area proposed to be cleared includes the following components:

- (a) An area comprising approximately 37,500 m² (3.75 ha) located in the south-eastern corner of Lot 101 adjacent to Madora Beach Road;
- (b) An area comprising approximately 24,350 m² (2.435 ha) located to the south of Madora Beach Road and to the west of Stages 7 -9.
- (c) A haul route comprising approximately 62,000 m² (approximately 1,550 m long and 40 m wide) (6.2 ha) connecting the northern end of component (a) and extending northwards connecting to both Stage 1 cells.

Works required to be conducted include:

- clearing of up to 12.385 ha of *Completely Degraded – Good* native vegetation;
- topsoil stripping; and
- stabilisation.

Following a desk-top review of environmental reports prepared for the site and subsequent site inspections conducted of the proposed clearing areas, *EndPlan Environmental* has assessed the proposed clearing of up to 12.385 ha of *Completely Degraded – Good* native vegetation against the clearing principles for native vegetation under Schedule 5 of the *Environmental Protection Act 1986*.

On the basis of the information contained within the reports and site observations, *EndPlan Environmental* considers that the proposed clearing of 12.385 ha of predominantly *Completely Degraded- Degraded* vegetation, required in order to construct *Madora Bay North Stage 1* in Lot 101 and *Madora Bay East Stages 7-9* within Lot 9016, does not contravene any of the ten clearing principles as listed under Schedule 5 of the *Environmental Protection Act 1986*.

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1. Background Information

1.1 Site Location

BH, JD and PR Perry (the landowners), have received subdivision approval for Stage 1 of their freehold landholding Lot 101 Mandurah Road and for Stages 7 – 9 of their freehold landholding Lot 9016 Mandurah Road, Madora Bay (the site).

The Certificates of Title for each of the Lots is included as **Appendix 1**.

The site is situated approximately 7 km north of the Mandurah CBD in the locality of Madora within the City of Mandurah municipal boundary. Lot 101 is bounded to the north by the *Singleton Beach* residential development, to the west by Regional Open Space, to the south by the existing suburb of Madora Bay and to the east by Mandurah Road. Lot 9016 is bounded in the west by the existing *Madora Bay East* residential development, to the east by Mandurah Road, to the south by existing *Madora Bay East* residential development and to the north by Madora Beach Road (refer to **Figure 1**).

The site is zoned 'Urban under the Peel Region Scheme and a combination of 'Residential R20' and 'Urban Development' under the City of Mandurah Town Planning Scheme No. 3. In September 2017, the landowner applied to the Western Australian Planning Commission (WAPC) for approval to subdivide a portion of Lot 101 to construct Stage 1 of the *Madora Bay North* residential development.

Subdivision approval for *Madora Bay North* Stage 1 was granted by the WAPC in January 2018 (WAPC Ref. 155645). Subdivision approval for *Madora Bay East* Stages 7 – 9 had previously been granted by the WAPC in 23 January 2015 (WAPC Ref. 150302) and 22 December 2015 (WAPC Ref. 152627) (refer to **Appendix 2**).

1.2 Purpose for Clearing Permit Application

The construction of *Madora Bay East* Stages 7-9, located to the south of Madora Beach Road, will require cut to fill earthworks required to construct Stages 7-9 and will result in an excess of approximately 280,000 m³ of clean sandy fill that it is proposed will be exported to *Madora Bay North* Stage 1.

Stage 1 comprises two cells (one located in the northwest corner and the other located in the southwest corner of Lot 101) (refer to **Plate 1** over the page), and due to the nature of the topography, construction will require the importation of additional clean fill.

The proposal to export excess fill from Stages 7 – 9 in Lot 9016 and its importation into Stage 1 in Lot 101 will require the clearing of native vegetation. Under Schedule 5 of the *Environmental Protection Act 1986*, an Application for a Clearing Permit (Area Permit) is therefore required to be submitted to the Department of Water and Environmental Regulation (DWER) for assessment under the Act.

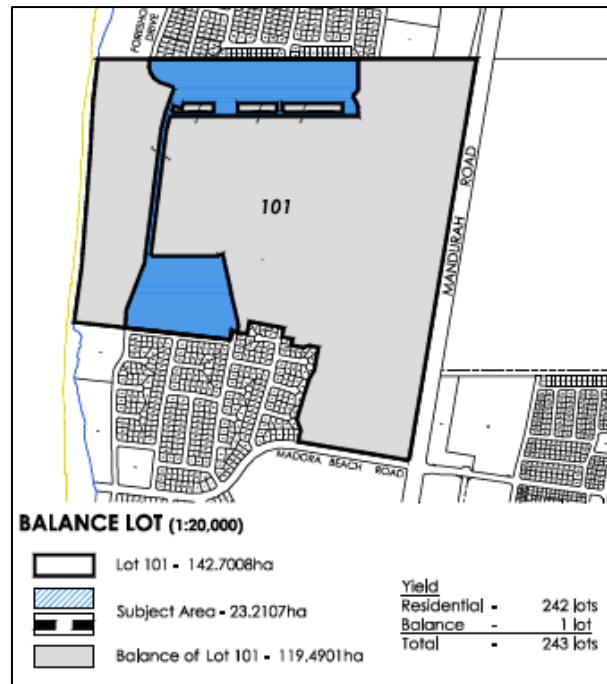


PLATE 1: Madora Bay North Stage 1 development

As shown on **Figure 2**, the proposed clearing area includes the following components:

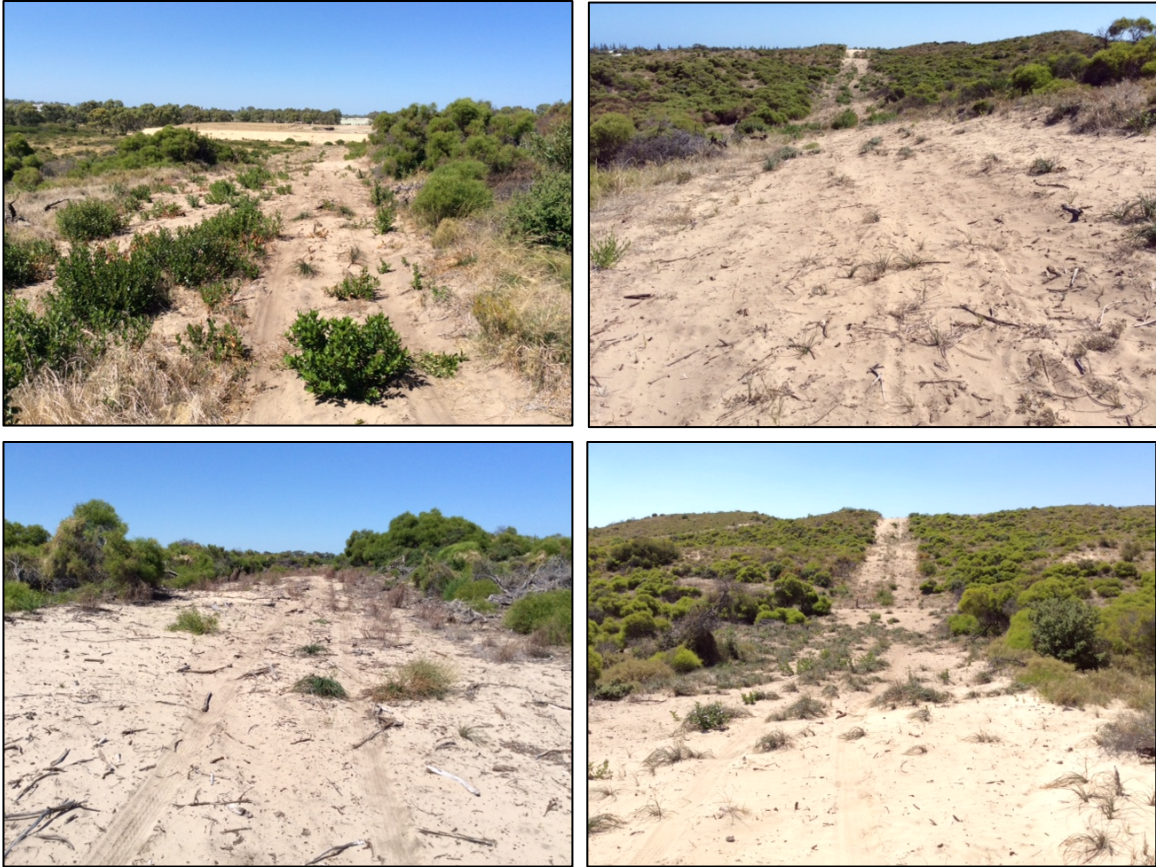
- Haul route (1,550 m long x 40 m wide) comprising approximately 62,000 m² (6.2 ha) located directly to the north of (a) and joining into the two Stage 1 cells. As shown on **Plates 2 – 5** (over the page) much of the haul route follows previously constructed firebreaks.
- Area comprising approximately 37,500 m² (3.75 ha) located in the south-eastern corner of Lot 101 adjacent and north of Madora Beach Road¹. As shown on **Plates 6 – 7** (over the page) this area is *Completely Degraded* with planted eucalypts.
- Area comprising approximately 24,350 m² (2.435 ha) located to the south of Madora Beach Road and to the west of Stages 7 -9 (refer to **Plates 8 – 9** over the page).

Works required to be conducted include:

- clearing of up to 12.385 ha of predominantly *Completely Degraded - Degraded* native vegetation;
- topsoil stripping; and
- stabilisation.

Detailed earthworks drawings for the site are included as **Appendix 3**.

¹ Note that the proposed clearing area as shown on **Figure 2** includes an area comprising approximately 62,000 m² that was previously cleared and earthworked under Area Permit No. 7086/1. This area has not been included in the calculation of the area of native vegetation proposed to be cleared (i.e. 12.385 ha).



Plates 2-5: Existing environment within portions of the proposed haul route



PLATES 7 – 8: Existing environmental in proposed Lot 101 southeast clearing area



PLATES 9 – 10: Existing environment in proposed Lot 9016 clearing area

1.3 Environmental Approvals

1.3.1 Western Australian

Lot 101:

In February 2011, a site meeting was held with the landowner's representatives and members of the former Office of the Environmental Protection Authority (OEPA). In March 2011 the OEPA provided advice with respect to the requirement for further environmental survey work to be undertaken to enable the EPA to assess the potential impacts of the proposed amendment including:

- Additional spring flora census incorporating previous survey and discussion of all significant flora found on-site.
- Amendment or re-assessment of the vegetation condition mapping to provide more detail.
- Assessment of ecological communities utilising 10 x 10 m quadrat recording.
- Assessment of regional significance of the site utilising EPA Guidance Statement No. 10.

In response to the OEPA's request for additional survey/assessment work within Lot 101, a Level 1 Spring flora survey and vegetation type and condition mapping was conducted in September 2011 and a Level 1 fauna assessment was conducted in July 2011 (refer to **Appendix 4**).

The proposed rezoning of Lot 101 under the PRS (i.e. Amendment 035/57 - to transfer approximately 61 hectares of land from 'Rural' zone to 'Urban' zone) was referred to the Environmental Protection Authority (EPA) by the WAPC in 2012. The EPA determined that the proposed scheme amendment should not be assessed under Part IV Division 3 of the *Environmental Protection Act 1986* (EP Act) and provided non-binding advice (refer to **Appendix 5**). Amendment 035/57 to the PRS was subsequently endorsed by the WAPC.

Lot 9016:

Formerly known as Lot 9013, the PRS originally rezoned the lot from 'Rural' to 'Urban Deferred'. In 2000, the EPA recommended that the 'Urban Deferred' zoning be lifted (Environmental Protection Authority, 2000).

1.3.2 Commonwealth

Lot 101:

During a fauna survey of Lot 101 undertaken in July 2011, 26 vertebrate species were identified by sighting or other signs (refer to **Appendix 4**).

In July 2012, the landowner referred the proposed action to develop Lot 101 to the then Department of Sustainability, Environment, Water, Population and Communities (now Department for the Environment and Energy) for a decision as to whether approval for the proposed action was needed under Chapter 4 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (EPBC Reference No. 2012/6466).

In January 2013, the Department advised the landowner that a decision had been made under Section 75 of the EPBC Act and issued the landowner with a Notification of the Referral Decision 'Not a Controlled Action' with respect to the proposed action to develop Lot 101 Mandurah Road (refer to **Appendix 6**).

Lot 9016:

Vegetation and fauna surveying of the former Lot 9013 undertaken in 2004 and 2005 (ATA Environmental, 2005) found that a significant proportion of the remnant vegetation was in a degraded condition. No Rare or Priority Flora, Threatened Ecological Communities or Commonwealth listed flora were identified from the site. In addition, no fauna of State or Commonwealth significance were expected to utilise the site for nesting/breeding. It was considered that while Carnaby's Black Cockatoo may occasionally use small areas of Tuart for feeding, the absence of Marri, *Banksia* species and Parrot Bush (*Dryandra sessilis*) would preclude the use of the majority of the lot by these species (refer to **Appendix 7**).

On the basis of the survey work undertaken within then Lot 9013, the landowner was advised that the action to develop the lot did not require referral under the EPBC Act.

2. Site Description

2.1 Topography

Topographic elevation at the proposed clearing area ranges from 8.93 – 15 mAHD within Lot 9016 and 12.5 - 7.5 mAHD along the eastern boundary of Lot 101.

The site's topography is shown on **Figure 3** and **Appendix 3**.

2.2 Geology

The Rockingham 1:50,000 Urban Geology Series map identifies the site as being comprised of two geological units; the Safety Bay Sand (Qhs) and the Tamala Limestone (Ls₁) units (Geological Survey of Western Australia, 1985).

The Safety Bay Sand unit is described as being composed of shell fragments (mainly foraminifers and molluscs) and variable quantities of quartz and minor amounts of feldspar and corresponds to the Quindalup Dune System and associated soil unit. Two sub-units (S₁₃ and S₂) occur within the site: sub-unit S₁₃ occurs along the coastline and is associated with low undulating relic foredune topography, with variably thick sands overlying Tamala Limestone, while sub-unit S₂ occupies a narrow strip that runs north-south across the length of the site and is associated with moderate to steep slopes and is susceptible to remobilisation (Gozzard, 1983).

The Tamala Limestone Ls₁ unit is located in the eastern portion of the site adjacent to Mandurah Road and consists of pale yellowish brown, fine to coarse-grained, sub-angular to well-rounded quartz with shell debris and traces of feldspar (Gozzard, 1983).

2.3 Soils

The surface sediments consist of a fine to medium grained calcareous sandy soil of aeolian origin (Safety Bay Formation) overlying Tamala limestone. The high sand content of the soil provides a high infiltration rate.

The proposed clearing area is predominantly located within a section of limestone plain that is characterised by limestone outcrops extending from the base of the dune system located to the west and eastward towards Mandurah Road.

2.4 Wetlands

The site is located outside of the Peel-Harvey Estuarine System catchment and there are no open water bodies, ephemeral water bodies, or defined watercourses occurring within the site (JDA Consultant Hydrologists, 2011).

No wetlands mapped in the *Swan Coastal Plains Geomorphic Wetlands dataset* occur within the proposed clearing area (refer to **Appendix 8**).

2.5 Vegetation and Flora

2.5.1 Vegetation

A standard vegetation classification and description system was utilised during the vegetation surveying of the site. Descriptions were defined using the height and estimated cover of dominant species of each stratum using the framework of Keighery (1994). The vegetation condition was determined using the vegetation condition rating scale described by Keighery (1994) and published within the *Bush Forever Strategy* (Government of Western Australia, 2000).

As shown in **Appendix 4**, the proposed clearing area within Lot 101 comprises three vegetation types:

ArTS: Consists of *Acacia rostellifera* tall shrubland over *Acanthocarpus preissii*, **Trachyandra divaricata*, *Senecio pinnatifolius* var. *latilobus* herbland (refer to **Plate 10**). The vegetation condition was recorded as 'Degraded' due to cattle grazing and weed invasion.



PLATE 10: ArSgTS vegetation at Quadrat 3a

ArTCS: Consists of *Acacia rostellifera* closed tall scrub over *Calandrinia brevipedata*, *Crassula glomerata*, *Apium annuum* herbland (refer to **Plate 11** over the page). The vegetation condition was recorded as 'Good' with the vegetation structure impacted by cattle grazing and weed invasion.



PLATE 11: ArTCS vegetation at Quadrat 4

AsMOS: Consists of *Acacia saligna*, *Adriana quadripartita* shrubland over *Trachyandra divaricata*, *Acanthocarpus preissii*, *Senecio pinnatifolius* var. *latilobus* herbland (refer to **Plate 12**). The condition of the vegetation type was recorded as 'Degraded' as a result of cattle grazing, erosion and weed invasion.



PLATE 12: AsMOS vegetation at Quadrat 6

The proposed clearing within Lot 9016 comprises two vegetation types:

ArS: The vegetation type occurs as small remnants and is dominated by *Acacia rostellifera* to 2.5 m in height, occasional *Spyridium globulosum* over a herb layer dominated by *Euphorbia terracina*, *Trachyandra divaricata*, *Phyllanthus calycinus* and *Acanthocarpus preissii*. The vegetation is generally in 'Degraded' to 'Good' condition.

ArSgOS: This vegetation type occurs as a small remnant located in the northwest corner of Lot 9016 and is dominated by *Acacia rostellifera* and *Spyridium globulosum* to 2 m in height. Other common species

are *Senecio lautus*, *Acanthorcarpus preissii* and scattered *Jacksonia furcellata*. Weed species were a dominant part of the vegetation type and included *Trachyandra divaricata* and *Euphorbia terracina*

Vegetation type and condition mapping is shown in **Figure 4**.

2.5.2 Flora

No Threatened Flora (TF) was found within either of the surveys conducted within the site (refer to **Appendices 4 and 7**).

Two Priority-listed (P4) flora were recorded during the Lot 101 survey: six plants were recorded from a single population of *Beyeria cinerea* subsp. *cinerea* and 26 individuals of *Conostylis pauciflora* subsp. *pauciflora*. Both populations were located in the southern half of Lot 101 Mandurah Road occurring in *Degraded* and *Completely Degraded* vegetation areas (refer to **Appendix 4**).

The EPA describe Priority 4 (P4) flora species as 'Taxa which are considered to have been adequately surveyed and which, while rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5 to 10 years'.

No Priority-listed (P4) flora is located within the proposed clearing area.

2.6 Fauna

During the Lot 101 fauna survey, 26 vertebrate species were identified by sighting or other signs. None of these were conservation significant species, and all are common in the region and expected to be present based on previous records (Ecoscape (Australia) Pty Ltd., 2011). No conservation-significant fauna species were observed during the site visit. Such species are mostly unlikely to be detected because they are uncommon and inconspicuous (e.g. sand-swimming reptiles) or only intermittently present within a discrete area (e.g. black cockatoos) (refer to **Appendix 4**).

During the former Lot 9013 survey, 22 vertebrate species were identified occurring within the Foreshore Reserve, nearshore waters, existing development and uncleared land. All the species observed were typical of the available habitats within the foreshore, nearshore and Eucalypt woodlands.

The fauna habitat value of the proposed clearing area is limited due to the Degraded (and in the case of much of the haul route) 'Completely Degraded' condition and fragmented nature of the vegetation found within it. Overall, the vegetation lacks an understorey and is heavily weed infested. Overstorey trees are scattered and comprise primarily eucalypts that were planted in the 1970's to provide shade for cattle.

3. Application of the Ten Clearing Principles

3.1 Principle 1

Vegetation should not be cleared if it comprises a high level of biological diversity.

The vegetation within the proposed clearing area does not contain a high level of biological diversity.

Comprising approximately 143 ha, a flora and vegetation survey undertaken within Lot 101 in September 2011 (Ecoscape (Australia) Pty Ltd, 2011) found that including opportunistic observations, a total of 99 vascular plant taxa (species, subspecies and varieties) from 42 families and 82 genera were recorded from within Lot 101 which comprises during a survey undertaken in September 2011 (refer to **Appendix 4**).

Two Priority-listed flora species were recorded during the 2011 survey: *Beyeria cinerea* subsp. *cinerea* (P4) and *Conostylis pauciflora* subsp. *pauciflora* (P4), both of which were observed in *Degraded* and *Completely Degraded* vegetation. Neither population is located within the proposed clearing area (refer to **Appendix 4**).

Comprising 61.53 ha, a flora and vegetation survey undertaken within the former Lot 9013 in September 2004 and March 2005 (ATA Environmental, 2005) recorded a total of 72 plant species of which 44 (61%) were native and 28 (39%) were introduced or non-endemic plant species. The family composition was found to be typical of the flora of the coastal region of the southwest of Western Australia and similar to that of the Mandurah coast region (refer to **Appendix 7**).

During all surveys, the condition of the site's vegetation was assessed according to the system devised by Keighery (1994) and described in *Bush Forever* (Western Australian Planning Commission, 2000) where the condition rating ranges from *Pristine* (where the vegetation exhibits no visible signs of disturbance) to *Completely Degraded* (where the vegetation structure is no longer intact and without native plant species).

The 2011 survey of Lot 101 reported that over 97% of the remnant native vegetation found on-site was in a *Degraded* to *Completely Degraded* condition. Only one vegetation unit (ArTCS: consisting of *Acacia rostellifera* closed tall scrub over *Calandrinia brevipedata*, *Crassula glomerata*, *Apium annuum* herbland) comprising 1.55 ha was found to be in a *Good* condition (Ecoscape (Australia) Pty Ltd., 2011) (refer to **Appendix 4**).

The site has been historically grazed by cattle which have adversely affected extensive areas of native vegetation through grazing, trampling, introducing and spreading weeds and nutrient enrichment. Clearing and frequent burning to encourage new shoots for grazing has also resulted in an altered vegetation structure and plant species composition resulted in degradation and weed invasion. The native vegetation is therefore highly disturbed and consists mainly of regrowth with limited species diversity (refer to **Appendix 7**).

With the exception of small areas within the proposed clearing area assessed as being in *Good* condition the majority of the proposed clearing area is predominantly in a *Completely Degraded - Degraded* condition.

The *Swan Bioplan-Peel Sector Peel Regionally Significant Natural Areas* is a biodiversity conservation project undertaken by the OEPA and the DEC aimed at updating the System 6

conservation planning on the Swan Coastal Plain, south of the Perth Metropolitan Region. As part of the project, landscape, habitat, vegetation and flora values were identified and this information used to delineate regionally significant natural areas that represent the range of landscapes, habitats, vegetation and flora that existed prior to extensive clearing on the southern Swan Coastal Plain (Office of the Environmental Protection Authority, 2010).

The *Swan Bioplan-Peel Sector Peel Regionally Significant Natural Areas 'Map 2a – North'*, identifies the whole of Lot 101 as being a 'Regionally Significant Natural Area on private land' (Office of the Environmental Protection Authority, 2010).

As the identification of the site as an RSNA was broad-scale based on aerial photography interpretation and not on a site-specific assessment, the Environmental Protection Authority (EPA) recommended therefore that development proposals and planning scheme amendments that will impact on the regionally significant natural areas will be required to undertake detailed investigations of their natural values consistent with EPA Guidance Statements 10, 51 and 56 (Environmental Protection Authority, 2010; 2004a; 2004b).

In 2011, the EPA requested that prior to supporting a PRS Amendment to rezone the portion of the site that was then zoned 'Rural' to 'Urban', detailed flora and fauna surveys be required to be undertaken to map the site-specific environmental attributes. Consequently, Level 1 Spring flora survey and vegetation type and condition mapping as well as a Level 1 fauna assessment of the site was conducted consistent with EPA Guidance Statements 10, 51 and 56 (refer to **Appendix 4**).

The proposed rezoning of the site under the PRS (i.e. Amendment 035/57 - to transfer approximately 61 hectares of land from Rural zone to Urban zone) and the supporting documentation demonstrating the suitability of this, was subsequently referred to the EPA by the WAPC in 2012. The EPA determined that the proposed scheme amendment should not be assessed under Part IV Division 3 of the *Environmental Protection Act 1986* and provided non-binding advice and recommendations (refer to **Appendix 5**).

The proposed clearing of 12.385 ha of predominantly *Completely Degraded – Degraded* vegetation is not considered to be at variance with this principle.

3.2 Principle 2

Vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.

During fauna surveys of the site undertaken in 2004 and 2011, numerous vertebrate species were identified by sighting or other signs. None of the species has specific protection status under either the *Wildlife Conservation Act 1950* or the *Environment Protection and Biodiversity Conservation Act 1999* and all species are common to the region and were expected to be present based on previous records relating to the site (refer to **Appendices 4 and 7**).

The site has historically been used for grazing cattle, and at the time of the fauna surveys were still being used for cattle grazing. It is also noted that periodic fires designed to encourage new growth for cattle fodder, had resulted in an altered vegetation structure and plant species which in turn had resulted in overall degradation and weed invasion.

The vegetation at the site was examined for potential habitat values for significant species including the threatened Black Cockatoo (*Calyptorhynchus*) species that may occur in the area. Carnaby's (*C. latirostris*) and Forest-Red-tailed Cockatoos (*C. banksii naso*), both known to occur nearby, have distinct but overlapping requirements for breeding, roosting, and foraging habitat, as does Baudin's (*C. baudinii*) which has not been recorded but may occur (refer to **Appendix 4**).

The remnant vegetation of the site is predominantly shrubland, scrub or heath, and does not provide breeding or roosting habitat for these cockatoo species. Scattered planted Tuarts (*Eucalyptus gomphocephala*) occur within Lot 9016 while the eastern section of Lot 101 contains established tree plantings including Marri (*Corymbia calophylla*), Tuart, and other eucalypt species that are not locally native. During fauna surveying, none of the trees showed development of hollows suitable for cockatoo nesting, it was considered that as such they are not considered to represent potential breeding habitat for any black cockatoo species. They are also unlikely to be used for roosting, which generally occurs in or near riparian environments or permanent water sources, or in tall trees within or on the edge of forests (refer to **Appendices 4 and 7**).

While the shrubland and heath vegetation contained within Lot 101 also includes some potential cockatoo food plants (e.g. species of *Allocasuarina*, *Banksia*, *Hakea* and *Grevillea*), they are a relatively minor component of the remnant vegetation found on-site (refer to **Appendix 4**).

All surveys identified that the fauna habitat value within the site, and therefore the proposed clearing area, is limited due to its predominantly degraded condition and fragmented nature of the vegetation found within it. The vegetation lacks an understorey and is heavily weed infested.

In July 2012, the landowner referred the proposed development of Lot 101 Mandurah Road to what is now the Commonwealth Department of the Environment for a decision as to whether approval for the proposed action was needed under Chapter 4 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Reference No. 2012/6466).

In January 2013, the Department issued the landowner with a Notification of the Referral Decision '**Not a Controlled Action**' with respect to the proposed action to develop Lot 101 Mandurah Road (refer to **Appendix 6**).

The proposed clearing of 12.385 ha of predominantly *Completely Degraded* – *Degraded* vegetation is not considered to be at variance with this principle.

3.3 Principle 3

Vegetation should not be cleared if it includes, or is necessary for the continued existence of rare flora.

As previously discussed in **Section 3.1**, two Priority-listed flora species were recorded within the September 2011 survey of Lot 101. *Beyeria cinerea* subsp. *cinerea* (P3)² and *Conostylis pauciflora*

² Priority 3 (P3) species are species that are known from several locations, and the species do not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations, but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

subsp. *pauciflora* (P4) both of which were observed in *Degraded* and *Completely Degraded* vegetation.

Beyeria cinerea subsp. *cinerea* is a low shrub to 0.9 m tall with small, cryptic flowers (refer to **Plate 13**). There are 31 collections held at the Western Australian Herbarium with a coastal distribution stretching from Warroora Station to Madora Bay. Madora Bay is at the southernmost extent of the distribution of *Beyeria cinerea* subsp. *cinerea*. Six plants were recorded from a single population at the southeastern end of the site (refer to **Appendix 4**).



PLATE 13: *Beyeria cinerea* subsp. *cinerea*

Conostylis pauciflora subsp. *pauciflora* is a sedge-like perennial herb to 0.35 m with yellow flowers from August to October (refer to **Plate 14**).



PLATE 14: *Conostylis pauciflora* subsp. *pauciflora* inflorescence

This taxon is known from 22 records including 14 collections held at the Western Australian Herbarium. Its distribution is restricted to the Swan Coastal Plain from Dawesville to Yanchep. Twenty six individual *Conostylis pauciflora* subsp. *pauciflora*³ plants were recorded from one population at the southeastern side of Lot 101 (refer to **Appendix 4**).

Neither of the species has specific protection status under either the *Wildlife Conservation Act 1950* or the *Environment Protection and Biodiversity Conservation Act 1999*.

None of the individuals are located within the proposed clearing area (refer to **Appendix 4**).

A total of 72 vascular plant species, of which 28 were introduced or non-endemic, were recorded from within former Lot 9013 during surveys undertaken in September 2004 and March 2005. None of the species were Priority-listed species (refer to **Appendix 7**).

No Threatened Flora (TF) species or Priority Flora (PF) species listed under either the Western Australian *Wildlife Conservation Act (1950)* or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* were identified within the proposed clearing area (refer to **Appendices 4 and 7**).

The proposed clearing of 12.385 ha of predominantly *Completely Degraded – Degraded* vegetation is not considered to be at variance with this principle.

3.4 Principle 4

Vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.

No Threatened Ecological Communities (TECs) were identified during the September 2011 survey of Lot 101, and the **inferred** results of the FCT analysis indicate that, with the exception of vegetation type ArAhMS, all of the vegetation types recorded were most likely to be SCP 29a (Coastal shrublands on shallow sands) or SCP 29b (Acacia shrublands on taller dunes). The ArAhMS vegetation type is best matched with SCP 24 (Northern Spearwood shrublands and woodlands) (Priority 3). In all cases, the reliability of the inferred FCTs is considered to be low due to overall site degradation and low species diversity. In general the then Department of Parks and Wildlife (now the Department of Biodiversity, Conservation and Attractions) did not consider *Degraded* and *Completely Degraded* vegetation to be a TEC or PEC (refer to **Appendix 4**).

No TECs were identified during the September 2004/March 2005 survey of former Lot 9013 and the **inferred** results of the FCT analysis indicate that all of the vegetation types recorded were also most likely to be SCP 29a (Coastal shrublands on shallow sands) or SCP 29b (Acacia shrublands on taller dunes). Neither of these FCTs is listed as a TEC

Given that the vegetation in the proposed clearing area is in a predominantly *Completely Degraded – Degraded* condition, it should therefore not be considered to be a TEC or a PEC.

³ Priority 4 (P4) species are species that are either (a) Rare - considered to have been adequately surveyed or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection; (b) Near Threatened - considered to have been adequately surveyed and that do not currently qualify for Conservation Dependent but that are close to qualifying for Vulnerable; (c) species that have been removed from the list of threatened species during the last five years for reasons other than taxonomy.

The proposed clearing of 12.385 ha of predominantly *Completely Degraded - Degraded* vegetation is not considered to be at variance with this principle.

3.5 Principle 5

Vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.

The majority of the vegetation covering both Lot 101 and the former Lot 9013 is typical of the near coastal environment of the Mandurah coastline being representative of the Quindalup Complex and the Cottesloe Complex - Central and South (refer to **Appendices 4 and 7**).

The Quindalup Complex is associated with coastal dunes and occupies the western two-thirds of the study area. It consists mainly of two alliances - the strand and foredune alliance and the mobile and stable dune alliance. The Quindalup Complex extends in a narrow coastal strip, almost continuously from Dongara to Busselton and is noted to have considerably variable species composition and structure both locally and regionally (Hedde *et al.* 1980).

The Cottesloe (Central and South) complex typically occurs on aeolian deposits and is described as a mosaic of woodland of *Eucalyptus gomphocephala* (Tuart) and open forest of *E. gomphocephala* - *E. marginata* (Jarrah) – *E. calophylla* (now *Corymbia calophylla*) (Marri) with closed heath on the limestone outcrops (Hedde *et al.* 1980).

Approximately 47.1% of the original extent of the Quindalup Vegetation Complex remains on the Southern Swan Coastal Plain with approximately 41.1% of the original extent of the Cottesloe Complex – Central and South remains in the southern Swan Coastal Plain (Environmental Protection Authority, 2006).

The remnant vegetation within the proposed clearing area should not be classified as significant as it is in a predominantly *Completely Degraded – Degraded* condition and is representative of Vegetation Complexes neither of which is identified as being under-represented on the southern Swan Coastal Plain (Environmental Protection Authority, 2006).

The proposed clearing of 12.385 ha of predominantly *Completely Degraded - Degraded* vegetation is not considered to be at variance with this principle.

3.6 Principle 6

Vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.

The site is located outside of the Peel-Harvey Estuarine System catchment and there are no open water bodies, ephemeral water bodies, or defined watercourses occurring within the site (JDA Consultant Hydrologists, 2011).

Based on interpretation of aerial photography, the *System Six* report (Environmental Protection Authority, 1983) mapped the northern portion of the site as an ecological linkage (M107) and identified an area of *Acacia rostellifera* shrubland as a possible interdunal wetland. The then

Ministry of Planning's during the preparation of the Peel Region Scheme (PRS) incorrectly identified the area of *Acacia rostellifera* shrubland as a wetland (refer to **Appendix 7**).

To investigate this finding in the PRS, the landowner subsequently commissioned three flora and vegetation surveys that were conducted by qualified and experienced field botanists (Alan Tingay and Associates, 1998; ATA Environmental, 2004; Ecoscape (Australia) Pty Ltd., 2011). None of the qualified and highly experienced field botanists who conducted the surveys observed a wetland being present on-site.

An examination of wetlands mapped in the *Swan Coastal Plains Geomorphic Wetlands dataset* found none occurring within the site including from within the proposed clearing area. The nearest wetland is Paganoni Swamp Conservation Category Wetland located 1.4 km to the east of the proposed clearing area.

The proposed clearing of 12.385 ha of predominantly *Completely Degraded - Degraded* vegetation is not considered to be at variance with this principle.

3.7 Principle 7

Vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

Topographic elevation at the proposed clearing area ranges from 8.93 – 15 mAHD within Lot 9016 and 12.5 - 7.5 mAHD along the eastern boundary of Lot 101.

The proposed clearing of approximately 2.435 ha of predominantly *Degraded* vegetation within Lot 9016 is required to enable cut to fill earthworks to be undertaken for Stages 7 - 9. This will result in approximately 280,000 m³ of excess clean sandy fill that is proposed to be exported to Lot 101 and deposited within the Stage 1 cells (refer to **Appendix 3**).

All works will be undertaken in accordance with a Development Approval (DA) issued by the City of Mandurah. It is anticipated that following series of actions will be undertaken within the proposed clearing are:

- Native vegetation from within the earthworks areas (as shown in **Appendix 3**) will be cleared and disposed of offsite;
- Topsoil stripped from the earthworks areas will be stockpiled within the earthworks boundary;
- Imported fill will be placed within the earthworks area for Stage 1 cells; and
- Topsoil will be respread over the fill.

Appropriate management measures will be put in place following vegetation clearing and fill deposition as needed (e.g. dust suppression and hydro-mulching).

The proposed clearing of 12.385 ha of predominantly *Completely Degraded - Degraded* vegetation is not considered to be at variance with this principle.

3.8 Principle 8

Vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.

The *Bush Forever* document has been sourced for the potential location of Bush Forever sites within the vicinity of the site (Western Australian Planning Commission, 2000). One Bush Forever site (395, Paganoni Swamp and adjacent bushland) was identified during this process. Site 395 is located diagonally opposite the north-eastern corner of Lot 101, approximately 2.43 km north-east of the proposed clearing area.

The southern boundary of Paganoni Swamp CCW is located approximately 1.4 km due east of the proposed clearing area.

The proposed clearing of predominantly *Completely Degraded – Degraded* vegetation within the proposed clearing area will not have an impact on any environmental values of either Bush Forever Site 395 or the Paganoni Swamp CCW given that the intervening distance between the two areas is covered by Mandurah Road and the extensive *Lakelands Estate* urban residential development. In addition, groundwater directional flow mapping provided by the former DoW indicates that in the Madora Bay area, groundwater flow is generally in a westerly direction towards the ocean.

The proposed clearing of 12.385 ha of predominantly *Completely Degraded - Degraded* vegetation is not considered to be at variance with this principle.

3.9 Principle 9

Vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.

The former Department of Water's (DoW) *Hydrogeological Atlas* (now Department of Water and Environmental Regulation) identifies that the groundwater flow beneath the proposed clearing area is generally in a westerly direction towards the ocean and identifies the presence of three aquifers beneath the site; the Superficial Formation (unconfined), the Rockingham Sand Formation (unconfined) and the Leederville Formation (confined).

With respect to Lot 101, monitoring of groundwater levels indicates that the maximum depth to the seasonal groundwater table is anticipated to be approximately 2 mAHD with nutrient concentrations found to be typical of rural stock grazing areas and are typical within the superficial aquifer on the Swan Coastal Plain (refer to **Appendix 8**).

Lot 101 is not located in either the *Environmental Protection (Peel Inlet-Harvey Estuary) Policy 1992* boundary for the Swan Coastal Plain Catchment of the Peel Inlet-Harvey Estuary (JDA Consultant Hydrologists 2011) or a Groundwater Protection Zone (GPZ). The closest Public Drinking Water Source Area (PWDSA) is located within approximately 3 km of the site (refer to **Appendix 8**).

No dewatering is proposed to be undertaken during the proposed clearing, cut to fill earthworks and associated fill importation. Given this factor, and the direction of groundwater flow being in a westerly direction towards the ocean and away from Paganoni Swamp CCW, it is considered that the hydrology the Paganoni Swamp CCW will not be adversely impacted by the proposed clearing.

The proposed clearing of 12.385 ha of predominantly *Completely Degraded - Degraded* vegetation is not considered to be at variance with this principle.

3.9 Principle 10

Vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.

The proposed clearing area is located within an area of limestone plain that is characterised by limestone outcrops extending from the base of the dune system (located along the western boundary of the proposed clearing area) and eastward towards Mandurah Road.

There are two major geological units mapped within the site: Safety Bay Sand and Tamala Limestone (Gozzard, 1983). The Safety Bay Sand extends inland from the coastline with two sub-units (S13 and S2). Both sub-units are described as calcareous sand, composed of white, medium-grained, rounded quartz and shell debris that are well sorted and of aeolian origin. The S13 sub-unit occurs along the coastline (in the vicinity of both Stage 1 cells) and is associated with low undulating relic foredune topography, with variably thick sands overlying Tamala Limestone. The S2 sub-unit occupies a narrow strip that runs north/south across the length of the site and is associated with moderate to steep slopes and is noted to be susceptible to remobilisation when disturbed (Gozzard, 1983).

The eastern portion of the site adjacent to Mandurah Road has been mapped as Tamala limestone LS1 (Gozzard 1983), consisting of pale yellowish brown, fine to coarse-grained, sub-angular to well-rounded quartz with shell debris and traces of feldspar. It is variably lithified and of aeolian origin with surface kankar (Gozzard, 1983).

The high sand content of the soil which provides a high infiltration rate following rainfall, in combination with a depth to the maximum seasonal groundwater table of approximately 2 mAHD, will combine to reduce the incidence of localised flooding (refer to **Appendix 8**).

The proposed clearing of 12.385 ha of predominantly *Completely Degraded - Degraded* vegetation is not considered to be at variance with this principle.

4 Conclusion

Clearing 12.835 ha of predominantly *Completely Degraded - Degraded* native vegetation from within the proposed clearing area. Clearing is required to enable the exportation of approximately 280,000 m³ of excess clean sandy fill from Stages 7 -8 of the *Madora Bay East* residential development to be used as fill during the construction of Stage 1 of the *Madora Bay North* residential development.

Following a desk-top review of environmental reports prepared for the site and subsequent site inspections conducted of the proposed clearing areas, *EndPlan Environmental* has assessed the proposed clearing of up to 12.385 ha of *Completely Degraded* native vegetation against the clearing principles for native vegetation under Schedule 5 of the *Environmental Protection Act 1986*.

On the basis of the information contained within the reports and site observations, *EndPlan Environmental* considers that the proposed clearing of 12.385 ha of predominantly *Completely Degraded- Degraded* vegetation, required in order to construct *Madora Bay North* Stage 1 in Lot 101 Mandurah Road, and *Madora Bay East* Stages 7-9 within Lot 9016 Mandurah Road, does not contravene any of the ten clearing principles as listed under Schedule 5 of the *Environmental Protection Act 1986*.

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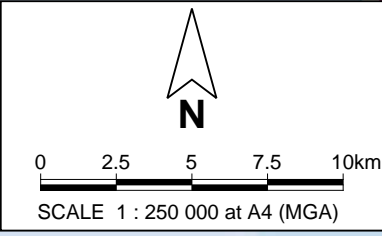
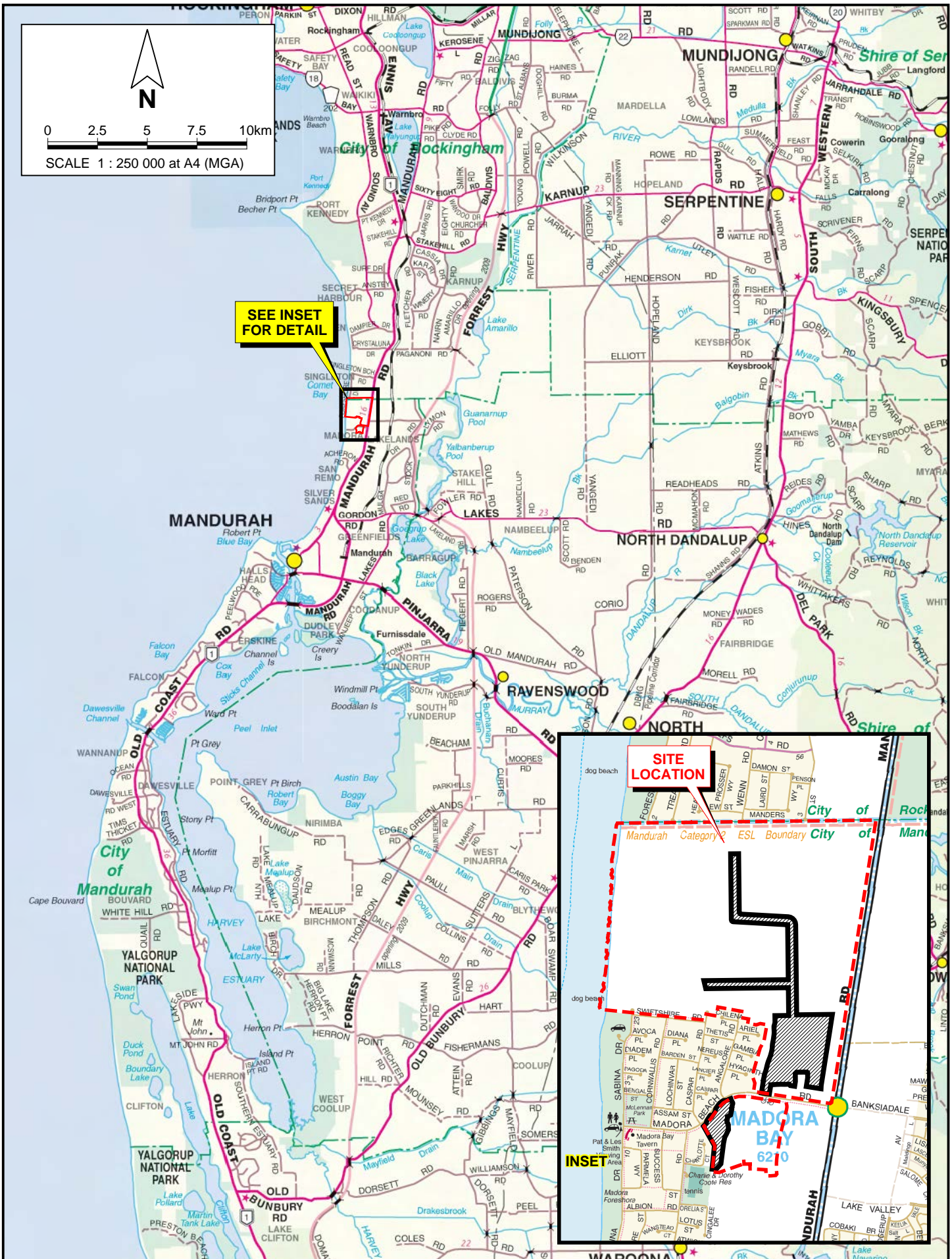
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FIGURES

**APPLICATION FOR A CLEARING PERMIT (AREA PERMIT)
PORTION OF LOTS 101 and 9016 MANDURAH ROAD,
MADORA BAY**



SEE INSET FOR DETAIL

SITE LOCATION

INSET

EndPlan
Environmental

APPLICATION FOR A CLEARING PERMIT (AREA PERMIT) PORTIONS OF LOTS 101 AND 9016 MANDURAH ROAD, MADORA BAY

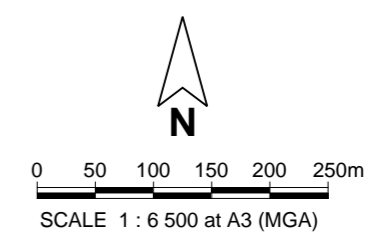
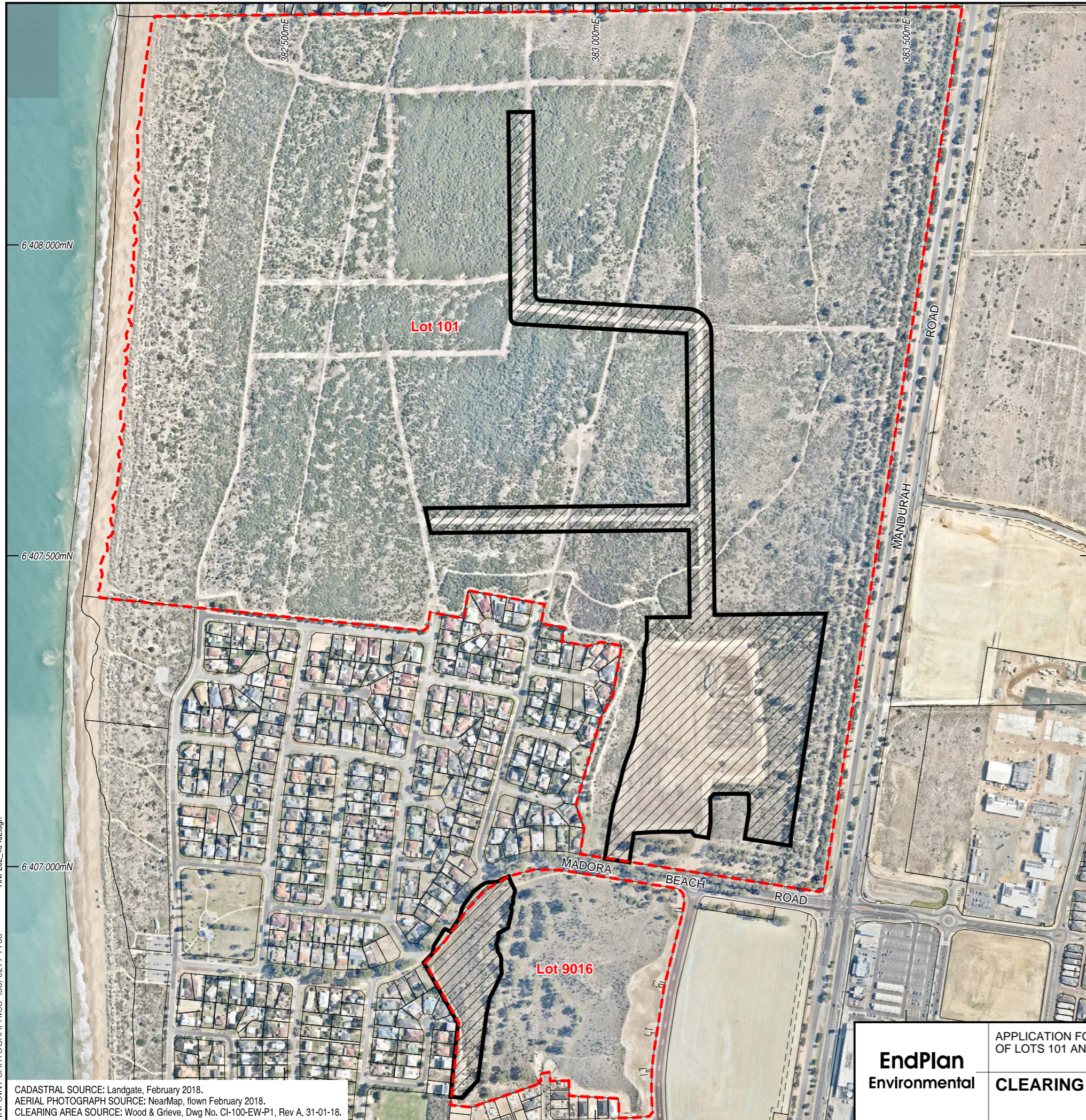
Date: 27 Feb 2018
Drawn: B. Van der Wiele

REGIONAL LOCATION

Figure 1

Report No. HNP292_46

PINPOINT CARTOGRAPHICS (08) 9562 7136 HNP292_46-01.dgn

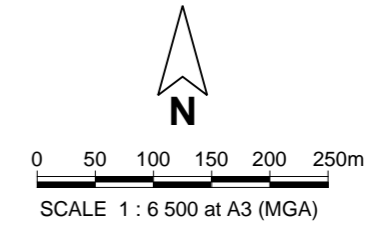
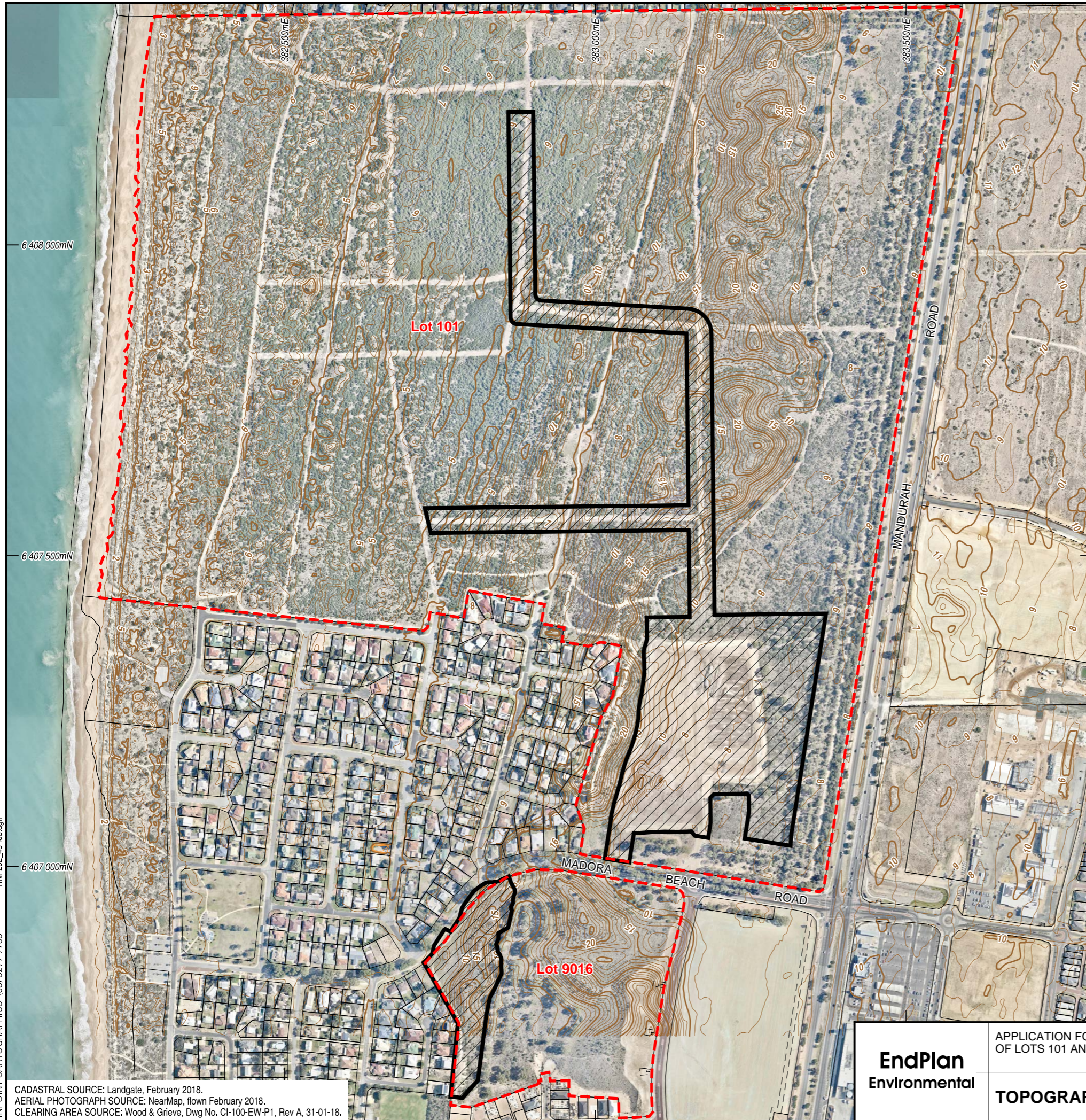


- Legend**
- - - Site Boundary
 - Cadastral Boundary
 - - - Easement Boundary
 - / / / / Proposed Clearing Area

HNP292_46-102.dgn
 PINPOINT CARTOGRAPHICS (08) 9277 7763

CADASTRAL SOURCE: Landgate, February 2018.
 AERIAL PHOTOGRAPH SOURCE: NearMap, flown February 2018.
 CLEARING AREA SOURCE: Wood & Grieve, Dwg No. CI-100-EW-P1, Rev A, 31-01-18.

<p>EndPlan Environmental</p>	<p>APPLICATION FOR A CLEARING PERMIT (AREA PERMIT) PORTIONS OF LOTS 101 AND 9016 MANDURAH ROAD, MADORA BAY</p> <p>CLEARING PERMIT APPLICATION AREA</p>	<p>Date: 27 Feb 2018 Drawn: B. Van der Wiele</p>
		<p>Figure 2</p> <p>Report No. HNP292_46</p>



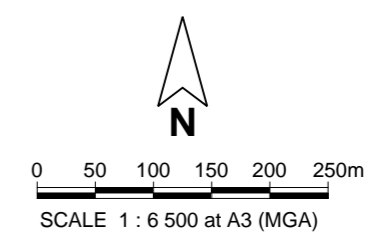
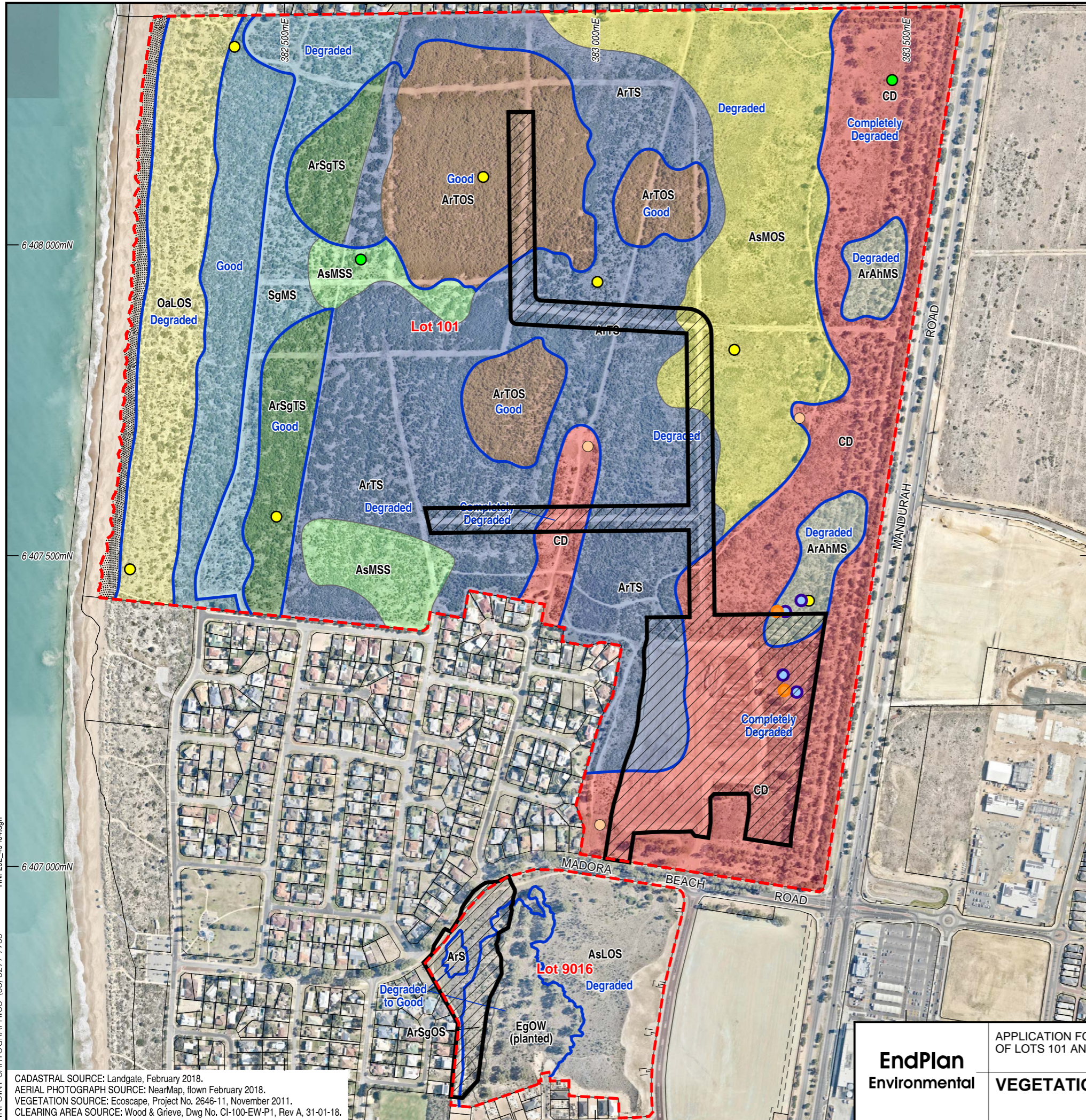
- Legend**
- - - Site Boundary
 - Cadastral Boundary
 - - - Easement Boundary
 - Topographic Contour (mAHD)
 - / / / / Proposed Clearing Area

HNP292_46-103.dgn
 PINPOINT CARTOGRAPHICS (08) 9277 7763

6 408 000mN
 6 407 500mN
 6 407 000mN

CADASTRAL SOURCE: Landgate, February 2018.
 AERIAL PHOTOGRAPH SOURCE: NearMap, flown February 2018.
 CLEARING AREA SOURCE: Wood & Grieve, Dwg No. CI-100-EW-P1, Rev A, 31-01-18.

EndPlan Environmental	APPLICATION FOR A CLEARING PERMIT (AREA PERMIT) PORTIONS OF LOTS 101 AND 9016 MANDURAH ROAD, MADORA BAY TOPOGRAPHY	Date: 27 Feb 2018 Drawn: B. Van der Wiele
		Figure 3 Report No. HNP292_46



Legend

- - - Site Boundary
- Cadastral Boundary
- Easement Boundary
- Proposed Clearing Area

Vegetation Legend

- Quadrat
 - Releve
- Conservation Significant Flora**
- *Beyeria cinerea* subsp. *cinerea* (P4)
 - *Conostylis pauciflora* subsp. *pauciflora* (P4)
- Declared Weeds**
- *Solanum linnaeanum*
- Vegetation Condition**
- Vegetation Condition
- Vegetation Type**
- ArAhMS: *Acacia rostellifera*, *Allocasuarina humilis* mid-high shrubland over *Poaceae* spp., *Trachyandra divaricata*, *Hypochaeris glabra* low grassland/forbland.
 - ArSgTS: *Acacia rostellifera*, *Spyridium globulosum*, *Alyxia buxifolia* tall shrubland over *Acanthocarpus preissii*, *Bromus diandrus*, *Senecio pinnatifolius* var. *latilobus* low forbland/grassland.
 - ArTCS: *Acacia rostellifera* tall closed shrubland over *Calandrinia brevipedata*, *Crassula glomerata*, *Apium annuum* low forbland.
 - ArTS: *Acacia rostellifera* tall strubland over *Acanthocarpus preissii*, *Trachyandra divaricata*, *Senecio pinnatifolius* var. *latilobus* low forbland.
 - AsMOS: *Acacia saligna*, *Adriana quadripartita* mid-high open shrubland over *Trachyandra divaricata*, *Acanthocarpus preissii*, *Senecio pinnatifolius* var. *latilobus* low forbland.
 - AsMSS: *Acacia saligna*, *A. rostellifera* mid-high sparse shrubland over *Acanthocarpus preissii*, *Trachyandra divaricata*, *Conostylis candicans* low forbland.
 - CD: Completely degraded: *Hakea prostrata*, *Allocasuarina humilis* mid-high sparse shrubland over *Lupinus cosentinii*, *Poaceae* spp., *Euphorbia terracina* low grassland/forbland.
 - OaLOS: *Olearia axillaris*, *Scaevola crassifolia* low open shrubland over *Trachyandra divaricata*, *Pelargonium capitatum*, *Gazania linearis* low open forbland.
 - SgMS: *Spyridium globulosum*, *Olearia axillaris*, *Acacia saligna* mid-high shrubland over *Acanthocarpus preissii*, *Carpobrotus virescens*, *Trachyandra divaricata* low shrubland/forbland.
 - BS: Bare sand

HNP292_46-104.dgn
 PINPOINT CARTOGRAPHICS (08) 9277 7763

CADASTRAL SOURCE: Landgate, February 2018.
 AERIAL PHOTOGRAPH SOURCE: NearMap, flown February 2018.
 VEGETATION SOURCE: Ecoscape, Project No. 2646-11, November 2011.
 CLEARING AREA SOURCE: Wood & Grieve, Dwg No. Cl-100-EW-P1, Rev A, 31-01-18.

<p>EndPlan Environmental</p>	<p>APPLICATION FOR A CLEARING PERMIT (AREA PERMIT) PORTIONS OF LOTS 101 AND 9016 MANDURAH ROAD, MADORA BAY</p> <p>VEGETATION TYPE AND CONDITION</p>	<p>Date: 26 Feb 2018 Drawn: B. Van der Wiele</p>
<p>Figure 4</p>		<p>Report No. HNP292_46</p>

APPENDICES

**APPLICATION FOR A CLEARING PERMIT (AREA PERMIT)
PORTION OF LOTS 101 and 9016 MANDURAH ROAD,
MADORA BAY**

APPENDIX 1

**CERTIFICATES OF TITLE – LOTS 101 and 9016 MANDURAH ROAD,
MADORA BAY**

(Source: Landgate, 2014)

WESTERN



AUSTRALIA

REGISTER NUMBER 101/DP73957	
DUPLICATE EDITION 2	DATE DUPLICATE ISSUED 17/7/2017

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

VOLUME **2792** FOLIO **290**

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.



REGISTRAR OF TITLES

LAND DESCRIPTION:

LOT I01 ON DEPOSITED PLAN 73957

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

PHILLIP RICHARD PERRY
IN 1/3 SHARE
JOHN DAVID PERRY
IN 1/3 SHARE
BRIAN HENRY PERRY
IN 1/3 SHARE
ALL OF 54 MANDURAH TERRACE MANDURAH WA 6210
AS TENANTS IN COMMON

(T N663790) REGISTERED 30/6/2017

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: DP73957
PREVIOUS TITLE: 2660-443
PROPERTY STREET ADDRESS: NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AUTHORITY: CITY OF MANDURAH

WESTERN



AUSTRALIA

REGISTER NUMBER 9016/DP411658	
DUPLICATE EDITION 1	DATE DUPLICATE ISSUED 20/2/2018

DUPLICATE CERTIFICATE OF TITLE
UNDER THE TRANSFER OF LAND ACT 1893

VOLUME **2942** FOLIO **550**

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.



REGISTRAR OF TITLES

LAND DESCRIPTION:

LOT 9016 ON DEPOSITED PLAN 411658

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

PHILLIP RICHARD PERRY
IN 1/3 SHARE
JOHN DAVID PERRY
IN 1/3 SHARE
BRIAN HENRY PERRY
IN 1/3 SHARE
ALL OF 54 MANDURAH TERRACE MANDURAH WA 6210
AS TENANTS IN COMMON

(AF N795419) REGISTERED 19/2/2018

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

1. T3377/1904 EASEMENT BENEFIT FOR RIGHT OF CARRIAGEWAY PURPOSES - SEE SKETCH ON PLAN 741. REGISTERED 8/6/1904.
2. EASEMENT BURDEN CREATED UNDER SECTION 167 P. & D. ACT FOR DRAINAGE PURPOSES TO CITY OF MANDURAH - SEE DEPOSITED PLAN 411658 AS CREATED ON DEPOSITED PLAN 406257.
3. EASEMENT BURDEN CREATED UNDER SECTION 167 P. & D. ACT FOR SEWERAGE PURPOSES TO WATER CORPORATION - SEE DEPOSITED PLAN 411658 AS CREATED ON DEPOSITED PLAN 411655
4. EASEMENT BURDEN CREATED UNDER SECTION 167 P. & D. ACT FOR SEWERAGE PURPOSES TO WATER CORPORATION SEE DEPOSITED PLAN 411658
5. EASEMENT BURDEN CREATED UNDER SECTION 167 P. & D. ACT FOR WATER PURPOSES TO WATER CORPORATION SEE DEPOSITED PLAN 411658

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.
Lot as described in the land description may be a lot or location.

-----END OF DUPLICATE 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.

END OF PAGE 1 - CONTINUED OVER



RECORD OF CERTIFICATE OF TITLE

REGISTER NUMBER: 9016/DP411658

VOLUME/FOLIO: 2942-550

PAGE 2

SKETCH OF LAND:

DP411658

PREVIOUS TITLE:

2938-699

PROPERTY STREET ADDRESS:

NO STREET ADDRESS INFORMATION AVAILABLE.

LOCAL GOVERNMENT AUTHORITY:

CITY OF MANDURAH

This certificate of title is a valuable document that is protected by overt and covert security features, including a thermochromic icon on the front of this document. To test, gently rub the icon. The icon should momentarily disappear then return. The absence of this feature could indicate a fraudulent certificate of title.

APPENDIX 2

**WAPC SUBDIVISION APPROVALS MADORA BAY (WAPC REF. 155645,
152627 and 150302
(Source: Western Australian Planning Commission, 2015, 2018)**



Your Ref : 962-162A-01/02

Everett Bennett Pty Ltd
Po Box 796
SUBIACO WA 6904

Approval Subject To Condition(s) Freehold (Green Title) Subdivision

Application No : 155645

Planning and Development Act 2005

Applicant	:	Everett Bennett Pty Ltd Po Box 796 SUBIACO WA 6904
Owner	:	Mr Brian Perry 54 Mandurah Terrace MANDURAH WA 6210; Mr John Perry 54 Mandurah Terrace MANDURAH WA 6210; Mr Phillip Perry 54 Mandurah Terrace MANDURAH WA 6210
Application Receipt	:	5 September 2017

Lot Number	:	101
Diagram / Plan	:	P073957
Location	:	
C/T Volume/Folio	:	2792/290
Street Address	:	Mandurah Road, Madora Bay
Local Government	:	City of Mandurah

The Western Australian Planning Commission has considered the application referred to and is prepared to endorse a deposited plan in accordance with the plan date-stamped **03 October 2017** once the conditions set out have been fulfilled.

This decision is valid for **four years** from the date of this advice, which includes the lodgement of the deposited plan within this period.

The deposited plan for this approval and all required written advice confirming that the requirement(s) outlined in the condition(s) have been fulfilled must be submitted by **25 January 2022** or this approval no longer will remain valid.

Reconsideration - 28 days

Under section 151(1) of the *Planning and Development Act 2005*, the applicant/owner may, within 28 days from the date of this decision, make a written request to the WAPC to reconsider any condition(s) imposed in its decision. One of the matters to which the



WAPC will have regard in reconsideration of its decision is whether there is compelling evidence by way of additional information or justification from the applicant/owner to warrant a reconsideration of the decision. A request for reconsideration is to be submitted to the WAPC on a Form 3A with appropriate fees. An application for reconsideration may be submitted to the WAPC prior to submission of an application for review. Form 3A and a schedule of fees are available on the WAPC website: <http://www.planning.wa.gov.au>

Right to apply for a review - 28 days

Should the applicant/owner be aggrieved by this decision, there is a right to apply for a review under Part 14 section 251 of the *Planning and Development Act 2005*. The application for review must be submitted in accordance with part 2 of the *State Administrative Tribunal Rules 2004* and should be lodged within 28 days of the date of this decision to: the State Administrative Tribunal, Level 6, State Administrative Tribunal Building, 565 Hay Street, PERTH, WA 6000. It is recommended that you contact the tribunal for further details: telephone 9219 3111 or go to its website: <http://www.sat.justice.wa.gov.au>

Deposited plan

The deposited plan is to be submitted to the Western Australian Land Information Authority (Landgate) for certification. Once certified, Landgate will forward it to the WAPC. In addition, the applicant/owner is responsible for submission of a Form 1C with appropriate fees to the WAPC requesting endorsement of the deposited plan. A copy of the deposited plan with confirmation of submission to Landgate is to be submitted with all required written advice confirming compliance with any condition(s) from the nominated agency/authority or local government. Form 1C and a schedule of fees are available on the WAPC website: <http://www.planning.wa.gov.au>

Condition(s)

The WAPC is prepared to endorse a deposited plan in accordance with the plan submitted once the condition(s) set out have been fulfilled.

The condition(s) of this approval are to be fulfilled to the satisfaction of the WAPC.

The condition(s) must be fulfilled before submission of a copy of the deposited plan for endorsement.

The agency/authority or local government noted in brackets at the end of the condition(s) identify the body responsible for providing written advice confirming that the WAPC's requirement(s) outlined in the condition(s) have been fulfilled. The written advice of the agency/authority or local government is to be obtained by the applicant/owner. When the written advice of each identified agency/authority or local government has been obtained, it should be submitted to the WAPC with a Form 1C and appropriate fees and a copy of the deposited plan.

If there is no agency/authority or local government noted in brackets at the end of the

condition(s), a written request for confirmation that the requirement(s) outlined in the condition(s) have been fulfilled should be submitted to the WAPC, prior to lodgement of the deposited plan for endorsement.

Prior to the commencement of any subdivision works or the implementation of any condition(s) in any other way, the applicant/owner is to liaise with the nominated agency/authority or local government on the requirement(s) it considers necessary to fulfil the condition(s).

The applicant/owner is to make reasonable enquiry to the nominated agency/authority or local government to obtain confirmation that the requirement(s) of the condition(s) have been fulfilled. This may include the provision of supplementary information. In the event that the nominated agency/authority or local government will not provide its written confirmation following reasonable enquiry, the applicant/owner then may approach the WAPC for confirmation that the condition(s) have been fulfilled.

In approaching the WAPC, the applicant/owner is to provide all necessary information, including proof of reasonable enquiry to the nominated agency/authority or local government.

The condition(s) of this approval, with accompanying advice, are:

CONDITION(S):

1. Prior to the commencement of subdivision works, a landscaping plan for the 'Green Linkage Street' shall be prepared in consultation with and approved by the local government, to the satisfaction of the Western Australian Planning Commission for the road reserve as illustrated on the approved plan of subdivision dated 3 October 2017(attached). (Local Government)
2. Uniform fencing being constructed along the boundaries of all of the proposed lots abutting public open space. (Local Government)
3. Engineering drawings and specifications are to be submitted, approved, and works undertaken in accordance with the approved engineering drawings, specifications and approved plan of subdivision, for grading and/or stabilisation of the site to ensure that:
 - a) lots can accommodate their intended use; and
 - b) finished ground levels at the boundaries of the lot(s) the subject of this approval match or otherwise coordinate with the existing and/or proposed finished ground levels of the land abutting. (Local Government)
4. Prior to the commencement of subdivisional works, an urban water management plan is to be prepared and approved, in consultation with the Department of Water and Environmental Regulation, consistent with any approved Local Water Management Strategy/Drainage and Water Management Plan. (Local Government)

5. A notification, pursuant to Section 165 of the *Planning and Development Act 2005* is to be placed on the certificates of title of the proposed lot(s) advising of the existence of a hazard or other factor. Notice of this notification is to be included on the diagram or plan of survey (deposited plan). The notification is to state as follows:

'This lot is in close proximity to known mosquito breeding areas. The predominant mosquito species is known to carry viruses and other diseases.' (Western Australian Planning Commission)

6. Engineering drawings and specifications are to be submitted and approved, and works undertaken in accordance with the approved engineering drawings and specifications and approved plan of subdivision, for the filling and/or draining of the land, including ensuring that stormwater is contained on-site, or appropriately treated and connected to the local drainage system. Engineering drawings and specifications are to be in accordance with an approved Urban Water Management Plan (UWMP) for the site, or where no UWMP exists, to the satisfaction of the Western Australian Planning Commission. (Local Government)
7. Measures being taken to ensure the identification and protection of any vegetation on the site worthy of retention that is not impacted by subdivisional works, prior to commencement of subdivisional works. (Local Government).
8. Information is to be provided to demonstrate that the measures contained in the bushfire management plan (Version 1.1 24 January 2018) that address the following:
 - a) The installation of a 100 metre wide Asset Protection Zone around each stage of proposed residential lots; and
 - b) the construction of the emergency access way in the northern portion as illustrated on the plan dated stamped 3 October 2017, have been implemented during subdivisional works.(Local Government)
9. A Notification, pursuant to Section 165 of the *Planning and Development Act 2005* is to be placed on the certificate(s) of title of the proposed lot(s) with a Bushfire Attack Level (BAL) rating of 12.5 or above, advising of the existence of a hazard or other factor.

Notice of this notification is to be included on the diagram or plan of survey (deposited plan).

The notification is to state as follows:

'This land is within a bushfire prone area as designated by an Order made by the Fire and Emergency Services Commissioner and may be subject to a Bushfire Management Plan Additional planning and building requirements may apply to development on this land' (Western Australian Planning Commission)

10. Local Development Plan(s) being prepared and approved for lots shown on the plan dated 3 October 2017 (attached) that address the following:
 - a) Lots abutting

the northern boundary;

b) Lots abutting public open space; and

c) Lots identified as being bushfire prone

to the satisfaction of the Western Australian Planning Commission. (Local Government)

11. The proposed reserve(s) shown on the approved plan of subdivision being shown on the diagram or plan of survey (deposited plan) as reserve(s) for recreation, drainage and pedestrian accessway and vested in the Crown under Section 152 of the *Planning and Development Act 2005*, such land to be ceded free of cost and without any payment of compensation by the Crown. (Local Government)
12. Arrangements being made for the proposed public open space to be developed by the landowner/applicant to a minimum standard and maintained for two summers through the implementation of an approved landscape plan providing for the development and maintenance of the proposed public open space in accordance with the requirements of Liveable Neighbourhoods and to the specifications of the local government. (Local Government)
13. Engineering drawings and specifications are to be submitted, approved, and subdivisional works undertaken in accordance with the approved plan of subdivision, engineering drawings and specifications, to ensure that those lots not fronting an existing road are provided with frontage to a constructed road(s) connected by a constructed road(s) to the local road system and such road(s) are constructed and drained at the landowner/applicant's cost.

As an alternative, and subject to the agreement of the Local Government the Western Australian Planning Commission (WAPC) is prepared to accept the landowner/applicant paying to the local government the cost of such road works as estimated by the local government and the local government providing formal assurance to the WAPC confirming that the works will be completed within a reasonable period as agreed by the WAPC. (Local Government)

14. Engineering drawings and specifications are to be submitted and approved, and subdivisional works undertaken in accordance with the approved plan of subdivision, engineering drawings and specifications to ensure that:
 - a) street lighting is installed on all new subdivisional roads to the standards of the relevant licensed service provider and
 - b) roads that have been designed to connect with existing or proposed roads abutting the subject land are coordinated so the road reserve location and width connect seamlessly and
 - c) temporary turning areas are provided to those subdivisional roads that are subject to future extension and
 - d) embayment parking is provided within the/abutting the proposed public open spaceto the satisfaction of the Western Australian Planning Commission. (Local Government)

15. Engineering drawings and specifications are to be submitted, approved, and subdivisional works undertaken in accordance with the approved plan of subdivision, engineering drawings and specifications, for the provision of shared paths through and connecting to the application area to the satisfaction of the Western Australian Planning Commission; The approved shared paths are to be constructed by the landowner/applicant. (Local Government)
16. All local streets within the subdivision being truncated in accordance with the Western Australian Planning Commission's *Liveable Neighbourhoods* policy (Local Government)
17. All pedestrian access way(s) within the subdivision being constructed and drained at the landowner/applicant's cost and shown on the diagram or plan of survey (deposited plan) as such and vested in the Crown under Section 152 of the *Planning and Development Act 2005*, such land to be ceded free of cost and without any payment of compensation by the Crown. (Local Government)
18. Prior to the commencement of subdivision works a dust management plan for land to be cleared or maintained in a low fuel state is to be prepared and approved with satisfactory arrangements being made for the implementation of the approved plan (Local Government)
19. Arrangements being made, to the satisfaction of the Western Australian Planning Commission, for the transfer of land free of cost to the Department of Education for the provision of a primary school site(s) to serve the area, as identified within the approved plan of Madora Bay North Structure Plan. (Department of Education)
20. Arrangements being made to the satisfaction of the Western Australian Planning Commission and to the specification of Western Power for the provision of an underground electricity supply to the lot(s) shown on the approved plan of subdivision. (Western Power)
21. The transfer of land as a Crown reserve free of cost to Western Power for the provision of electricity supply infrastructure. (Western Power)
22. Arrangements being made with the Water Corporation so that provision of a suitable water supply service will be available to the lots shown on the approved plan of subdivision. (Water Corporation)
23. Arrangements being made with the Water Corporation so that provision of a sewerage service will be available to the lots shown on the approved plan of subdivision. (Water Corporation)

ADVICE:

1. Condition 6 has been imposed in accordance with *Better Urban Water Management Guidelines (WAPC 2008)*. Further guidance on the contents of urban water management plans is provided in '*Urban Water Management Plans*:'

Guidelines for preparing and complying with subdivision conditions' (Published by the then Department of Water 2008).

2. With regard to Condition 8, the maintenance of the low-fuel zone is to be undertaken in accordance with the City of Mandurah's annual firebreak notice, or, if that year's notice does not reference compliance with Bushfire Management Plans, a variation to the annual firebreak notice.
3. With regard to Condition 12, the development is to include full earthworks, basic reticulation, grassing of key areas, and pathways that form part of the overall pedestrian and/or cycle network.
4. In regard to Condition 15, the landowner/applicant is advised that the road reserves, including the constructed carriageways, laneways, truncations, footpaths/dual use paths and car embayments, are to be generally consistent with the approved plan of subdivision.
5. In regards to Condition 19 the applicant is advised that the Department of Education do not require land identified for the primary school site on the Madora Bay North Structure Plan to be ceded free of cost as part of the implementation of the plan of subdivision date stamped 3 October 2017.
6. In regard to Condition 20, Western Power provides only one underground point of electricity supply per freehold lot.
7. In regard to Conditions 22 & 23, the landowner/applicant shall make arrangements with the Water Corporation for the provision of the necessary services. On receipt of a request from the landowner/applicant, a Land Development Agreement under Section 83 of the *Water Services Act 2012* will be prepared by the Water Corporation to document the specific requirements for the proposed subdivision.
8. The landowner applicant is advised that Main Road Western Australia will require the applicant to enter into an agreement with Main Roads Western Australia to address the design and timing of construction of the intersection of subdivisional roads with Mandurah Road as part of subsequent subdivision applications.
9. The landowner/applicant is advised that area identified a 'Future Proposed Foreshore Reserve' on the plan dated stamped 3 October 2017 will be required to be ceded to the crown free of cost as part of a future subdivision application.



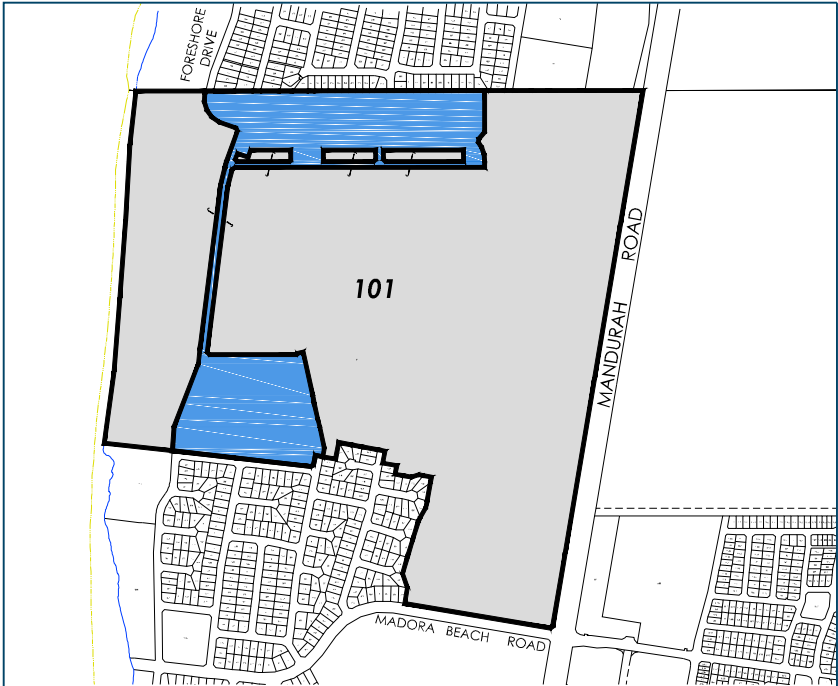
Kerrine Blenkinsop
Secretary
Western Australian Planning Commission
25 January 2018

Enquiries : Cale Luxton (Ph 9586 4691)



DEPARTMENT OF PLANNING, LANDS AND HERITAGE

DATE 03-Oct-2017 FILE 155645



BALANCE LOT (1:20,000)

	Lot 101 - 142.7008ha	
	Subject Area - 23.2107ha	
	Balance of Lot 101 - 119.4901ha	

Yield	
Residential -	242 lots
Balance -	1 lot
Total	243 lots

All road carriageway detail depicted on this subdivision plan including road pavements, road treatments, medians or parking, are for illustrative purposes only and are subject to final engineering design and separate approval processes. The detail reflects the preferred urban design intent for the road network standards.

All dimensions and areas where depicted on this plan are subject to pre-cal and final survey and will vary from the figures shown. This plan remains the property of CLE.



JOB NO: 2016.
 SUB JOB:

Your Ref :
 Enquiries : Brett Pye (Ph 9586 4689)

DATE: 23 DEC 2015

C L E Town Planning + Design
 P O Box 796
 SUBIACO WA 6904

STATUS: APP
 SCAN/DB:

CC'S: John Arney - Madora Bay Path.
 Carry Bardi - Madora Bay Path.
 Mike Del Bordo - WTC.
 John Brinkworth - Road
 Neil Bartlett - RGR

**Approval Subject To Condition(s)
 Freehold (Green Title) Subdivision**

Application No : 152627

Planning and Development Act 2005

Applicant	: C L E Town Planning + Design P O Box 796 SUBIACO WA 6904
Owner	: Phillip Richard Perry 54 Mandurah Terrace, MANDURAH WA 6210 ; John David Perry 54 Mandurah Terrace, MANDURAH WA 6210 ; Brian Henry Perry 54 Mandurah Terrace, MANDURAH WA 6210
Application Receipt	: 21 September 2015

Lot Number	:
Diagram / Plan	: 403856
Location	:
C/T Volume/Folio	: 2880/219
Street Address	: Lot 9008 Madora Beach Road, Madora Bay
Local Government	: City of Mandurah

The Western Australian Planning Commission has considered the application referred to and is prepared to endorse a deposited plan in accordance with the plan date-stamped **21 September 2015** once the condition(s) set out have been fulfilled.

This decision is valid for **four years** from the date of this advice, which includes the lodgement of the deposited plan within this period.

The deposited plan for this approval and all required written advice confirming that the requirement(s) outlined in the condition(s) have been fulfilled must be submitted by **22 December 2019** or this approval no longer will remain valid.

Reconsideration - 28 days



Under section 151(1) of the *Planning and Development Act 2005*, the applicant/owner may, within 28 days from the date of this decision, make a written request to the WAPC to reconsider any condition(s) imposed in its decision. One of the matters to which the WAPC will have regard in reconsideration of its decision is whether there is compelling evidence by way of additional information or justification from the applicant/owner to warrant a reconsideration of the decision. A request for reconsideration is to be submitted to the WAPC on a Form 3A with appropriate fees. An application for reconsideration may be submitted to the WAPC prior to submission of an application for review. Form 3A and a schedule of fees are available on the WAPC website: <http://www.planning.wa.gov.au>

Right to apply for a review - 28 days

Should the applicant/owner be aggrieved by this decision, there is a right to apply for a review under Part 14 of the *Planning and Development Act 2005*. The application for review must be submitted in accordance with part 2 of the *State Administrative Tribunal Rules 2004* and should be lodged within 28 days of the date of this decision to: the State Administrative Tribunal, 12 St Georges Terrace, Perth, WA 6000. It is recommended that you contact the tribunal for further details: telephone 9219 3111 or go to its website: <http://www.sat.justice.wa.gov.au>

Deposited plan

The deposited plan is to be submitted to the Western Australian Land Information Authority (Landgate) for certification. Once certified, Landgate will forward it to the WAPC. In addition, the applicant/owner is responsible for submission of a Form 1C with appropriate fees to the WAPC requesting endorsement of the deposited plan. A copy of the deposited plan with confirmation of submission to Landgate is to be submitted with all required written advice confirming compliance with any condition(s) from the nominated agency/authority or local government. Form 1C and a schedule of fees are available on the WAPC website: <http://www.planning.wa.gov.au>

Condition(s)

The WAPC is prepared to endorse a deposited plan in accordance with the plan submitted once the condition(s) set out have been fulfilled.

The condition(s) of this approval are to be fulfilled to the satisfaction of the WAPC.

The condition(s) must be fulfilled before submission of a copy of the deposited plan for endorsement.

The agency/authority or local government noted in brackets at the end of the condition(s) identify the body responsible for providing written advice confirming that the WAPC's requirement(s) outlined in the condition(s) have been fulfilled. The written advice of the agency/authority or local government is to be obtained by the applicant/owner. When the written advice of each identified agency/authority or local government has been obtained, it should be submitted to the WAPC with a Form 1C and appropriate fees and a copy of the deposited plan.

If there is no agency/authority or local government noted in brackets at the end of the condition(s), a written request for confirmation that the requirement(s) outlined in the



condition(s) have been fulfilled should be submitted to the WAPC, prior to lodgement of the deposited plan for endorsement.

Prior to the commencement of any subdivision works or the implementation of any condition(s) in any other way, the applicant/owner is to liaise with the nominated agency/authority or local government on the requirement(s) it considers necessary to fulfil the condition(s).

The applicant/owner is to make reasonable enquiry to the nominated agency/authority or local government to obtain confirmation that the requirement(s) of the condition(s) have been fulfilled. This may include the provision of supplementary information. In the event that the nominated agency/authority or local government will not provide its written confirmation following reasonable enquiry, the applicant/owner then may approach the WAPC for confirmation that the condition(s) have been fulfilled.

In approaching the WAPC, the applicant/owner is to provide all necessary information, including proof of reasonable enquiry to the nominated agency/authority or local government.

The condition(s) of this approval, with accompanying advice, are:

CONDITIONS:

1. Satisfactory arrangements being made with Main Roads Western Australia for the full cost of upgrading the intersection of Madora Beach Road and Mandurah Road, including the sections of Madora Beach Road affected by turn lanes required for the intersection upgrade, to the specification of Main Roads Western Australia and to the satisfaction of the Western Australian Planning Commission. (Main Roads Western Australia)
2. Satisfactory arrangements being made with the local government for the full cost of a roundabout at the intersection of Madora Beach Road and the extension of Eleanor Drive. (Local Government)
3. Satisfactory arrangements being made with the local government for the full cost of upgrading and/or construction of Madora Beach Road in the locations as shown on the plan dated 21 September 2015 (attached). (Local Government)
4. A 2.0 metre high acoustic barrier/wall, parallel to Mandurah Road as shown on the plan dated 21 September 2015 (attached) is to be constructed to the specifications of Main Roads Western Australian and to the satisfaction of the Western Australian Planning Commission. (Main Roads Western Australia)
5. Local Development Plan being prepared and approved for the lots shown on the approved plan dated 21 September 2015 (attached) that address the implementation of 'Quiet House Design Packages' in accordance with the recommendations of the Acoustic Assessment - Madora Bay East dated 25 August 2015 (Ref: 18204-2-12045-

03), to the satisfaction of the Western Australian Planning Commission. (Main Roads Western Australia)

6. A notification, pursuant to Section 70A of the *Transfer of Land Act 1893* is to be placed on the certificate(s) of title of the proposed lot(s). Notice of this notification is to be included on the diagram or plan of survey (deposited plan). The notification is to state as follows:

'The lot/s is/are situated in the vicinity of a transport corridor and is currently affected, or may in the future be affected by transport noise.' (Local Government)

7. Engineering drawings and specifications are to be submitted, approved, and subdivisional works undertaken in accordance with the approved plan of subdivision, engineering drawings and specifications, to ensure that those lots not fronting an existing road are provided with frontage to a constructed road(s) connected by a constructed road(s) to the local road system and such road(s) are constructed and drained at the landowner/applicant's cost.

As an alternative, and subject to the agreement of the Local Government the Western Australian Planning Commission (WAPC) is prepared to accept the landowner/applicant paying to the local government the cost of such road works as estimated by the local government and the local government providing formal assurance to the WAPC confirming that the works will be completed within a reasonable period as agreed by the WAPC. (Local Government)

8. Engineering drawings and specifications are to be submitted and approved, and subdivisional works undertaken in accordance with the approved plan of subdivision, engineering drawings and specifications to ensure that:
- street lighting is installed on all new subdivisional roads to the standards of the relevant licensed service provider and/or
 - roads that have been designed to connect with existing or proposed roads abutting the subject land are coordinated so the road reserve location and width connect seamlessly and/or
 - temporary turning areas are provided to those subdivisional roads that are subject to future extension and/or
 - embayment parking is provided within the/abutting the proposed laneway lots;
- to the satisfaction of the Western Australian Planning Commission. (Local Government)

9. Engineering drawings and specifications are to be submitted, approved, and subdivisional works undertaken in accordance with the approved plan of subdivision, engineering drawings and specifications, for the provision of shared paths on at least one side of all local streets through and connecting to the application area in accordance with the endorsed *Madora Bay East Outline Development Plan*. The approved shared paths are to be constructed by the landowner/applicant. (Local Government)

10. All local streets within the subdivision being truncated in accordance with the Western Australian Planning Commission's *Liveable Neighbourhoods* policy. (Local Government)
11. Engineering drawings and specifications are to be submitted, approved, and works undertaken in accordance with the approved engineering drawings, specifications and approved plan of subdivision, for grading and/or stabilisation of the site to ensure that:
 - a) lots can accommodate their intended use; and
 - b) finished ground levels at the boundaries of the lot(s) the subject of this approval match or otherwise coordinate with the existing and/or proposed finished ground levels of the land abutting. (Local Government)
12. Prior to the commencement of subdivisional works, an urban water management plan is to be prepared and approved, in consultation with the Department of Water, consistent with any approved Local Water Management Strategy/Drainage and Water Management Plan. (Local Government)
13. Engineering drawings and specifications are to be submitted and approved, and works undertaken in accordance with the approved engineering drawings and specifications and approved plan of subdivision, for the filling and/or draining of the land, including ensuring that stormwater is contained on-site, or appropriately treated and connected to the local drainage system. Engineering drawings and specifications are to be in accordance with an approved Urban Water Management Plan (UWMP) for the site, or where no UWMP exists, to the satisfaction of the Western Australian Planning Commission. (Local Government)
14. Prior to the commencement of subdivisional works, the landowner/applicant is to provide a pre-works geotechnical report certifying that the land is physically capable of development or advising how the land is to be remediated and compacted to ensure it is capable of development; and

In the event that remediation works are required, the landowner/applicant is to provide a post geotechnical report certifying that all subdivisional works have been carried out in accordance with the pre-works geotechnical report. (Local Government).
15. Measures being taken to ensure the identification and protection of any vegetation on the site worthy of retention that is not impacted by subdivisional works, prior to commencement of subdivisional works. (Local Government).
16. The proposed reserve(s) shown on the approved plan of subdivision being shown on the diagram or plan of survey (deposited plan) as reserve(s) for Recreation and vested in the Crown under Section 152 of the *Planning and Development Act 2005*, such land to be ceded free of cost and without any payment of compensation by the Crown. (Local Government)
17. Arrangements being made for the proposed public open space to be developed by the landowner/applicant to a minimum standard and maintained for two summers through the implementation of an approved landscape plan providing for the development and maintenance of the proposed public open space in accordance with the requirements

of Liveable Neighbourhoods and to the specifications of the local government. (Local Government)

18. Local Development Plan(s) being prepared and approved for lots shown on the plan dated 21 September 2015 (attached) that address the following:

- a) building envelopes;
- b) vehicular access;
- c) fencing;
- d) private open space
- e) location of verge trees; and
- f) variations from the R-Codes;

to the satisfaction of the Western Australian Planning Commission. (Local Government)

19. Uniform fencing being constructed along the boundaries of all of the proposed lots abutting public open space in accordance with the endorsed *Madora Bay East Outline Development Plan*. (Local Government)

20. Arrangements being made to the satisfaction of the Western Australian Planning Commission and to the specification of Western Power for the provision of an underground electricity supply to the lot(s) shown on the approved plan of subdivision. (Western Power)

21. The transfer of land as a Crown reserve free of cost to Western Power for the provision of electricity supply infrastructure. (Western Power)

22. Arrangements being made with the Water Corporation so that provision of a suitable water supply service will be available to the lots shown on the approved plan of subdivision. (Water Corporation)

23. Arrangements being made with the Water Corporation so that provision of a sewerage service will be available to the lots shown on the approved plan of subdivision. (Water Corporation)

ADVICE:

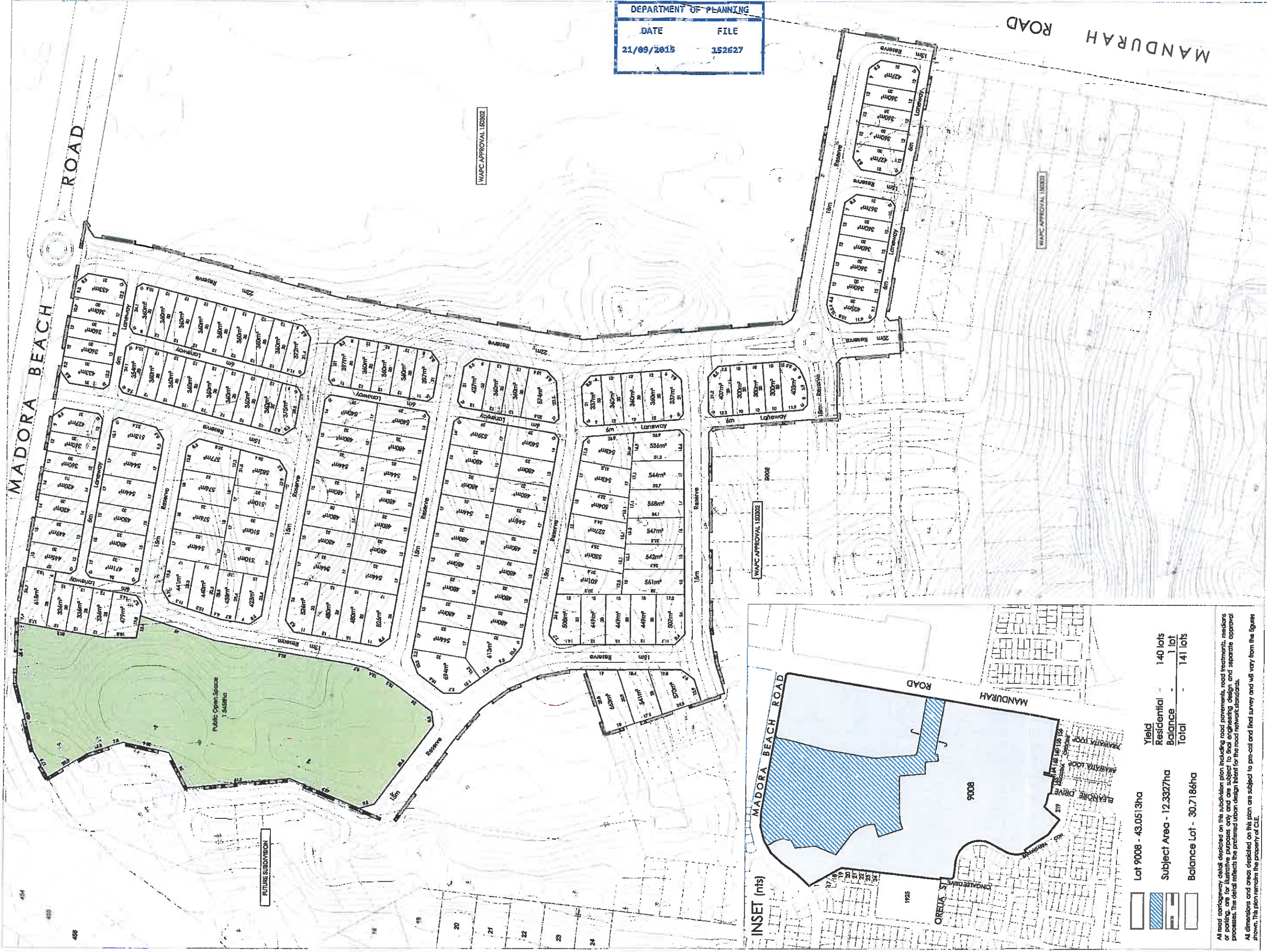
1. With regard to Condition 7, the landowner/applicant is advised that the road reserves, including the constructed carriageways, laneways, truncations, footpaths/dual use paths and car embayments, are to be generally consistent with the approved plan of subdivision.
2. The landowner/applicant is advised that the Department of Environment and Regulation has prepared dust control guidelines for development sites, which, outline the procedures for the preparation of dust management plans. The dust management plans are generally approved, and their implementation overseen, by Local Government. Further information on the guidelines can be obtained from the Department of Environment and Regulation's website: www.der.wa.gov.au under air quality publications.

3. Condition 12 has been imposed in accordance with *Better Urban Water Management Guidelines (WAPC 2008)*. Further guidance on the contents of urban water management plans is provided in *'Urban Water Management Plans: Guidelines for preparing and complying with subdivision conditions' (Department of Water 2008)*.
4. With regard to Condition 15, the landowner/applicant is advised that vegetation identified for protection shall be incorporated into subdivision works plans where reasonably practicable, having regard to the need for ground level modification and installation of services and setback requirements.
5. With regard to Condition 17, the development is to include full earthworks, basic reticulation, grassing of key areas, and pathways that form part of the overall pedestrian and/or cycle network.
6. In regard to Condition 20, Western Power provides only one underground point of electricity supply per freehold lot.
7. In regard to Conditions 22 and 23, the landowner/applicant shall make arrangements with the Water Corporation for the provision of the necessary services. On receipt of a request from the landowner/applicant, a Land Development Agreement under Section 83 of the *Water Services Act 2012* will be prepared by the Water Corporation to document the specific requirements for the proposed subdivision.



Kerrine Blenkinsop
Secretary
Western Australian Planning Commission
22 December 2015

DEPARTMENT OF PLANNING
 DATE: 21/09/2015 FILE: 152627



Lot 9008 - 43.0513ha	Yield Residential	140 lots
Subject Area - 12.3327ha	Balance	1 lot
Balance Lot - 30.7186ha	Total	141 lots

All road contingency detail depicted on this subdivision plan including road pavements, road treatments, medians or parking, are for illustrative purposes only and are subject to final engineering design and separate approval processes. The detail reflects the preferred urban design intent for the road network standards.

All dimensions and areas depicted on this plan, are subject to pre-call and final survey and will vary from the figures shown. This plan remains the property of CLE.

PROPOSED SUBDIVISION
 Lot 9008 Mandurah Road, Modora Bay
 City of Mandurah

plan no: 2046-122D-01
 scale: 1:2000 @ A3
 date: 28.08.2015



This plan is created from the revised data subject to approval, survey & engineering detail. This plan remains the property of CLE @ www.cleplan.com.au



JOB NO: 2016.

SUB JOB:

DATE: 27 JAN 2015

STATUS: APPROVED.

SCAN/DB: ✓ - 105x

CC'S: John Perry + Gary Bradli - H+N Perry

✓ PE 27-1-15 | Mike Del Acetello - Wood + Care.

Neil Bartlett - Fugro.

Howard Mitchell - Epiad

Your Ref :
Enquiries : Brett Pye (Ph (08) 9586 4689)Cle Town Planning
P O Box 796
SUBIACO WA 6904**Approval Subject To Condition(s)
Freehold (Green Title) Subdivision**

Application No : 150302

Planning and Development Act 2005

Applicant	: Cle Town Planning P O Box 796 SUBIACO WA 6904
Owner	: Mr Phillip Richard Perry 71 Aztec Island Retreat MANDURAH WA 6210, Mr John David Perry 23 Cambria Island Retreat HALLS HEAD WA 6210, Mr Brian Henry Perry 4 Sovereign Gardens HALLS HEAD WA 6210
Application Receipt	: 2 July 2014

Lot Number	:
Diagram / Plan	: Plan 400774
Location	:
C/T Volume/Folio	: 2839/538
Street Address	: Lot 9002 Madora Beach Rd, Madora Bay
Local Government	: City of Mandurah

The Western Australian Planning Commission has considered the application referred to and is prepared to endorse a deposited plan in accordance with the plan date-stamped **02 July 2014** once the condition(s) set out have been fulfilled.

This decision is valid for **four years** from the date of this advice, which includes the lodgement of the deposited plan within this period.

The deposited plan for this approval and all required written advice confirming that the requirement(s) outlined in the condition(s) have been fulfilled must be submitted by **23 January 2019** or this approval no longer will remain valid.

Reconsideration - 28 days

Under section 151(1) of the *Planning and Development Act 2005*, the applicant/owner may, within 28 days from the date of this decision, make a written request to the WAPC to reconsider any condition(s) imposed in its decision. One of the matters to which the WAPC will have regard in reconsideration of its decision is whether there is compelling evidence by way of additional information or justification from the applicant/owner to warrant a reconsideration of the decision. A request for reconsideration is to be submitted to the WAPC on a Form 3A with appropriate fees. An application for reconsideration may be submitted to the WAPC prior to submission of an application for review. Form 3A and a schedule of fees are available on the WAPC website: <http://www.planning.wa.gov.au>

Right to apply for a review - 28 days

Should the applicant/owner be aggrieved by this decision, there is a right to apply for a review under Part 14 of the *Planning and Development Act 2005*. The application for review must be submitted in accordance with part 2 of the *State Administrative Tribunal Rules 2004* and should be lodged within 28 days of the date of this decision to: the State Administrative Tribunal, 12 St Georges Terrace, Perth, WA 6000. It is recommended that you contact the tribunal for further details: telephone 9219 3111 or go to its website: <http://www.sat.justice.wa.gov.au>

Deposited plan

The deposited plan is to be submitted to the Western Australian Land Information Authority (Landgate) for certification. Once certified, Landgate will forward it to the WAPC. In addition, the applicant/owner is responsible for submission of a Form 1C with appropriate fees to the WAPC requesting endorsement of the deposited plan. A copy of the deposited plan with confirmation of submission to Landgate is to be submitted with all required written advice confirming compliance with any condition(s) from the nominated agency/authority or local government. Form 1C and a schedule of fees are available on the WAPC website: <http://www.planning.wa.gov.au>

Condition(s)

The WAPC is prepared to endorse a deposited plan in accordance with the plan submitted once the condition(s) set out have been fulfilled.

The condition(s) of this approval are to be fulfilled to the satisfaction of the WAPC.

The condition(s) must be fulfilled before submission of a copy of the deposited plan for endorsement.

The agency/authority or local government noted in brackets at the end of the condition(s) identify the body responsible for providing written advice confirming that the WAPC's requirement(s) outlined in the condition(s) have been fulfilled. The written advice of the agency/authority or local government is to be obtained by the applicant/owner. When the written advice of each identified agency/authority or local government has been obtained, it should be submitted to the WAPC with a Form 1C and appropriate fees and a copy of the deposited plan.

If there is no agency/authority or local government noted in brackets at the end of the condition(s), a written request for confirmation that the requirement(s) outlined in the condition(s) have been fulfilled should be submitted to the WAPC, prior to lodgement of the deposited plan for endorsement.

Prior to the commencement of any subdivision works or the implementation of any condition(s) in any other way, the applicant/owner is to liaise with the nominated agency/authority or local government on the requirement(s) it considers necessary to fulfil the condition(s).

The applicant/owner is to make reasonable enquiry to the nominated agency/authority or local government to obtain confirmation that the requirement(s) of the condition(s) have been fulfilled. This may include the provision of supplementary information. In the event that the nominated agency/authority or local government will not provide its written confirmation following reasonable enquiry, the applicant/owner then may approach the WAPC for confirmation that the condition(s) have been fulfilled.

In approaching the WAPC, the applicant/owner is to provide all necessary information, including proof of reasonable enquiry to the nominated agency/authority or local government.

The condition(s) of this approval, with accompanying advice, are:

CONDITIONS:

1. The plan of subdivision is to be modified so that the portion of the site adjacent to the southern boundary of the superlot site is shown as a single lot as marked 'A' on the approved plan dated 2 July 2014 (attached) to the satisfaction of the Western Australian Planning Commission.
2. The plan of subdivision is to be modified so that the portion of the site adjacent to the southern boundary of the superlot site is shown as a single lot as marked 'B' on the approved plan dated 2 July 2014 (attached) to the satisfaction of the Western Australian Planning Commission.
3. Satisfactory arrangements being made with Main Roads Western Australia for the full cost of upgrading the intersection of Madora Beach Road and Mandurah Road, including the sections of Madora Beach Road affected by turn lanes required for the intersection upgrade, to the specification of Main Roads Western Australia and to the satisfaction of Western Australian Planning Commission. (Main Roads Western Australia)
4. Satisfactory arrangements being made with the local government for the full cost of a round-about at the intersection of Madora Beach Road and the extension of Eleanor Drive. (Local Government)
5. A 2.0 metre high acoustic barrier/wall, parallel to Mandurah Road as shown on the plan dated 2 July 2014 (attached), to be constructed in accordance with the *Acoustic Assessment - Madora Bay East* dated 25 August 2014 (Ref: 18204-2-12045-03), to the



satisfaction of the Western Australian Planning Commission. (Main Roads Western Australia)

6. Detailed Area Plans being prepared and approved for lots shown on the approved plan dated 2 July 2014 (attached) that address the following:
 - a) the implementation of 'Quiet House Design Packages' in accordance with the recommendation(s) of the Acoustic Assessment - Madora Bay East dated 25 August 2014 (Ref: 18204-2-12045-03);to the satisfaction of the Western Australian Planning Commission. (Main Roads Western Australia)

7. A notification, pursuant to Section 70A of the Transfer of Land Act 1893, is to be placed on the certificate(s) of title of the proposed lot(s). Notice of this notification is to be included on the diagram or plan of survey (deposited plan). The notification is to state as follows:

"The lot/s are situated in the vicinity of a transport corridor and is currently affected, or may in the future be affected by transport noise."

8. Engineering drawings and specifications are to be submitted, approved, and subdivisional works undertaken in accordance with the approved plan of subdivision, engineering drawings and specifications, to ensure that those lots not fronting an existing road are provided with frontage to a constructed road(s) connected by a constructed road(s) to the local road system and such road(s) are constructed and drained at the landowner/applicant's cost.

As an alternative, and subject to the agreement of the Local Government the Western Australian Planning Commission (WAPC) is prepared to accept the landowner/applicant paying to the local government the cost of such road works as estimated by the local government and the local government providing formal assurance to the WAPC confirming that the works will be completed within a reasonable period as agreed by the WAPC. (Local Government)

9. Engineering drawings and specifications are to be submitted and approved, and subdivisional works undertaken in accordance with the approved plan of subdivision, engineering drawings and specifications to ensure that:
 - a) street lighting is installed on all new subdivisional roads to the standards of the relevant licensed service provider and/or
 - b) roads that have been designed to connect with existing or proposed roads abutting the subject land are coordinated so the road reserve location and width connect seamlessly and/or
 - c) temporary turning areas are provided to those subdivisional roads that are subject to future extension and/or
 - d) embayment parking is provided abutting the proposed laneway lots.to the satisfaction of the Western Australian Planning Commission. (Local Government)

10. Engineering drawings and specifications are to be submitted, approved, and subdivisional works undertaken in accordance with the approved plan of subdivision, engineering drawings and specifications, for the provision of shared paths through and connecting to the application area in accordance with the approved *Madora Bay East Outline Development Plan*. The approved shared paths are to be constructed by the landowner/applicant. (Local Government)
11. All local streets within the subdivision being truncated in accordance with the Western Australian Planning Commission's *Liveable Neighbourhoods* policy. (Local Government)
12. Engineering drawings and specifications are to be submitted, approved, and works undertaken in accordance with the approved engineering drawings, specifications and approved plan of subdivision, for grading and/or stabilisation of the site to ensure that:
 - a) lots can accommodate their intended use; and
 - b) finished ground levels at the boundaries of the lot(s) the subject of this approval match or otherwise coordinate with the existing and/or proposed finished ground levels of the land abutting. (Local Government)
13. Prior to the commencement of subdivisional works, an urban water management plan is to be prepared and approved, in consultation with the Department of Water, consistent with any approved Local Water Management Strategy/Drainage and Water Management Plan. (Local Government)
14. Engineering drawings and specifications are to be submitted and approved, and works undertaken in accordance with the approved engineering drawings and specifications and approved plan of subdivision, for the filling and/or draining of the land, including ensuring that stormwater is contained on-site, or appropriately treated and connected to the local drainage system. Engineering drawings and specifications are to be in accordance with an approved Urban Water Management Plan (UWMP) for the site, or where no UWMP exists, to the satisfaction of the Western Australian Planning Commission. (Local Government)
15. Prior to the commencement of subdivisional works, the landowner/applicant is to provide a pre-works geotechnical report certifying that the land is physically capable of development or advising how the land is to be remediated and compacted to ensure it is capable of development; and

In the event that remediation works are required, the landowner/applicant is to provide a post geotechnical report certifying that all subdivisional works have been carried out in accordance with the pre-works geotechnical report. (Local Government).
16. Drainage easements and reserves as may be required by the local government for drainage infrastructure being shown on the diagram or plan of survey (deposited plan) as such, granted free of cost, and vested in that local government under Sections 152 and 167 of the *Planning and Development Act 2005*. (Local Government)

17. Measures being taken to ensure the identification and protection of any vegetation on the site worthy of retention that is not impacted by subdivisional works, prior to commencement of subdivisional works. (Local Government).
18. The proposed reserve(s) shown on the approved plan of subdivision being shown on the diagram or plan of survey (deposited plan) as reserve(s) for Local Recreation and vested in the Crown under Section 152 of the *Planning and Development Act 2005*, such land to be ceded free of cost and without any payment of compensation by the Crown. (Local Government)
19. Arrangements being made for the proposed public open space to be developed by the landowner/applicant to a minimum standard and maintained for two summers through the implementation of an approved landscape plan providing for the development and maintenance of the proposed public open space in accordance with the requirements of Liveable Neighbourhoods and to the specifications of the local government. (Local Government)
20. Detailed Area Plans being prepared and approved for lots shown on the plan dated 2 July 2014 (attached) that address the following:
 - a) building envelopes;
 - b) vehicular access;
 - c) fencing;
 - d) private open space;
 - e) variations from the R-codes; and
 - f) mechanisms for the variation of Detailed Area Plansto the satisfaction of the Western Australian Planning Commission. (Local Government)
21. Uniform fencing being constructed along the boundaries of all the proposed lots abutting public open space. (Local Government)
22. A notification, pursuant to Section 165 of the *Planning and Development Act 2005* is to be placed on the certificates of title of the proposed lot(s) advising of the existence of a hazard or other factor. Notice of this notification is to be included on the diagram or plan of survey (deposited plan). The notification is to state as follows:

'This lot is in close proximity to known mosquito breeding areas. The predominant mosquito species is known to carry viruses and other diseases.' (Western Australian Planning Commission)
23. Arrangements being made to the satisfaction of the Western Australian Planning Commission and to the specification of Western Power for the provision of an underground electricity supply to the lot(s) shown on the approved plan of subdivision. (Western Power)
24. The transfer of land as a Crown reserve free of cost to Western Power for the provision of electricity supply infrastructure. (Western Power)

25. Arrangements being made with the Water Corporation so that provision of a suitable water supply service will be available to the lots shown on the approved plan of subdivision. (Water Corporation)
26. Arrangements being made with the Water Corporation so that provision of a sewerage service will be available to the lots shown on the approved plan of subdivision. (Water Corporation)

ADVICE:

1. With regard to conditions 5 and 6, the landowner/applicant is advised to liaise with the City of Mandurah and Main Roads WA regarding the implementation of the condition.
2. With regard to Condition 8, the landowner/applicant is advised that the road reserves, including the constructed carriageways, laneways, truncations, footpaths/dual use paths and car embayments, are to be generally consistent with the approved plan of subdivision.
3. The landowner/applicant is advised that the Department of Environment and Regulation has prepared dust control guidelines for development sites, which, outline the procedures for the preparation of dust management plans. The dust management plans are generally approved, and their implementation overseen, by Local Government. Further information on the guidelines can be obtained from the Department of Environment and Regulation's website: www.der.wa.gov.au under air quality publications.
4. Condition 13 has been imposed in accordance with *Better Urban Water Management Guidelines (WAPC 2008)*. Further guidance on the contents of urban water management plans is provided in *'Urban Water Management Plans: Guidelines for preparing and complying with subdivision conditions'* (Department of Water 2008).
5. With regard to condition 17, the landowner/applicant is advised that vegetation identified shall be incorporated into subdivision works plans where reasonably practicable, having regard to the need for ground level modification and installation of services and setback requirements.
6. With regard to condition 19, the landowner/applicant is advised that the development of the dune public open space may include portion of revegetation as part of dune stabilisation in accordance with notation 11 on the approved *Madora Bay East Outline Development Plan*.
7. With regard to Condition 19, the development is to include full earthworks, basic reticulation, grassing of key areas, and pathways that form part of the overall pedestrian and/or cycle network.
8. In regard to Condition 23 Western Power provides only one underground point of electricity supply per freehold lot.
9. In regard to Conditions 25 and 26 the landowner/applicant shall make arrangements with the Water Corporation for the provision of the necessary services. On receipt of a



request from the landowner/applicant, a Land Development Agreement under Section 83 of the *Water Services Act 2012* will be prepared by the Water Corporation to document the specific requirements for the proposed subdivision.

10. The landowner/applicant is advised to liaise with the City of Mandurah regarding their subdivision management procedures which will include fauna inspections. Where a conflict between the City's requirements and existing licences obtained from the Department of Environmental Regulation (DER) arise, the landowner/applicant is advised to comply with the DER licence.

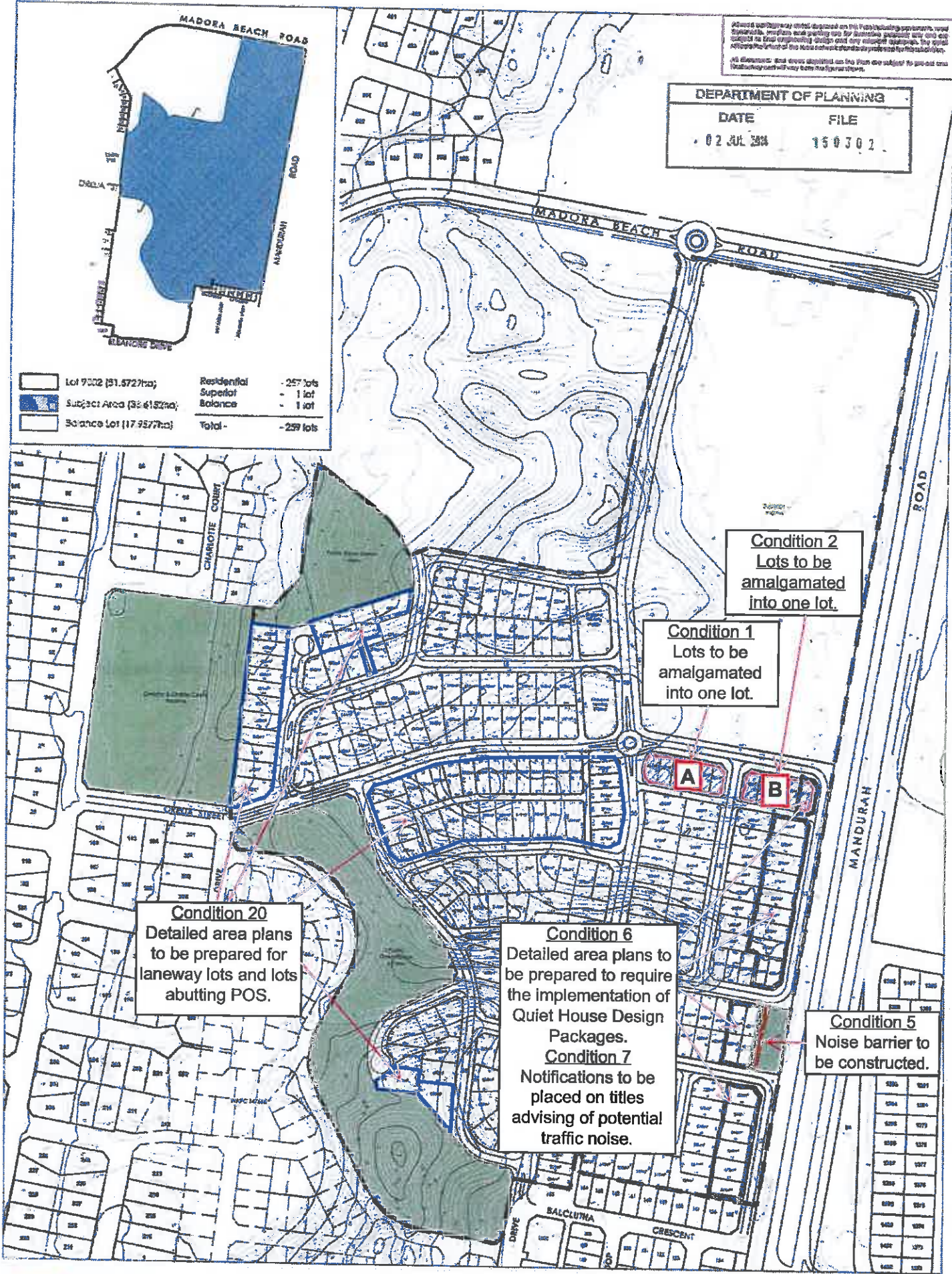
A handwritten signature in black ink, appearing to read "T. Hillyard".

Tim Hillyard
Secretary
Western Australian Planning Commission
23 January 2015

Advised that the proposed subdivision is subject to the provisions of the Planning and Development Act 2005 and the Planning and Development Regulations 2006. The applicant is advised that the proposed subdivision is subject to the provisions of the Planning and Development Act 2005 and the Planning and Development Regulations 2006. The applicant is advised that the proposed subdivision is subject to the provisions of the Planning and Development Act 2005 and the Planning and Development Regulations 2006.

DEPARTMENT OF PLANNING
 DATE 02 JUL 2014
 FILE 150302

Lot 9002 (31.5727ha)	Residential Superior	257 lots
Subject Area (33.4152ha)	Balance	1 lot
Balance Lot (17.9577ha)	Total	258 lots



Condition 2
 Lots to be amalgamated into one lot.

Condition 1
 Lots to be amalgamated into one lot.

Condition 20
 Detailed area plans to be prepared for laneway lots and lots abutting POS.

Condition 6
 Detailed area plans to be prepared to require the implementation of Quiet House Design Packages.
Condition 7
 Notifications to be placed on titles advising of potential traffic noise.

Condition 5
 Noise barrier to be constructed.



PROPOSED SUBDIVISION
 Lot 9002 Mandurah Road, Madora Bay East
 City of Mandurah



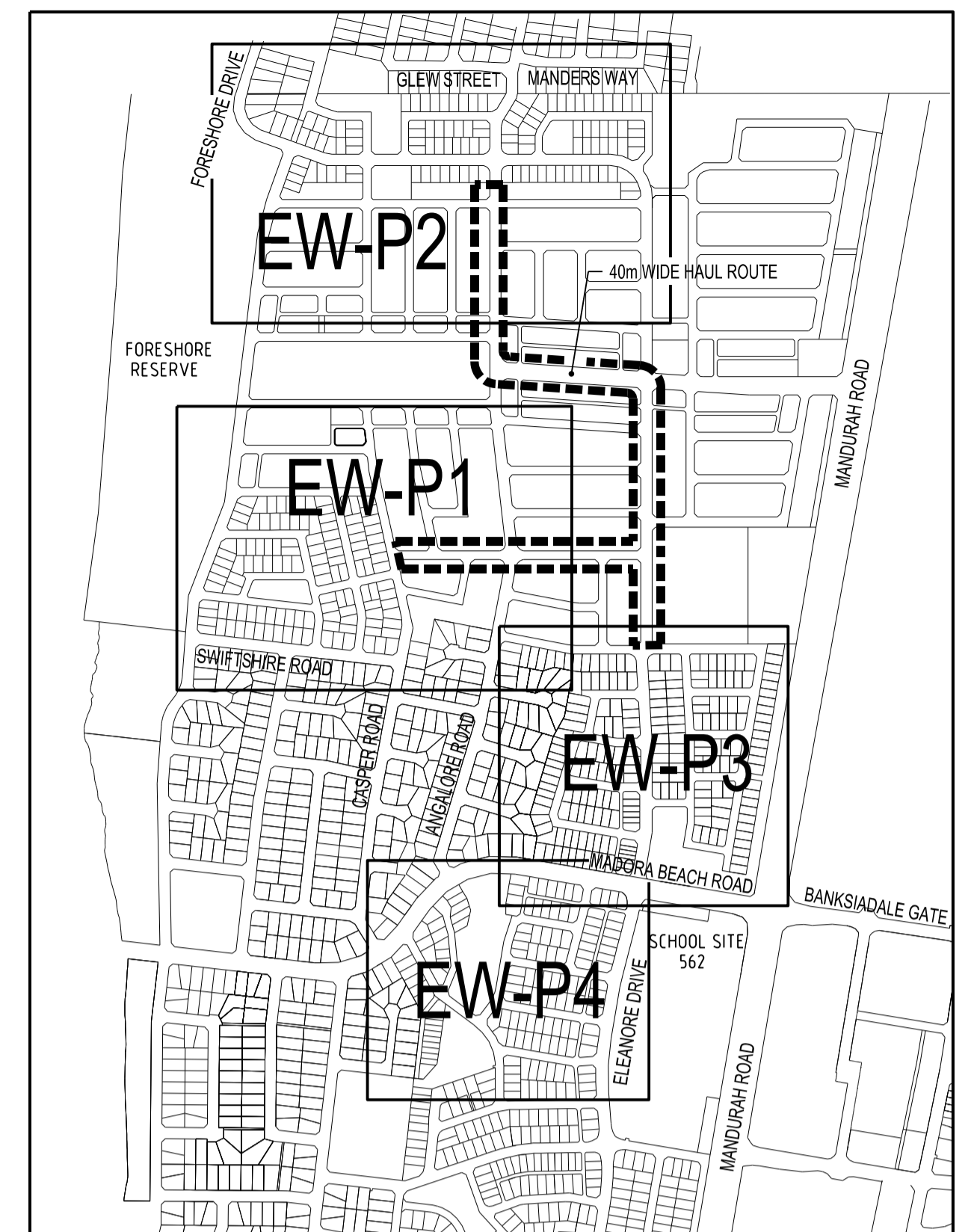
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 scale: 1:3000@A3, 1:1500@A1
 date: 26-06-2014



This plan is subject to the provisions of the Planning and Development Act 2005 and the Planning and Development Regulations 2006. It is not to be used for any other purpose.

APPENDIX 3

**DETAILED EARTHWORKS DRAWINGS
(Source: Wood & Grieve Engineers, 2018)**



LOCALITY PLAN
SCALE 1:10000

- NOTES :
- REFER TO DRG 22577-1/CL-1-100-EW-P4 FOR STANDARD NOTES / DETAILS & LEGEND
 - ALL DESIGN BATTERS FOR THIS DRAWING ARE 1 IN 4 UNLESS OTHERWISE NOTED.

PLAN
SCALE 1:1000

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A	ORIGINAL ISSUE	AIN	AIN	MPAL	MJD	31/01/2018

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PCG94 AHD
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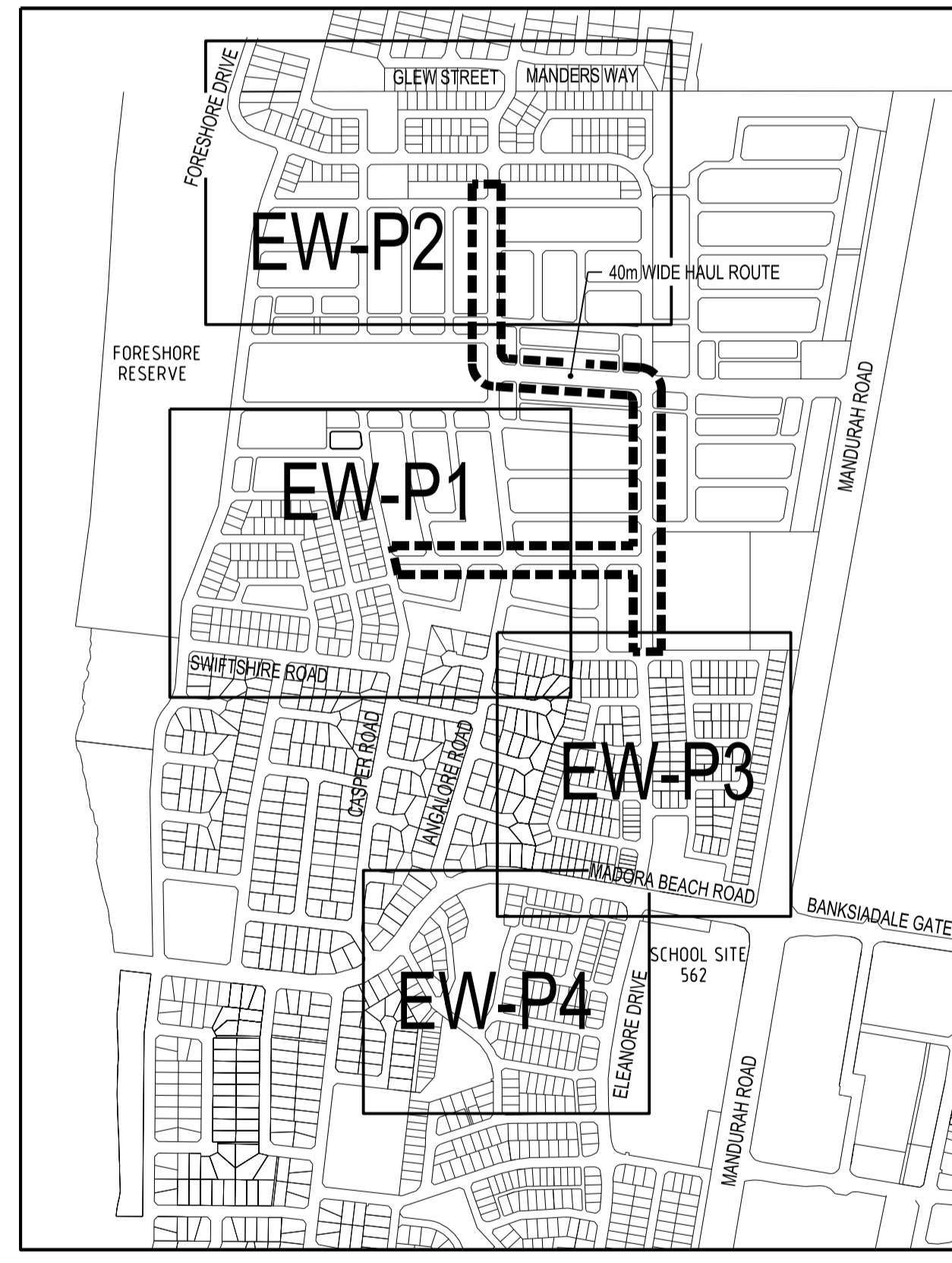
CLIENT
MADORA BAY PARTNERSHIP

PROJECT
MADORA BAY NORTH - STAGE 1

TITLE
EARTHWORKS PLAN - SHEET 1



22577-1	CI-1-100-EW-P1	A
PROJECT No.	DRAWING No.	REVISION



LOCALITY PLAN
SCALE 1:10000

- NOTES:
- REFER TO DRG 22577-1/CL-1-100-EW-P4 FOR STANDARD NOTES / DETAILS & LEGEND
 - ALL DESIGN BATTERS FOR THIS DRAWING ARE 1 IN 4 UNLESS OTHERWISE NOTED.



PLAN
SCALE 1:1000

REV	DESCRIPTION	DRW	DGN	VER	APPROVED	DATE
A	ORIGINAL ISSUE	AIN	AIN	MPAL	MJD	31/01/2018

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PCG94 AHD
WAPC No. COORDINATES DATUM

CLIENT
MADORA BAY PARTNERSHIP

PROJECT
MADORA BAY NORTH - STAGE 1

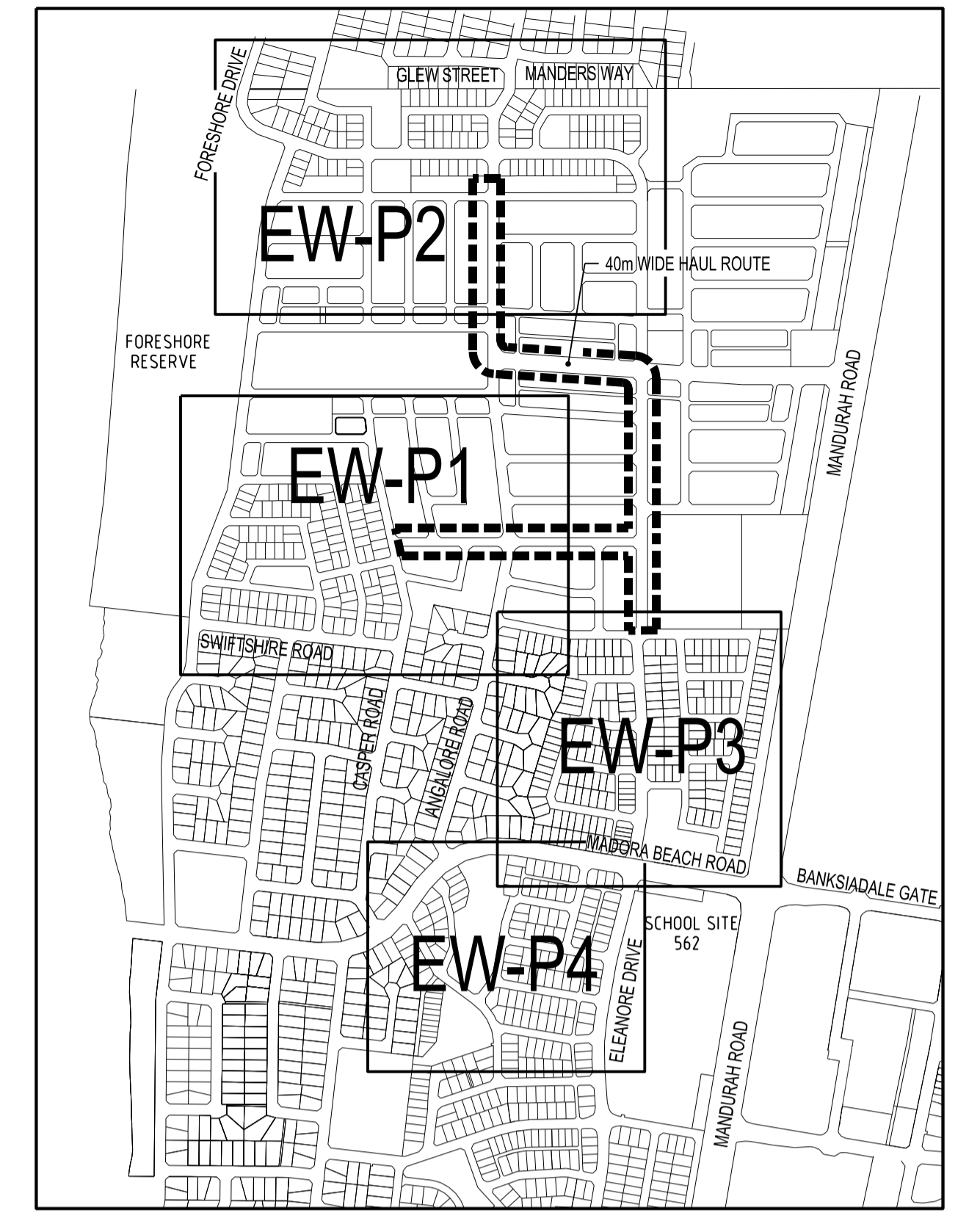
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PROJECT No.	DRAWING No.	REVISION



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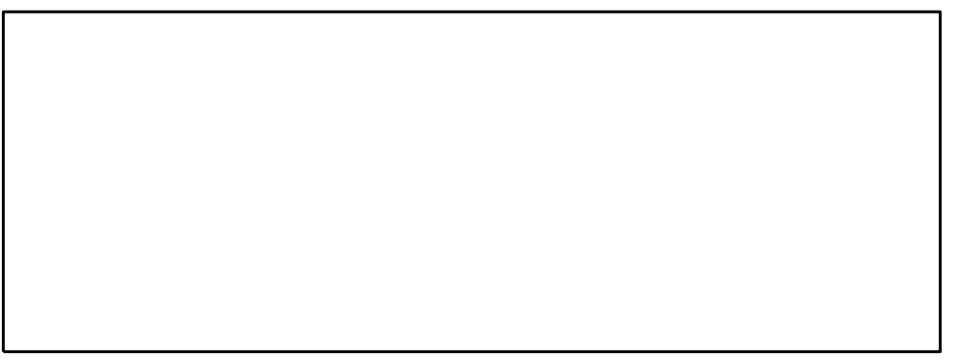


LOCALITY PLAN
SCALE 1:10000

- NOTES:
1. REFER TO DRG 22577-1/CL-1-100-EW-P4 FOR STANDARD NOTES / DETAILS & LEGEND
 2. ALL DESIGN BATTERS FOR THIS DRAWING ARE 1 IN 4 UNLESS OTHERWISE NOTED.



REV	DESCRIPTION	DRW	DGN	VER	APPROVED	DATE
A	ORIGINAL ISSUE	AIN	AIN	MPAL	MJD	31/01/2018



0 5 10 20 50
A1 @ 1:1000 (A3 @ 1:2000)

WAPC No. PCG94 AHD
COORDINATES DATUM

CLIENT
MADORA BAY PARTNERSHIP

PROJECT
MADORA BAY NORTH - STAGE 1

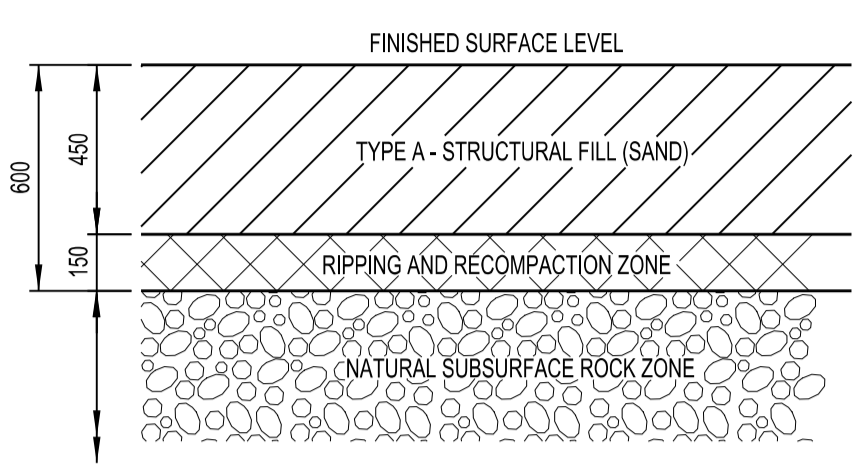
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EARTHWORKS PLAN - SHEET 3



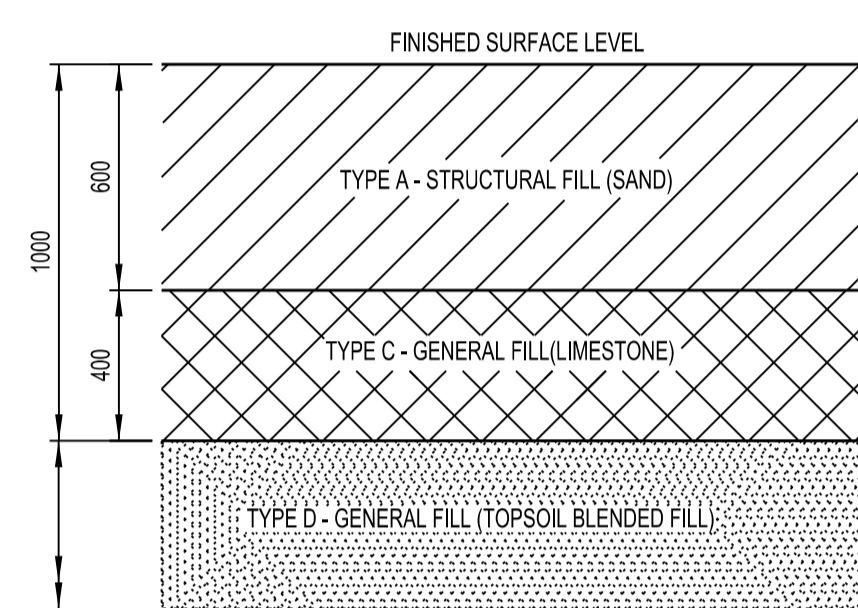
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PROJECT No.	DRAWING No.	REVISION



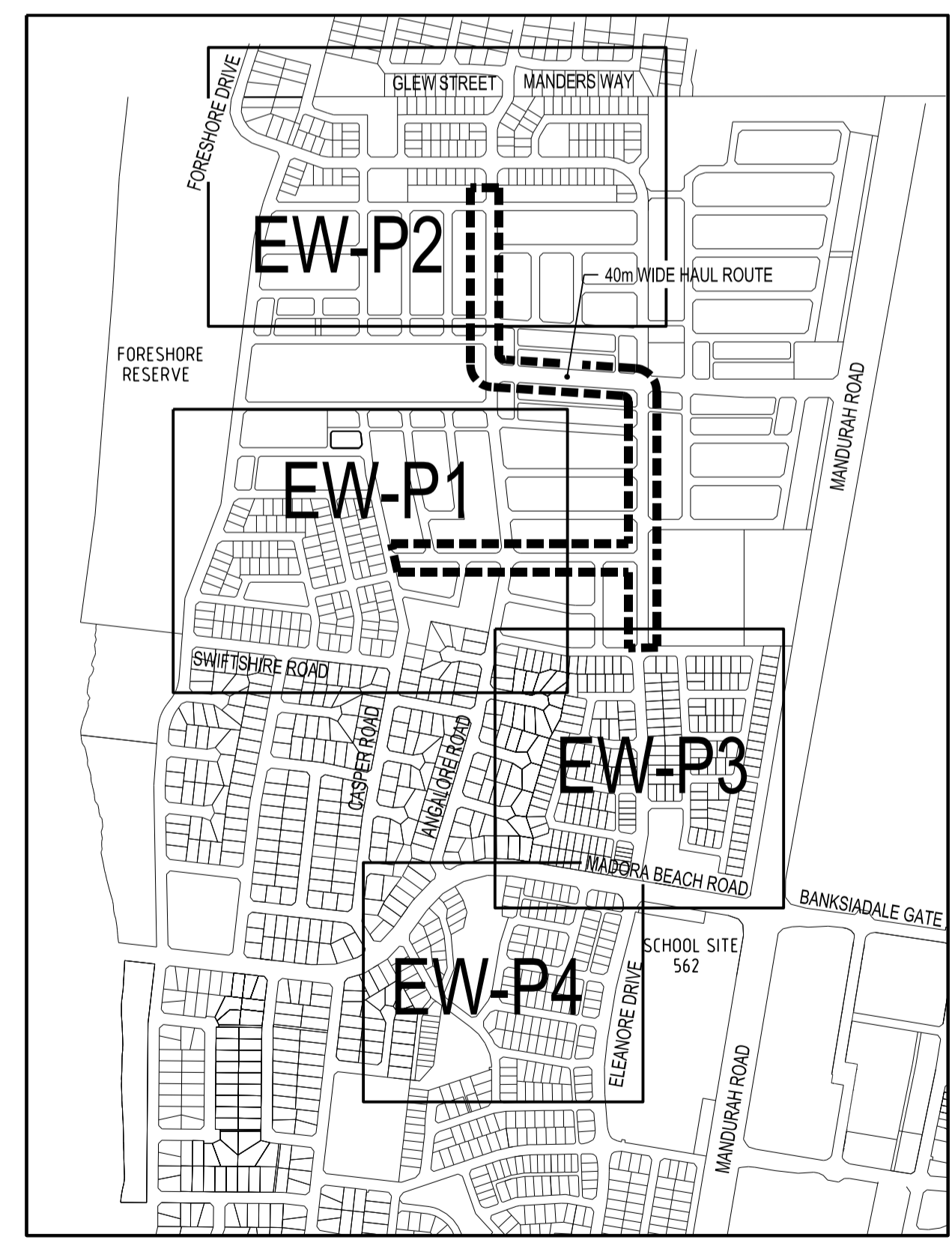
PLAN
SCALE 1:1000



TYPICAL EARTHWORKS PROFILE IN CUT
SCALE 1:20



TYPICAL EARTHWORKS PROFILE IN FILL
SCALE 1:20

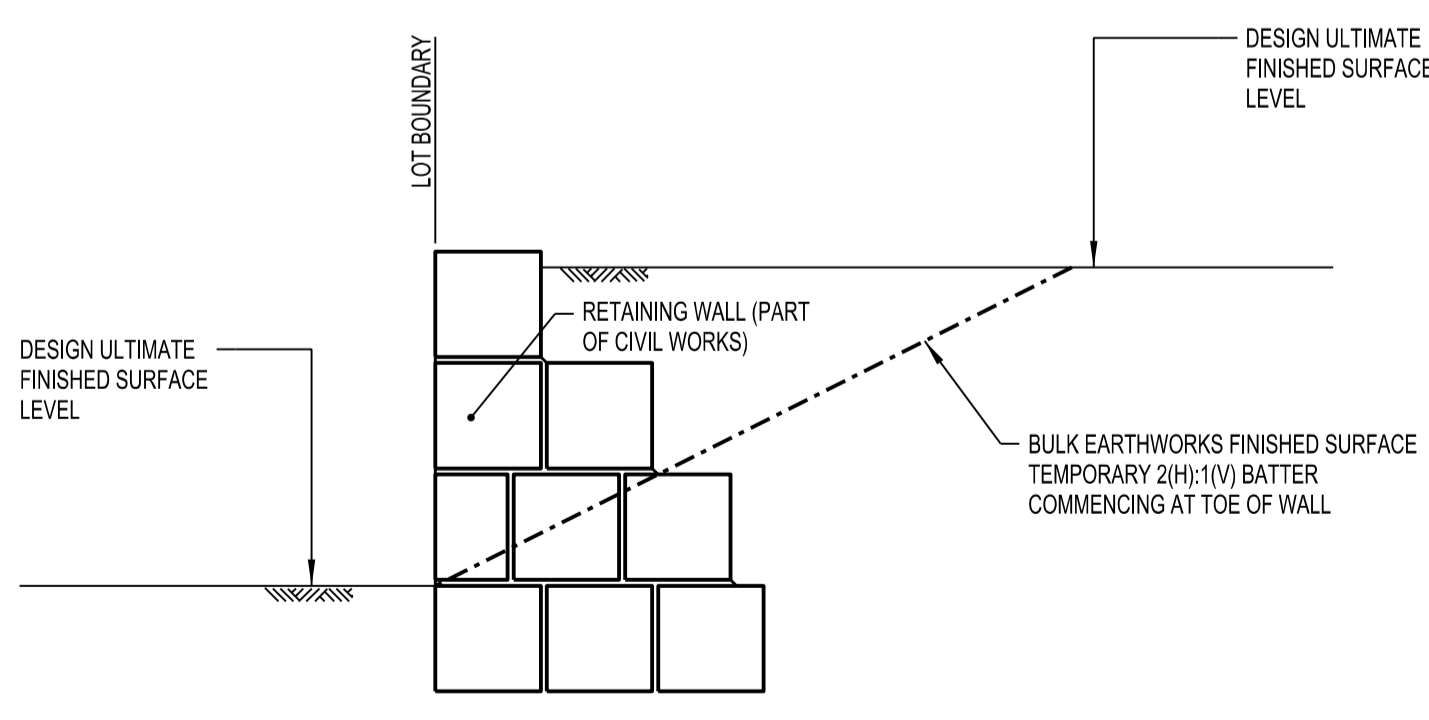


LOCALITY PLAN
SCALE 1:10000

- NOTES**
- GENERAL
- LEVELS ARE REDUCED FROM A.H.D.
 - THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE DRAWING SET AND THE SPECIFICATION.
 - DESIGN LEVELS SHOWN ARE THE FINISHED SURFACE.
 - EXISTING LEVELS AND CONTOURS INDICATED ARE REFLECTIVE OF THE BULK EARTHWORKS DESIGN.
- CLEARING AND TOPSOIL**
- REMOVE AND DISPOSE OFFSITE ALL RUBBISH, FENCING AND MISCELLANEOUS MATTER WITHIN THE EARTHWORKS BOUNDARY, UNLESS OTHERWISE NOTED.
 - PRIOR TO CLEARING, REFER TO TREE PROTECTION AND FAUNA TRAPPING REQUIREMENTS IN SECTION 6 OF THE SPECIFICATION.
 - CLEAR EXISTING VEGETATION WITHIN THE EARTHWORKS BOUNDARY AND DISPOSE OFF SITE, UNLESS OTHERWISE NOTED.
 - CONTRACTOR SHALL STRIP TOPSOIL FROM THE WORKS AREA AND STOCKPILE WITHIN THE EARTHWORKS BOUNDARY FOR LATER RE-Spread. CONTRACTOR SHALL ALLOW TO RELOCATE AND MANAGE TOPSOIL STOCKPILES WITHIN THE EARTHWORKS BOUNDARY, AS REQUIRED TO COMPLETE THE WORKS.
 - FOLLOWING COMPLETION OF EARTHWORKS, TOPSOIL SHALL BE RESPIRED TO A THICKNESS OF 75MM AS FOLLOWS:
 - ALL DISTURBED AREAS, INCLUDING BUT NOT LIMITED TO LOTS, BATTERS, VERGES.
 - ANY EXCESS TOPSOIL MUST BE MANAGED ONSITE, IN ACCORDANCE WITH SECTION 6 OF THE SPECIFICATION. EXCESS TOPSOIL SCREENING AND BLENDING; TOPSOIL SHALL NOT BE DISPOSED OFFSITE.
- EARTHWORKS**
- NO ACCESS IS PERMITTED BEYOND THE EXTENT OF EARTHWORKS BOUNDARY. THE CONTRACTOR SHALL LIMIT MOVEMENT OF MANPOWER TO THE MINIMUM AREA NECESSARY AND PROTECT ALL VEGETATION ONSITE, UNLESS OTHERWISE NOTED.
 - PRIOR TO COMMENCEMENT OF WORKS, THE CONTRACTOR SHALL ERECT 1.8M HIGH DUST FENCE (SHADE CLOTH ON STAR PICKETS WITH 3 TENSION WIRES) ALONG THE FULL EXTENT OF EARTHWORKS BOUNDARY. INSTALL GATES AS REQUIRED. FENCING SHALL BE MAINTAINED FOR THE DURATION OF THE CONTRACT AND REMOVED UPON COMPLETION OF THE WORKS.
 - CONTRACTOR SHALL ALLOW TO CUT TO FILL THE SITE AS SPECIFIED.
 - WHERE PROPOSED LOTS FACE THE ROAD, CONTRACTOR TO GRADE TO A MAXIMUM OF 1 IN 6 FROM THE VERGE TO DESIGN PAD LEVEL OF THE LOT.
 - FOR DESIGN DETAIL OF EARTHWORKS WITHIN ROAD RESERVES, REFER TO THE LONGITUDINAL DRAWINGS.
 - FINISHED EARTHWORKS PROFILES SHALL BE IN ACCORDANCE WITH THE TYPICAL PROFILE DETAILS.
 - THE TEMPORARY TREATMENT BETWEEN ADJACENT LOTS SHALL BE AS PER THE 'TYPICAL FUTURE RETAINING WALL DETAIL' ON THIS DRAWING.

- DUST CONTROL**
- THE CONTRACTOR SHALL ALLOW DUST CONTROL MEASURES AS SPECIFIED.
- STABILISATION**
- ALL DISTURBED AREAS MUST BE STABILISED BY HYDROMULCH WITH SEED, GREEN DYE AND FERTILISER.
- SAFETY SIGNS**
- SAFETY SIGNS SHALL BE ERECTED AT APPROPRIATE LOCATIONS THROUGHOUT THE SITE. UNAUTHORISED ENTRY IS NOT PERMITTED.
- EXISTING RESIDENTS**
- THE CONTRACTOR SHALL NOTIFY ALL EXISTING RESIDENTS OF THE INTENDED WORKS AND PROVIDE THE APPROPRIATE CONTACT DETAILS.
 - THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE SUPERINTENDENT OF DUST AND/OR CONSTRUCTION COMPLAINTS BY THE RESIDENTS.
 - THE CONTRACTOR SHALL NOT INTERFERE WITH EXISTING PROPERTIES WITHOUT THE OWNERS WRITTEN PERMISSION.
 - DISTURBANCE TO EXISTING VERGE TREATMENTS SHALL BE RECTIFIED AT THE CONTRACTORS EXPENSE.
- GEOTECHNICAL SUPERVISION AND SITE CLASSIFICATION**
- THE CONTRACTOR SHALL DIRECTLY ENGAGE A SUITABLY QUALIFIED GEOTECHNICAL CONSULTANT TO UNDERTAKE SITE SUPERVISION DURING CONSTRUCTION ACTIVITIES AND UPON COMPLETION OF THE WORKS, PROVIDE SITE CLASSIFICATION. ALL COSTS SHALL BE INCLUDED IN CONTRACTORS LUMP SUM TENDER VALUE.

- LEGEND**
- EXTENT OF EARTHWORKS BOUNDARY
 - NO ACCESS PERMITTED BEYOND
 - EXISTING CLEARED CORRIDOR
 - 10.0 --- DESIGN CONTOURS
 - 10.0 --- EXISTING CONTOURS
 - 18.52 --- PROPOSED TOP OF PAD LEVEL
 - 18.52 --- FUTURE TOP OF PAD LEVEL
 - 21.66 --- EXISTING PAD LEVELS
 - FUTURE RETAINING WALL
 - EXISTING RETAINING WALL
 - EXISTING TREES TO BE MAINTAINED AND PROTECTED



TYPICAL FUTURE RETAINING WALL DETAIL
SCALE 1:25

REV	DESCRIPTION	DRW	DGN	VER	APPROVED	DATE
A	ORIGINAL ISSUE					31/01/2018

AIN	AIN	MPAL	MJD

0 5 10 20 50
A1 @ 1:1000 (A3 @ 1:2000)

PCG94 AHD
WAPC No. COORDINATES DATUM

CLIENT
MADORA BAY PARTNERSHIP

PROJECT
MADORA BAY NORTH - STAGE 1

TITLE
EARTHWORKS PLAN - SHEET 4



22577-1	CI-1-100-EW-P4	A
PROJECT No.	DRAWING No.	REVISION

APPENDIX 4

**LEVEL 1 FLORA AND FAUNA ASSESSMENT
(Source: Ecoscape (Australia) Pty Ltd., 2011)**

Lot 100 Mandurah Road – Flora and Fauna Assessments

Madora Bay Partnership



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Lot 100 Mandurah Road – Flora and Fauna Assessments

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acknowledgements

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summary

The Madora Bay Partnership is intending to develop Lot 100 Mandurah Road, Madora Bay, requiring the clearing of native vegetation. Ecoscape was commissioned by the Madora Bay Partnership to conduct a Level 1 flora and vegetation and a Level 1 fauna assessment of Lot 100 Mandurah Road, Madora Bay to assist in obtaining environmental approvals for future development of the area.

The results of the desktop assessment show that:

- there is no known risk of Acid Sulfate Soil occurring within three metres of the natural soil surface
- there are no contaminated sites known from the study area
- there are no wetlands present within the study area and none nearby that may be influenced by the development of the site
- the site is not included in a Public Drinking Water Source Area; the groundwater depth varies from 4-22 m below the surface
- the study area contains two mapped vegetation complexes which are both above the 10% threshold for clearing vegetation within the Perth Metropolitan Area
- one Threatened Ecological Community (TEC) and three Priority Ecological Communities (PECs) are known within a 10 km search radius of the study area, however there are no TECs or PECs within the study area
- the study area does not fall within an environmentally sensitive area
- a Bush Forever site (395, Pagononi Swamp and adjacent bushland) occurs to the northeast of the study area
- two Threatened Flora species and 15 Priority Flora species were identified by DEC database searches within a 10 km radius of the study area. An additional six Threatened Flora species were identified by the *Protected Matters Search Tool*
- nineteen conservation significant fauna species were identified by DEC database searches. An additional 17 species were identified by the *Protected Matters Search Tool*
- previous targeted surveys have identified the Graceful Sun Moth (*Endangered*) from the study area, and Carnaby's Black Cockatoo (*Endangered*) and Forest Red-tailed Black Cockatoo (*Vulnerable*) are known from the vicinity
- there are records of the Black-striped Snake (DEC P3) from within the study area, which is at the southern limit of the species range
- results of the online heritage database searches revealed that the study area contains one 'Other Heritage Place', listed as 'Madora Bay Foreshore Reserve-Bush Tucker Area (Site ID 20780).

The results of the field assessment have shown that:

- there are eight vegetation types within the study area, as well as completely degraded pasture and bare sand.
- the vegetation condition ranged from 'Good' to 'Completely degraded', with 77.6% being rated as either 'Degraded' or 'Completely degraded'
- analysis of floristic community types infers the potential presence of up to three PECs within the study area, however only SCP29a and SCP29b are likely to be considered as extant communities
- there were 99 vascular plant taxa recorded, five of which could not be identified to species level
- no Threatened Flora were found within the study area and Two Priority-listed flora (*Beyeria cinerea* subsp. *cinerea* and *Conostylis pauciflora* subsp. *pauciflora*) were recorded
- the record of *Calandrinia* sp. Two Rocks (K. Richardson 211) represents a minor southern range extension
- Twenty nine introduced flora species were recorded within the study area, including one Declared Plant (*Solanum linnaeanum*)
- there were no conservation significant fauna species observed within the study area, but several difficult-to-detect species may occur there
- most of the study area is stocked with cattle. Other introduced fauna occurring within the study area included dogs, foxes, cats and rabbits

1.0 Introduction

1.1 Background

The Madora Bay Partnership is intending to develop Lot 100 Mandurah Road, Madora Bay, requiring the clearing of native vegetation. In May 2011 Ecoscape was commissioned by the Madora Bay Partnership to conduct a Level 1 flora and vegetation and a Level 1 fauna assessment of Lot 100 Mandurah Road, Madora Bay to assist in obtaining approval for future development of the area.

1.2 Project Objectives

The project objectives were:

- Vegetation and Flora
 - o conduct a desktop review of all available literature on the flora and vegetation of the site including a search of the Department of Environment and Conservation's (DEC) Threatened and Priority Species database
 - o define and map the vegetation units present within the study area
 - o conduct a targeted survey for conservation significant flora species.

- Fauna
 - o conduct a desktop review of all available literature on the fauna of the site and general area, including a search of the DEC's Threatened and Priority Species database
 - o conduct a field assessment to verify the accuracy of desktop investigations and determine the likelihood of any Threatened or Priority Species of fauna that may visit or occur on-site or in the area.

1.3 Study Area

Lot 100 Mandurah Road, Madora Bay (the study area, **Figure 1**) is located within the City of Mandurah. The study area is bounded by residential properties to the north and south, Mandurah Road to the east and Comet Bay to the west. The northern boundary of the study area occurs on the boundary between the City of Mandurah and the City of Rockingham.

The study area is 139.6 hectares comprised of bushland, as well as cleared pasture and a beach. The study area has been used for grazing for approximately 100 years, and continues to the present day.



Figure 1: Study area location

2.0 Existing Environment

2.1 Physical Environment

2.1.1 CLIMATE

Southwest Western Australia has a 'Mediterranean' climate characterised by mild, wet winters and warm to hot, dry summers (Bureau of Meteorology 2011).

The closest Bureau of Meteorology (BoM) site is approximately 8 km south of the study area at Mandurah, and has been operating since 2003. The closest long-term BoM site (operating 1955-2011) is located at the Kwinana BP Refinery, approximately 25 km north of the study area. The annual rainfall is 743.3 mm, 79% of which falls in the months May to September. February is the hottest month, with a mean term maximum temperature of 29.4°C. July is the coldest month, with a mean maximum temperature of 17.7°C (BoM 2011).

Rainfall and temperature data for Kwinana BP Refinery, is shown in **Figure 2**.

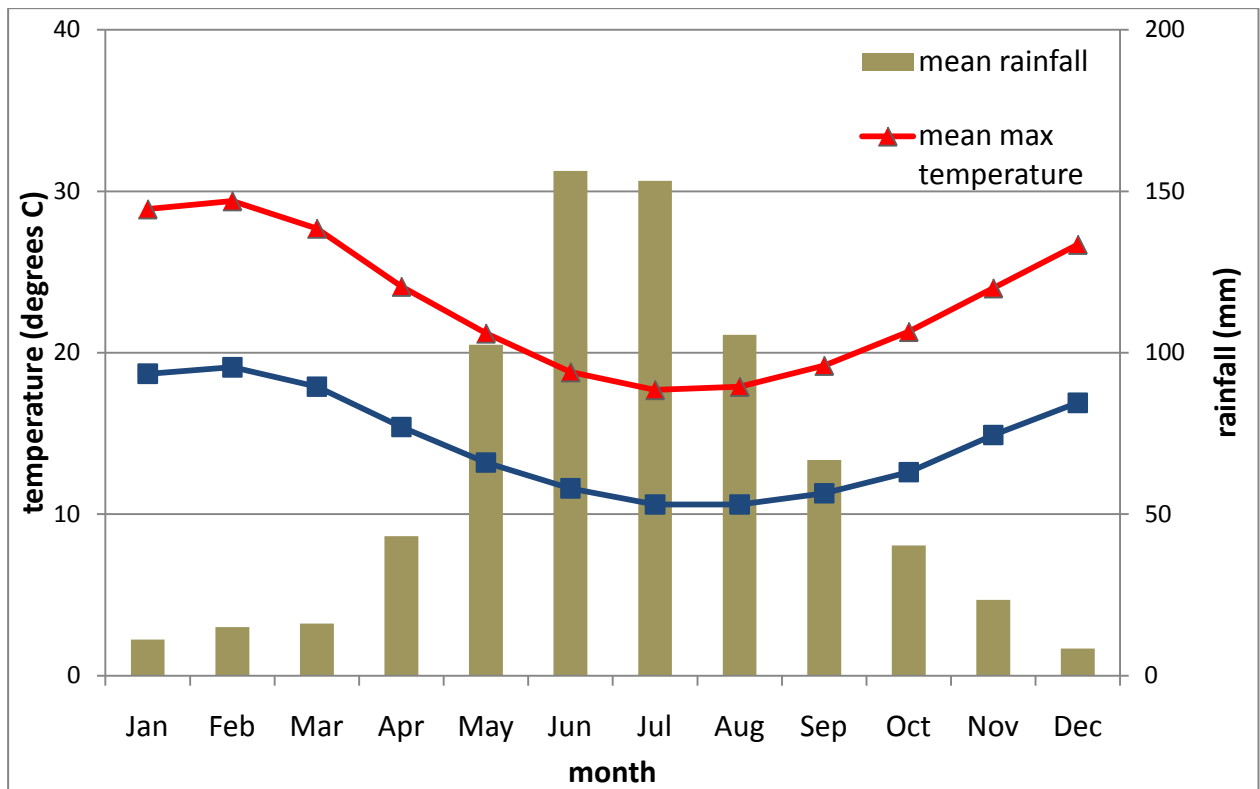


Figure 2: Mean monthly rainfall, maximum temperature and minimum temperature for the Kwinana BP Refinery BoM site (BoM 2011)

2.1.2 TOPOGRAPHY, GEOLOGY AND SOILS

The study area is located adjacent to the coast and includes a series of dunes that are aligned roughly parallel to the coastline.

There are two major geological units mapped within the study area, Safety Bay Sand and Tamala Limestone (Gozzard 1983). The Safety Bay Sand extends inland from the coastline with two sub-units (S13 and S2) occurring within the study area. Both sub-units are described as calcareous sand, composed of white, medium-grained, rounded quartz and shell debris. They are well sorted and of aeolian origin. The S13 sub-unit occurs along the coastline and is associated with low undulating relic foredune topography, with variably thick sands overlying Tamala Limestone. The S2 sub-unit occupies a narrow strip that runs north/south across the length of the study area. It is associated with moderate to steep slopes and is noted to be susceptible to remobilisation (Gozzard 1983).

The eastern portion of the study area adjacent to Mandurah Road has been mapped as Tamala limestone LS1 (Gozzard 1983), consisting of pale yellowish brown, fine to coarse-grained, sub-angular to well-rounded quartz with shell debris and traces of feldspar. It is variably lithified and of aeolian origin with surface kankar.

A search of the soil-landscape maps (Department of Agriculture and Food Western Australia 2007) determined that the study area contains the following soil groups:

- Quindalup Qf1 phase – foredune/blowout complexes (semi-erosional) with very low relief ridge and swale topography with deep uniform calcareous sands
- Quindalup Qf2 phase – relict foredunes and gently undulating beach ridge plain with deep uniform calcareous sands
- Quindalup Qp1 phase – complex of nested low relief parabolic dunes with moderate to steep slopes and uniform calcareous sands showing variable depths of surface darkening
- Spearwood S2b phase – lower slopes (1-5%) of dune ridge with shallow to deep siliceous yellow-brown sands and common limestone outcrop
- Spearwood S5 phase – stony plain with extremely low ridges (relict beach ridges) and shallow to moderately deep siliceous yellow-brown sands.

2.1.2.1 Acid Sulfate Soil (ASS)

The Department of Environment and Conservation (DEC) has compiled maps of ASS risk areas for several coastal regions of Western Australia. These provide a broad-scale indication of areas where ASS is most likely to occur. According to the mapping for the Swan Coastal Plain, viewable online using the Government of Western Australia's (2011) *WA Atlas*, there is no known risk of ASS occurring within three metres of natural soil surface (or deeper) within the study area.

2.1.3 CONTAMINATED SITES

The DEC maintains a database of contaminated sites, viewable online (DEC 2011a). According to this database, there are no contaminated sites known from the study area or within a 3 km radius.

2.1.4 HYDROLOGY

2.1.4.1 Wetlands

Wetlands can be divided into three management categories (Hill *et al.* 1996):

- C category (conservation): wetlands which support high levels of attributes and functions, with the management priorities being to preserve wetland attributes and functions under environmental protection policies
- R category (resource enhancement): wetlands which have been partly modified but still support substantial functions and attributes, with the management priorities being to restore and enhance wetland functions and attributes
- M category (multiple use): wetlands with few attributes which still provide important wetland functions, with the management priorities developed in an appropriate context with land use

According to the Geomorphic Wetlands mapping for the Swan Coastal Plain, viewable online using the Government of Western Australia's (2011) *WA Atlas*, there are no wetlands present within the study area and none nearby that may be influenced by development of the site. The nearest mapped geomorphic wetland lies 1.2 km east of the study area (Pagononi Swamp, Sumpland, C class, UFI 13887). Based on the mapped contours, it is unlikely that the study area lies within the catchment area of this wetland.

The Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) *Protected Matters Search Tool* (DSEWPC 2011a) was used to search for protected areas listed under the *Environment Protection and Biodiversity (EPBC) Act* (1999). The search identified that there are two wetlands of international significance (Ramsar Wetlands) within a 10 km radius of the study area; the Peel-Yalgorup System and the Becher Point Wetlands.

2.1.4.2 Groundwater

The groundwater depth, according to the *Perth Groundwater Atlas* online data set (Department of Water 2011), ranges across the study area between 4.0 m to 22.0 m below the surface. There are no Public Drinking Water Source Areas (PDWSA) present within three km of the study area.

2.2 Biological Environment

2.2.1 BIOGEOGRAPHIC REGION

The study area is located within the Swan Coastal Plain 2 (SWA2) subregion of the Swan Coastal Plain bioregion as defined in the *Interim Biogeographic Regionalisation of Australia* (IBRA) (Australian Government 2011b). The Swan Coastal Plain is a low lying coastal plain dominated by Banksia or Tuart on sandy soils, *Casuarina obesa* on outwash plains, and paperbark in swampy areas. SWA2 is primarily composed of colluvial and aeolian sands, alluvial river flats and coastal limestone. The vegetation is predominantly heath and/or Tuart woodlands on limestone, Banksia and Jarrah-Banksia woodlands on Quaternary marine dunes of various ages, Marri on colluvial and alluvials (Mitchell, Williams & Desmond 2002).

2.2.2 VEGETATION

2.2.2.1 Vegetation Complexes

Hedde *et al.* (1980) divided the Swan Coastal Plain into medium to large areas based on soil and landform units, with the vegetation within these areas defined in terms of floristic composition, growth-form dominance, species composition and stratal structure. The Hedde Vegetation Complexes are used to estimate areas of remaining vegetation, and determine (in part) if an area is below a predetermined percentage for which clearing is not permitted.

According to Hedde *et al.* (1980), there are two Vegetation Complexes associated with the study area: the Quindalup Complex and the Cottesloe Complex - Central and South. The Quindalup Complex is associated with coastal dunes and occupies the western two-thirds of the study area. It consists mainly of two alliances - the strand and foredune alliance and the mobile and stable dune alliance. The Quindalup Complex extends in a narrow coastal strip, almost continuously from Dongara to Busselton. It is noted to have considerably variable species composition and structure both locally and regionally.

The Cottesloe (Central and South) complex typically occurs on aeolian deposits and is described as a mosaic of woodland of *Eucalyptus gomphocephala* (Tuart) and open forest of *E. gomphocephala* - *E. marginata* (Jarrah) – *E. calophylla* (now *Corymbia calophylla*) (Marri) with closed heath on the limestone outcrops (Hedde *et al.* 1980).

The Perth Metropolitan Area is considered to be a 'constrained area' and as such the minimum requirement the Office of the Environmental Protection Authority (OEPA) has adopted to protect biodiversity has been modified to retaining at least 10% of the pre-clearing extent of each vegetation complex. The Cottesloe Complex (Central and South) has 41.1% of its original extent remaining on the Swan Coastal Plain (**Table 1**), whilst the Quindalup Complex has 47.1% remaining. Both vegetation complexes are therefore above the 10% threshold set by the OEPA for clearing vegetation within constrained areas (EPA 2006).

Table 1: Vegetation Complexes remaining on the Swan Coastal Plain (SCP)

Vegetation Complex	Pre European Extent	Remaining on SCP		Remaining on SCP in Secure Tenure	
	Area (ha)	Area (ha)	% Original Area	Area (ha)	% Original Area
Cottesloe- Central and South	44,995	18,474	41.1	3,951	8.8
Quindalup	38,238	18,000	47.1	1,971	5.2

2.2.2.2 Threatened and Priority Ecological Communities

Ecological Communities are defined as ‘naturally occurring biological assemblages that occur in a particular type of habitat’ (English & Blyth 1997). Threatened Ecological Communities (TECs) are categorised at both State (DEC 2010b) and Commonwealth (DSEWPC 2011b) levels. Priority Ecological Communities (PECs) are classed at State level (DEC 2011f). The State and Commonwealth ratings are summarised in **Table 15** and **Table 16**, respectively, **Appendix One**.

A search was conducted of the DEC TEC database for the study area and surrounding 10 km radius. One TEC (containing two sub-categories) was recorded within the 10 km search radius of the site. An additional three PECs were recorded within the search radius. TECs and PECs identified in the search are outlined in **Table 2**. None of the identified TECs or PECs are located within the study area, however an administrative buffer assigned to SCP24 extends across the northeastern corner of the study area. Definitions and categories of TECs and PECs are included in **Table 15** and **Table 16**, **Appendix One**.

Table 2: TECs and PECs occurring within a 10km radius of the study area

Code	Description	DEC	EPBC
SCP19a	Sedgeland in Holocene dune swales of the southern Swan Coastal Plain.	CR B) ii)	EN
SCP19b	Woodlands over sedgeland in Holocene dune swales of the southern Swan Coastal Plain (original description; Gibson <i>et al.</i> (1994).	CR B) ii)	EN
SCP24	Northern Spearwood shrublands and woodlands ('community type 24'): Heaths with scattered <i>Eucalyptus gomphocephala</i> occurring on deeper soils north from Woodman Point. Most sites occur on the Cottesloe unit of the Spearwood system. The heathlands in this group typically include <i>Dryandra sessilis</i> , <i>Calothamnus quadrifidus</i> , and <i>Schoenus grandiflorus</i> .	Priority 3	-
SCP25	Southern Swan Coastal Plain <i>Eucalyptus gomphocephala</i> - <i>Agonis flexuosa</i> woodlands (type 25): Woodlands of <i>Eucalyptus gomphocephala</i> - <i>Agonis flexuosa</i> south of Woodman Point. Recorded from the Karrakatta, Cottesloe and Vasse units. Dominants other than tuart were occasionally recorded, including <i>Corymbia calophylla</i> at Paganoni block and <i>Eucalyptus decipiens</i> at Kemerton. Tuart formed the overstorey nearby however.	Priority 3	-
SCP29b	<i>Acacia</i> shrublands on taller dunes, southern Swan Coastal Plain ('community type 29b'): Community is dominated by <i>Acacia</i> shrublands or mixed heaths on the larger dunes. This community stretches from Seabird to south of Mandurah. No consistent dominant but species such as <i>Acacia rostelifera</i> , <i>Acacia lasiocarpa</i> , and <i>Melaleuca acerosa</i> were important.	Priority 3	-

2.2.1 ENVIRONMENTALLY SENSITIVE AREAS

There are a number of areas around Western Australia of environmental significance within which the exemptions to the Native Clearing Regulations do not apply. These are referred to as Environmentally Sensitive Areas (ESAs), and are declared under section 51B of the *Environmental Protection Act* (1986) and described in the *Environmental Protection (Environmentally Sensitive Areas) Notice* (Government of Western Australia 2005).

According to the ESA mapping, viewable on the Government of Western Australia's (2011) online WA Atlas, the study area does not fall within an ESA. An ESA is located to the northeast of the study area on the eastern side of Mandurah Road.

Bush Forever sites are regionally significant areas of natural vegetation within the Perth Metropolitan Region (Department of Environmental Protection 2000). The Western Australian Government, the Western Australian Planning Commission (WAPC), the OEPA and other key environmental agencies have endorsed Bush Forever and the sites are set aside for protection (WAPC 2004).

The WAPC Bush Forever document was sourced for the potential location of Bush Forever sites within the study area (WAPC 2000). One Bush Forever site (395, Paganoni Swamp and adjacent bushland) was identified during this process, located immediately east of Mandurah Road, diagonally opposite the north-eastern corner of the study area (WAPC 2000).

2.2.2 CONSERVATION SIGNIFICANT FLORA

Flora is classified as Threatened Flora (TF) where populations are geographically restricted or threatened by local processes. The DEC enforces regulations under Government of Western Australia's *Wildlife Conservation Act (1950) (WC Act)* to conserve TF and protect significant populations. Rare flora species are gazetted under Sub-section 2 of Section 23F of the *WC Act*, thereby making it an offence to remove or damage rare flora without Ministerial approval.

The DEC also maintains a list of flora taxa which are considered to be poorly known, uncommon, or under threat, but for which there is insufficient justification on the basis of known distribution and population sizes to be included on the TF schedule. These are classified as Priority Flora (PF). There are seven categories covering TF and PF, which are outlined in **Table 17, Appendix One**.

2.2.2.1 DEC Database Searches

A search of DEC databases (including the *Threatened (Declared Rare) Flora* database, the *WA Herbarium Specimen* database and the *Declared Rare and Priority Flora List*) was undertaken for TF and Priority Flora within a 10 km radius of the study area. This search identified 17 conservation significant species (**Table 3**). Two of these are TF, three are P2, six are P3, and six are P4. There are no records of the species identified by the DEC database searches occurring within boundaries of the study area. *Beyeria cinerea* subsp. *cinerea* has been recorded just to the south of the study area. A flora survey conducted in 2003 did not identify any TF or PF within the study area (ATA Environmental 2004).

Table 3: DEC Threatened and Priority Flora Database Search Results

Species Name	DEC Status	EPBC Act Status	Description	Fl. Period	Soil / Landform
<i>Acacia benthamii</i>	P2	-	Shrub, approximately 1 m high	Aug–Sep	Sand. Typically on limestone breakaways
<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3	-	Shrub to 0.9 m high	?Sep	Sand/ limestone
<i>Caladenia speciosa</i>	P4	-	Tuberous, perennial, herb, 0.35–0.6 m high	Sep–Oct	White, grey or black sand
<i>Cardamine paucijuga</i>	P2	-	Slender erect annual, herb, to 0.4 m high	Sep–Oct	In moist to dry habitats
<i>Conostylis pauciflora</i> subsp. <i>pauciflora</i>	P4	-	Rhizomatous, stoloniferous perennial, grass-like or herb, 0.1–0.35 m high	Aug–Oct	Grey sand, limestone. Hillslopes, consolidated dunes
<i>Dillwynia dillwynioides</i>	P3	-	Decumbent or erect, slender shrub, 0.3–1.2 m high	Aug–Dec	Sandy soils. Winter-wet depressions
<i>Diuris drummondii</i>	T	V	Tuberous, perennial, herb, 0.5–1.05 m high	Nov–Jan	Low-lying depressions, swamps.
<i>Drakaea elastica</i>	T	E	Tuberous, perennial, herb, 0.12–0.3 m high	Oct–Nov	White or grey sand. Low-lying situations adjoining swamps
<i>Eucalyptus rudis</i> subsp. <i>cratyantha</i>	P4	-	Tree, 5–20 m high, bark rough, box-type	Jul–Sep	Loam. Flats, hillsides
<i>Jacksonia sericea</i>	P4	-	Low spreading shrub, to 0.6 m high	Dec–Feb	Calcareous & sandy soils
<i>Johnsonia pubescens</i> subsp. <i>cygnorum</i>	P2	-	Tufted perennial, herb, 0.15–0.25 m high	Sep	Grey-white-yellow sand. Flats, seasonally-wet sites
<i>Lasiopetalum membranaceum</i>	P3	-	Erect or spreading shrub, 0.2–0.5 m high	Jul–Oct	Sand. Near-coastal limestone ridges, outcrops & cliffs
<i>Ornduffia submersa</i>	P4	-			Freshwater lake
<i>Parsonsia diaphanophleba</i>	P4	-	Woody climber, to 10 m high	Jan–Jun/Sep	Alluvial soils. Along rivers
<i>Schoenus capillifolius</i>	P3		Semi-aquatic tufted annual, grass-like or herb (sedge), 0.05m high	Oct–Nov	Brown mud, claypans
<i>Sphaerobolium calcicola</i>	P3	-	Slender, multi-stemmed, scandent or erect shrub, to 1.5 m high	Jun/Sep–Nov	White-grey-brown sand, sandy clay over limestone, black peaty sandy clay.
<i>Stylidium longitubum</i>	P3	-	Erect annual (ephemeral), herb, 0.05–0.12 m high	Oct–Dec	Sandy clay, clay. Seasonal wetlands

2.2.2.2 DSEWPC Database Searches

Flora may also be listed federally under the Commonwealth *EPBC Act* (1999) that lists threatened species considered to be *Critically Endangered* (CR), *Endangered* (E), *Vulnerable* (V), *Conservation Dependant* (CD), *Extinct* (X), or *Extinct in the Wild* (XW). Definitions and criteria for flora recognised by the *EPBC Act* are provided in **Table 18, Appendix One**. The *Protected Matters Search Tool* (Australian Government 2011a; DSEWPC 2011a) identified seven additional Threatened Species (flora) within 10 km of the study area (**Table 4**).

Table 4: Threatened Flora from DSEWPC Protected Matters Search Tool

Species Name	DEC Status	EPBC Act Status	Description	Fl. Period	Soil/landform
† <i>Andersonia gracilis</i>	T	E	Slender erect or open straggly shrub, 0.1–0.5(–1) m high. Flowers white, pink, purple	Sep–Nov	White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps
<i>Caladenia huegelii</i>	T	E	Tuberous, perennial, herb, 0.25–0.6 m high. Flowers green, cream, red	Sep–Oct	Grey or brown sand, clay loam
<i>Centrolepis caespitosa</i>	4	E	Tufted annual, herb (forming a rounded cushion up to 25 mm across)	Oct–Dec	White sand, clay. Salt flats, wet areas
† <i>Darwinia foetida</i>	T	CE	Compact shrub to 0.5 m high. Flowers Green/red	Sep–Nov	Sand
<i>Lasiopetalum pterocarpum</i>	T	E	Open, multi-stemmed shrub (with distinctly winged fruit), to 1.2 m high. Flowers pink	Aug–Dec	Dark red-brown loam or clayey sand over granite. On sloping banks near creeklines
† <i>Lepidosperma rostratum</i>	T	E	Rhizomatous, tufted perennial, grass-like or herb (sedge), 0.5 m high. Flowers brown		Peaty sand, clay
<i>Synaphea</i> sp. Fairbridge Farm (D.Papenfus 696)	T	CE	Dense, clumped shrub, to 0.3 m high, to 0.4 m wide. Flowers yellow	Oct	Sandy with lateritic pebbles. Near winter-wet flats, in low woodland with weedy grasses

† indicates species outside their natural distribution according to *FloraBase*.

2.2.3 CONSERVATION SIGNIFICANT FAUNA

The conservation status of fauna species is assessed under the Commonwealth *EPBC Act* (1999) and the Western Australian *Wildlife Conservation Act* (1950). The significance levels for fauna used in the *EPBC Act* (1999) are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN) and reviewed by Mace and Stuart (1994). *EPBC Act* (1999) categories are listed in **Table 18, Appendix One**.

The WA *Wildlife Conservation Act* (1950) uses a set of Schedules but also classifies species using some of the IUCN categories. DEC Schedules, which provide special protection to listed fauna under the WA *Wildlife Conservation Act* (1950) and definitions are shown in **Table 17, Appendix One**.

In Western Australia, the DEC has produced a supplementary list of Priority Fauna, listed using priority codes, which are species that are not considered *Threatened* under the *Wildlife Conservation Act* but for which the DEC considers there is cause for concern. Some Priority species, however, are also assigned to the IUCN Conservation Dependent category. DEC Priority categories definitions are shown in **Table 17, Appendix One**. It is important to recognise that such Priority Lists have no statutory standing, they are used to assist the DEC when considering which fauna are most in need of more surveys or other investigations, in order to establish their status in the wild.

The Priority Fauna List for Western Australia includes taxa organised by priority codes that either:

- have recently been removed from the schedule of threatened fauna
- have a restricted range, are uncommon or are declining in range and/or abundance, but which do not meet the criteria for inclusion on the schedule of threatened fauna
- have been nominated for consideration for the schedule of threatened fauna and for which there is insufficient information for the advisory committee to make an assessment of their status
- are worthy of inclusion on such a list, as determined by the DEC.

The Priority Fauna List for Western Australia is reviewed by the DEC whenever new information on relevant taxa becomes available. Taxa are removed from the list by the DEC as they cease to meet the requirements identified above. In addition to these conservation levels, species that have been introduced are indicated.

2.2.3.1 DEC Database Search

There were 19 conservation significant fauna species (Threatened, Priority or other specially protected) identified through DEC database searches conducted across a 10 km radius from the study area; five of these are exclusively marine species and not shown here (**Table 5**).

Table 5: DEC Threatened and Priority Fauna search results (marine species omitted)

Scientific Name	Common Name	EPBC Act	WC Act	State/DEC Listing
<i>Bettongia penicillata</i> subsp. <i>ogilbyi</i>	Brush-tailed Bettong, Woylie	-	Schedule 1	T - EN
<i>Dasyurus geoffroii</i>	Western Quoll, Chuditch	Vulnerable	Schedule 1	T - VU
<i>Isoodon obesulus</i> subsp. <i>fusciventer</i>	Southern Brown Bandicoot, Quenda	-	-	P5
<i>Macropus Irma</i>	Western Brush Wallaby	-	-	P4
<i>Myrmecobius fasciatus</i>	Numbat, Walpurti	Vulnerable	Schedule 1	T - VU
<i>Calyptorhynchus banksii</i> subsp. <i>naso</i>	Forest Red-tailed Black-Cockatoo	Vulnerable	Schedule 1	T - VU
<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo	Endangered	Schedule 1	T - EN
<i>Charadrius rubricollis</i>	Hooded Plover	-	-	P4
<i>Falco peregrinus</i> subsp. <i>macropus</i>	Peregrine Falcon	-	Schedule 4	S
<i>Numenius madagascariensis</i>	Eastern Curlew	-	Schedule 3	P4
<i>Lerista lineata</i>	Perth Lined Lerista	-	-	P3
<i>Morelia spilota</i> subsp. <i>imbricata</i>	Carpet Python	-	Schedule 4	P4
<i>Neelaps calonotos</i>	Black-striped Snake	-	-	P3
<i>Synemon gratiosa</i>	Graceful Sunmoth	Endangered	Schedule 1	T - EN

2.2.3.2 Protected Matters Search Tool

Results of the *Protected Matters Search Tool* (Australian Government 2011a) identified the following terrestrial Threatened Species, in addition to those identified by the DEC database searches, as potentially occurring within 10 km of the study area:

- *Calyptorhynchus baudinii* (Baudin's Black-Cockatoo) – Vulnerable – 'likely to occur'
- *Phascogale calura* (Red-tailed Phascogale) – Endangered
- *Setonix brachyurus* (Quokka) – Vulnerable

The full fauna species list returned by the *Protected Matters Search Tool* (including marine birds, mammals, reptiles and sharks, and migratory species) is provided in **Appendix Two**.

2.2.3.3 NatureMap and other resources

A search of the DEC's online *NatureMap* database (DEC 2011e) identified 215 fauna taxa (195 species, due to redundancy in the list) recorded within a 10 km radius of the study area (**Appendix Three**), including the conservation significant fauna species listed in Table 5.

Previous surveys of the study area have confirmed the presence of the Graceful Sun Moth within the study area (Terrestrial Ecosystems 2011). A survey was conducted in July 2011 to quantify the abundance of *Lomandra maritima* within the study area (Ecoscape 2011).

2.3 Social

2.3.1 ABORIGINAL HERITAGE

The Department of Indigenous Affairs online *Aboriginal Heritage Enquiry System* was investigated to identify surveys within the study area and any known heritage concerns. The full results of these inquiries are presented in **Appendix Four**. The results of the online heritage database searches revealed that the study area contains one 'Other Heritage Place', listed as 'Madora Bay Foreshore Reserve – Bush Tucker Area' (Site ID 20780) supporting populations of the plant resource, *Santalum acuminatum* (Quandong). This area has been surveyed by Dr. Amanda Yates and Senior Elder Joseph Walley (Yates & Walley 2003). It is currently fenced to exclude cattle and is planned to be retained as foreshore reserve.

There are no National or Commonwealth Heritage Places listed under the *EPBC Act* within a 10 km radius of the study area according to the *Protected Matters Search Tool*.

3.0 Methods

3.1 Flora and Vegetation Assessment

3.1.1 APPROACH

The flora and vegetation assessment methodology used was developed to comply with Ecoscape's interpretation of a Level 1 survey according to the EPA's *Guidance for the Assessment of Environmental Factors No 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (2004a) and *Terrestrial Biological Surveys as an Element of Biodiversity Protection Position Statement No. 3* (2002).

In order to determine the overall value of the vegetation and flora of the study area, data collected during the field survey was used to assess two different botanical attributes:

- vegetation types were described (using the methodology of Keighery (1994)) and mapped, indicating the distribution and relative abundance of each vegetation type
- the overall flora was determined through the sampling of unmarked floristic quadrats and relevé sites (unbounded flora survey sites) plus opportunistic recordings. Data collected provided a measure of the overall floristic richness of the area, and identified the individual species present. It also identified species of particular conservation significance and introduced plant species.

A systematic grid survey, at approximately 70 m intervals, of all areas of native bushland in 'Good' or better condition was undertaken to search for conservation significant flora species. 'Degraded' and 'Completely Degraded' areas were searched at lower intensity.

The vegetation and floristic data was collected and described from seven quadrats with the floristic, biological and physical data from each of these recorded in detail. An additional two relevé sites were used to describe the vegetation of 'Completely Degraded' vegetation types. The flora records provided the names for use in the vegetation descriptions, and contributed to the flora species inventory. Several parameters relating to the individual quadrats were used to assist in both the description of vegetation types and the determination of flora.

3.1.2 TIMING OF SURVEY

The field assessment of the study area was conducted by Stephen Kern (Senior Environmental Scientist, Botanist) on September 7-8th, 2011. Additionally, conservation significant flora was targeted during a survey of *Lomandra maritima* (Graceful Sun Moth habitat species) survey on July 5th, 2011. For the identification of Threatened Flora (TF), the EPA and DEC generally recommends that flora surveys be conducted after the major rainfall period for the particular region. For the south-west of Western Australia, the optimal flowering period is considered to be in the spring months from August to November.

Conditions during this survey were considered to be good for flora species identification, given the region had experienced 87.2% of the average rainfall in the six months prior to survey in 2011 (BoM 2011). **Figure 3** outlines monthly rainfall totals for the 12 months prior to the flora and vegetation survey in September 2011, compared with long term means. BoM data from the Kwinana BP refinery was used as this site was the closest that provided long-term data.

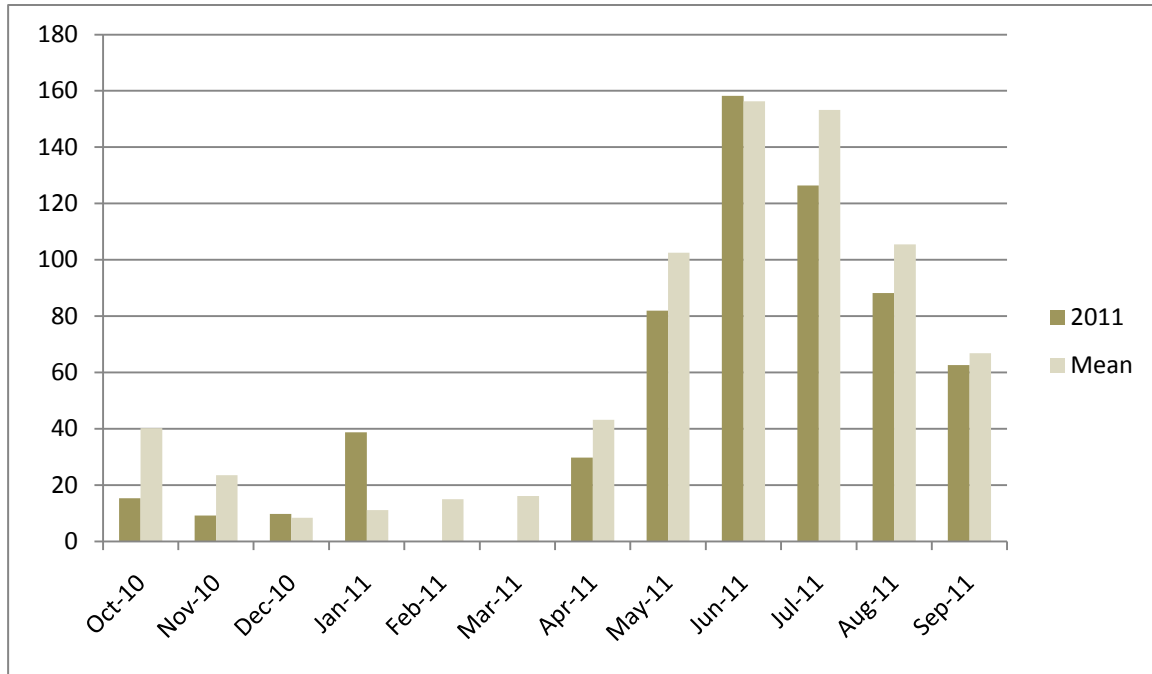


Figure 3: Monthly rainfall totals for the 12 months prior to survey compared with long term means (BoM 2011)

3.1.3 VEGETATION

A standard vegetation classification and description system was utilised during the vegetation survey. Descriptions were defined using the height and estimated cover of dominant species of each stratum using the framework of Keighery (1994) (**Table 19, Appendix One**). Each floristic quadrat and relevé site included a vegetation description which was used to characterise the corresponding vegetation type.

Vegetation condition was assessed using a rating scale that was developed based on a rating scale of Keighery (1994) detailed in **Table 20, Appendix One**.

To collect spatial information for the study area, 1:5000 scale photographic images were marked up in the field with vegetation type boundaries by reference to aerial photography in combination with vegetation data collected from the seven quadrats and two relevés sampled. These hand drafted vegetation boundaries were then digitised and attributed in ArcGIS Version 10.

3.1.4 FLORISTIC ANALYSIS

Floristic Community Types (FCTs) are groups of co-occurring plant species, identified by floristic analysis from over 500 10 m x 10 m quadrats located on the southern Swan Coastal Plain between Seabird and the foothills of the Wicher Range by Gibson *et al.* (1994). This floristic analysis defined 43 community types and subtypes. The major correlates with the floristic classification were seasonal moisture regime and geomorphology; however there was poor correlation with vegetation structure and mapped vegetation units. Despite the poor correlation with mapped vegetation units, DEC defines many TECs and PECs on the Swan Coastal Plain in terms of FCTs, as identified from the Gibson *et al.* (1994) data.

Affinities with FCTs are identified after analysis of field survey quadrat data. There were three types of comparisons conducted:

- statistical analysis
- comparing dominant species to FCT descriptions
- examining inferred FCT types and soil types of surrounding bushlands.

3.1.4.1 Statistical Analysis

FCT analysis of the collected data is conducted using an in-house database program which compares the species list collected from the quadrat data with the information in Table 12 of Gibson *et al.* (1994) and includes data from additional unpublished sites. The analysis produces a list of possible FCTs, with the output including:

- the number of FCT species in the quadrat in relation to the defined FCT list
- the percentage of FCT species in the quadrat in relation to the defined FCT list
- the total cumulative frequency of FCT species in the quadrat for each defined FCT, which weights typical FCT species.

The output list of possible FCTs is compared with landform, landscape position, distribution and descriptions in Gibson *et al.* (1994), to indicate the best possible match with an FCT.

This analysis provides an objective and quantitative method for determining FCTs. Ecoscape appreciates that, as TECs on the Swan Coastal Plain are generally described in terms of FCTs, DEC is required to confirm the presence of TECs if they are determined from FCT analysis.

3.1.4.2 Typical Species Comparison

As an additional tool to assist with FCT determination, species for each quadrat were then compared to the Gibson *et al.* (1994) descriptions of Typical and Common species of each of the possible FCTs indicated from the statistical analysis.

3.1.4.3 Surrounding Bushlands

Bush Forever sites occurring within 3 km of the study area were investigated to reveal inferred FCTs and soil/landform types for each site, and whether they matched the soil/landform type and possible FCTs of the study area.

3.1.5 FLORA

The flora survey involved the systematic sampling of floristic quadrats. Quadrats were 10 m x 10 m in dimension, as this size gives a good sample of flora presence in the Southwest Botanical Province and is in line with the DEC's Draft Botanical Survey Requirements for the Southwest Region (CALM 2003) and the EPA's *Guidance for the Assessment of Environmental Factors No 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (2004a).

Quadrat locations were determined on the basis of topography/landform, interpretation and ground truthing of aerial photography, and field observations of vegetation structure and composition.

Each quadrat was uniquely numbered, and though not permanently marked, a GPS coordinate was recorded for the northwest corner. The quadrats were orientated north-south and east-west.

The following parameters were recorded at each quadrat:

- MGA coordinates recorded in GDA 94 datum using a hand-held Global Positioning System (GPS), to an accuracy usually within 10 m
- broad vegetation description based on the height and estimated cover of dominant species
- an inventory of all species, with estimated average height and percentage foliage cover
- description of landform and habitat
- broad description of surface soil type and stony surface mantle
- percentage of litter cover and depth
- percentage of bare ground
- notes on evidence of grazing, weed invasion, fires, rubbish dumping etc.

Photographs of the vegetation at each site were taken from the north-west corner of each quadrat.

Flora species not recorded within quadrats were opportunistically recorded on traverses between locations to supplement the list of species recorded from the flora survey sites.

Common species that were well known to the survey botanists were identified in the field. Voucher specimens of all other species were collected, assigned a unique number to facilitate tracking of data, and pressed in the field. Specimens collected were dried and treated in accordance with the requirements of the Western Australian Herbarium (WAH). These voucher specimens were identified, using appropriate publications, and/or comparison with pressed specimens housed at the WAH.

Nomenclature was checked against the current listing of scientific names recognised by the WAH and listed on FloraBase (DEC 2011c) and updated as necessary.

All raw data was entered into a Microsoft Access database, with species names entered following formal identification of the collected specimens.

3.1.5.1 Targeted Survey for Conservation Significant Flora

Conservation significant species identified by the database searches were targeted for field survey, searching for their presence in areas of good or better condition vegetation. Degraded and lesser condition vegetation was also assessed for presence of conservation significant flora, but at a wider spacing and in a more targeted manner.

The targeted survey for conservation significant flora involved recording the presence of any potential TF or PF species with a hand-held GPS, and recording an estimation of the numbers of individuals of each flora species. Where the identity of the species was not certain, a voucher specimen was collected.

3.1.6 LIMITATIONS

Table 6: Statement of botanical limitations

Possible Limitations	Constraints (Yes/No): Significant, Moderate or Negligible	Comment
Competency/experience of the consultant conducting the survey	No	Survey undertaken by botanist with extensive survey experience and taxonomic skills
Proportion of the flora identified	Negligible	5% of vascular plant specimens collected from the survey area could not be identified to species level. None of these taxa match known conservation significant species from the area
Proportion of the task achieved and further work that may need to be undertaken	No	Survey meets the requirements for a Level 1 flora survey
Timing/weather/season/cycle	No	Survey undertaken in spring to coincide with peak flowering period. Rainfall in the six months prior to survey was comparable to the long term mean and as such conditions were considered to be good
Intensity of survey (e.g. In retrospect was the intensity adequate?)	No	Approximately 14 hours spent on site in September plus nine hours in June. All vegetation types were sampled, including seven floristic quadrats
Completeness (e.g. was relevant area fully surveyed?)	No	The entire area was traversed on foot along transects at 70 m intervals
Resources (e.g. Degree of expertise available for plant identification)	No	The senior botanist identifying the plants has extensive taxonomic experience. Adequate reference material was carried during the field survey to identify potential conservation. Conservation significant flora was compared with reference collections held at the WA Herbarium. Specialist taxonomists were consulted where necessary
Remoteness and/or access problems	No	Entire site accessible on foot
Availability of contextual (e.g. bioregional) information for the survey area	No	Previous botanical survey reports for the area were reviewed. Several available documents provide contextual information

3.2 Fauna Assessment

3.2.1 APPROACH

The fauna assessment methodology used was developed to comply with Ecoscape's interpretation of a Level 1 survey according to the EPA's *Guidance for the Assessment of Environmental Factors No 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (2004b) and *Terrestrial Biological Surveys as an Element of Biodiversity Protection Position Statement No. 3* (2002).

This includes a reconnaissance survey by suitably qualified personnel to undertake selective, low intensity sampling of the fauna and faunal assemblages in order to verify the accuracy of the background study (desktop assessment), to further delineate and characterise the fauna and faunal assemblages present within the target area and to identify potential impacts. Discussion of key fauna values present in the area consider its biodiversity value at the genetic, species and ecosystem levels, and its ecological functional value at the ecosystem level.

3.2.2 FIELD SURVEY

A site fauna survey was conducted by John Scanlon (Senior Environmental Scientist, Zoologist) on 5 July, 2011. The survey consisted of traversing the site on foot and examining it for habitat quality, in particular those habitat values that may support any identified conservation significant or priority species, and examining the habitat for tracks, traces, and evidence of fauna that may inhabit the study site. Paths and firebreaks were followed in order to observe animal tracks on sandy surfaces, and the traverse also sampled the major topographic and vegetation features of the site. Hand-searching for terrestrial vertebrates involved lifting items of loose cover, raking patches of leaf litter, and peeling bark from dead wood. Notes and photographs were taken to record the existing habitat values and document the presence of fauna species.

3.2.3 FIELD SURVEY TIMING

As a Level 1 survey does not include trapping, timing of the survey was not considered to be critical. The inspection took place on a cool, mostly clear afternoon, several days after the end of a two-week period with significant rain (147.4 mm from 14-30 June, 19.4 mm from 1-3 July; recorded at Mandurah). Consequently, conditions were good for diurnal bird and mammal activity and preservation of recent tracks, but little reptile activity could be expected due to the cool conditions.

3.2.4 LIMITATIONS

Table 7: Fauna survey limitations and constraints

Aspect	Constraint	
	(Yes/No)	Comment
Competency/experience of the consultant carrying out the survey	No	The zoologist conducting the fauna assessment had had appropriate training and experience in conducting Level 1 vertebrate fauna assessments
Scope	No	This section refers to the field survey component of a Level 1 fauna survey.
Proportion of fauna identified, recorded and/or collected	Negligible	Some smaller birds present may not have been identified (based on calls or distant sightings). Shorebirds not surveyed
Sources of information	Negligible	Information available from databases accessed through DEC's NatureMap, EPBC Protected Matters Report, and unpublished or Web-published reports of surveys conducted in the general area. These sources usually rely on limited searching/trapping effort in any one location together with opportunistic observations, but collectively represent the potential vertebrate assemblage of the survey site
Proportion of the task achieved	No	All tasks completed
Timing/weather/season/cycle	Negligible	Due to cool conditions reptile activity was low, and seasonal condition of vegetation may have affected presence of birds and mammals that may visit the site occasionally. In a wet year after successive dry years, proportional abundance of vertebrate species may not be representative
Disturbances which affected results of survey	No	Access was sufficient to survey the entire site
Intensity of survey effort	No	Intensity of on-ground assessment was adequate compared to other Level 1 assessments
Completeness	No	The entire study area was traversed on foot
Resources	No	Adequate resources were available.
Remoteness and/or access problems	No	There were no access or remoteness issues
Availability of contextual information on the region	Negligible	Information available from databases accessed through DEC's NatureMap, EPBC Protected Matters Report, and unpublished or Web-published reports of surveys conducted in the general area. Lack of local survey information for some groups

4.0 Results

4.1 Vegetation

4.1.1 VEGETATION TYPES

Nine different native vegetation types (including completely degraded pasture areas) were identified as occurring in the study area (**Map 1**). Descriptions of these vegetation types are detailed below with, with representative floristic quadrats and extents listed in **Table 8**.

Table 8: Vegetation type extents in the study area

Code	Quadrat/ relevé	Extent (ha)	Extent (%)
OaLOS	Q1	9.22	6.60
SgMS	Q2	14.21	10.18
ArSgTS	Q3	5.91	4.23
ArTS	Q3a	37.48	26.85
ArTCS	Q4	15.12	10.83
AsMSS	R5	4.56	3.27
AsMOS	Q6	17.29	12.39
ArAhMS	Q8	3.24	2.32
CD- cleared areas	R7	30.55	21.89
BS- bare sand	-	2.00	1.81

OaLOS

The vegetation consisted of *Olearia axillaris* and *Scaevola crassifolia* low open shrubland over **Trachyandra divaricata*, **Pelargonium capitatum* and **Gazania linearis* very open herbland (**Plate 1**). **OaLOS** accounted for 6.60% of the study area (9.22 ha) and was represented by a single floristic quadrat (Q1). It occupied the primary dunes adjacent to the coastline on the western side of the study area. The vegetation condition was 'Degraded' with several dominant weed species and erosion evident.



Plate 1: OaLOS vegetation at Q1

SgMS

The vegetation consisted of *Spyridium globulosum*, *Olearia axillaris*, *Acacia saligna* open heath over *Acanthocarpus preissii*, *Carpobrotus virescens*, **Trachyandra divaricata* low shrubland/herbland (**Plate 2**). **SgMS** accounted for 10.18% of the study area (14.21 ha) and was represented by a single floristic quadrat (Q2). ‘Good’ condition vegetation occurred closer to the coast within a fenced area, whilst ‘Degraded’ vegetation had been heavily impacted by cattle grazing.



Plate 2: SgMS vegetation in ‘Good’ condition at Q2

ArSgTS

The vegetation consisted of *Acacia rostellifera*, *Spyridium globulosum*, *Alyxia buxifolia* tall shrubland over *Acanthocarpus preissii*, **Bromus diandrus*, *Senecio pinnatifolius* var. *latilobus* herbland/grassland (**Plate 3**). **ArSgTS** accounted for 4.23% of the study area (5.91 ha) and was represented by a single floristic quadrat (Q3). The vegetation was considered to be in ‘Good’ condition despite grazing by cattle.



Plate 3: ArSgTS vegetation at Q3

ArTS

The vegetation consisted of *Acacia rostellifera* tall shrubland over *Acanthocarpus preissii*, **Trachyandra divaricata*, *Senecio pinnatifolius* var. *latilobus* herbland (**Plate 4**). **ArTS** accounted for 26.85% of the study area (37.48 ha) and was represented by a single floristic quadrat (Q3a). The vegetation condition was recorded as 'Degraded' due to cattle grazing and weed invasion.



Plate 4: ArSgTS vegetation at Q3a

ArTCS

The vegetation consisted of *Acacia rostellifera* closed tall scrub over *Calandrinia brevipedata*, *Crassula glomerata*, *Apium annuum* herbland (**Plate 5**). **ArTCS** accounted for 10.83% of the study area (15.12 ha) and was represented by a single floristic quadrat (Q4). The vegetation condition was recorded as 'Good' with vegetation structure impacted by cattle grazing and weed invasion.



Plate 5: ArTCS vegetation at Q4

AsMSS

The vegetation consisted of *Acacia saligna*, *A. rostellifera* open shrubland over *Acanthocarpus preissii*, **Trachyandra divaricata*, *Conostylis candicans* herbland (**Plate 6**). **AsMSS** accounted for 3.27% of the study area (4.56 ha). Due to the degraded nature and restricted size of this vegetation type, a floristic quadrat was not established, instead a relevé was recorded (R5). The vegetation condition was considered to be ‘Degraded’ due to cattle grazing, erosion and weed invasion.



Plate 6. AsMSS vegetation at R5

AsMOS

The vegetation consisted of *Acacia saligna*, *Adriana quadripartita* shrubland over **Trachyandra divaricata*, *Acanthocarpus preissii*, *Senecio pinnatifolius* var. *latilobus* herbland (**Plate 7**). **AsMOS** accounted for 12.39% of the study area (17.29 ha) and was represented by a single floristic quadrat (Q6). The condition of the **AsMOS** vegetation type was recorded as ‘Degraded’ as a result of cattle grazing, erosion and weed invasion.



Plate 7. AsMOS vegetation at Q6

ArAhMS

The vegetation consisted of *Acacia rostellifera*, *Allocasuarina humilis* open heath over *Poaceae spp., **Trachyandra divaricata*, **Hypochaeris glabra* grassland/forbland (**Plate 8**). **ArAhMS** accounted for 2.32% of the study area (3.24 ha) and was represented by a single floristic quadrat (Q8). The vegetation condition was recorded as ‘Degraded’ due to cattle grazing and weed invasion.



Plate 8. ArAhMS vegetation at Q8

CD

CD (completely degraded pasture) accounted for 21.89% of the study area (30.55 ha). Due to the ‘Completely degraded’ nature of this vegetation type, a floristic quadrat was not established, instead a relevé was recorded (R7). The vegetation consisted of *Hakea prostrata*, *Allocasuarina humilis* mid-high sparse shrubland over **Lupinus cosentinii*, Poaceae spp., **Euphorbia terracina* low grassland/forbland (**Plate 9**). The vegetation structure has been completely modified, with few native species remaining and planted trees and shrubs scattered throughout.



Plate 9. CD vegetation at R7 (planted *Eucalyptus gomphocephala* windrow in background)

4.1.2 VEGETATION CONDITION

The Keighery (1994) vegetation condition within the study area is displayed on **Map 1**. The extent of each condition class within the study area is presented in **Table 9**.

Table 9: Vegetation condition extents within the study area

Condition	Area (ha)	Percentage
Pristine	0	0
Excellent	0	0
Very Good	0	0
Good	29.20	20.92
Degraded	77.83	55.76
Completely Degraded	30.55	21.89
Bare Sand	2.00	1.43
	139.59	100.0%

4.1.1 FLORISTIC COMMUNITY TYPES

The following section examines the species compositions of the quadrats to determine their most similar FCTs listed by Gibson *et al.* (1994).

Results of Ecoscape’s floristic analysis are detailed in **Table 10**. The results of Ecoscape’s FCT analysis indicate that, with the exception of **ArAhMS**, all of the vegetation types recorded within the study area are most likely to be SCP 29a or SCP 29b. The **ArAhMS** vegetation type is most likely to be SCP 24 or SCP26b. The reliability of these inferred FCTs is low, partially because of degradation.

Table 10: FCT analysis output, shaded cells indicate the FCT with the closest affinity

Quadrat	FCT	Typical Landform	Species Richness			DEC Criteria
			No. of FCT Spp	% of FCT Spp	Cumulative Frequency	
Q1-OaLOS	SCP 29a – Coastal shrublands on shallow sands	Quindalup	7	17.20%	366	PEC
	SCP 29b – Acacia shrublands on taller dunes	Quindalup	6	16.85%	262	PEC
Q2-SgMS	SCP 29a – Coastal shrublands on shallow sands	Quindalup	15	36.86%	689	PEC
	SCP 29b – Acacia shrublands on taller dunes	Quindalup	14	39.33%	624	PEC
Q3-ArSgTS	SCP 29a – Coastal shrublands on shallow sands	Quindalup	10	24.57%	479	PEC
	SCP 29b – Acacia shrublands on taller dunes	Quindalup	9	25.28%	431	PEC
Q3a-ArTS	SCP 29a – Coastal shrublands on shallow sands	Quindalup	9	22.11%	412	PEC
	SCP 29b – Acacia shrublands on taller dunes	Quindalup	8	22.47%	447	PEC
Q4-ArTCS	SCP 29b – Acacia shrublands on taller dunes	Quindalup	9	25.28%	438	PEC
	SCP 29a – Coastal shrublands on shallow sands	Quindalup	9	22.11%	445	PEC
R5-AsMSS	SCP 29a – Coastal shrublands on shallow sands	Quindalup	6	14.74%	211	PEC
	SCP 29b – Acacia shrublands on taller dunes	Quindalup	5	14.04%	286	PEC
Q6-AsMOS	SCP 29b – Acacia shrublands on taller dunes	Quindalup	10	28.09%	532	PEC
	SCP 29a – Coastal shrublands on shallow sands	Quindalup	9	22.11%	356	PEC
Q8-ArAhMS	SCP 24 – nthn Spearwood shrublands & woodlands	Spearwood	8	19.14%	340	PEC
	SCP 26b – Woodlands & mallees on limestone	Spearwood	8	15.18%	321	

4.1.2 TECS/PECS

The results from the FCT analysis in addition to a review of the current listings indicate that the vegetation types recorded within the study area do not match any TEC from the region. The FCT analysis indicates that several of the vegetation types recorded within the study area may be analogous with listed PECs. The **OaLOS**, **SgMS** and **ArSgTS** vegetation types are most closely associated with SCP 29a, a Priority 3 listed ecological community. The **ArTS**, **ArTCS**, **AsMSS** and **AsMOS** vegetation types are most closely associated with SCP 29b, a Priority 3 listed ecological community. The **ArAhMS** vegetation type is best matched with SCP 24 (Priority 3).

In all cases the reliability of the inferred FCTs is considered to be low due to degradation and low species diversity. In general the DEC do not consider ‘Degraded’ and ‘Completely degraded’ vegetation to be a TEC or PEC. As such, only the **ArTCS**, **ArSgTS** and part of **SgMS** can be potentially considered extant PECs as the vegetation condition was rated as ‘Good’.

4.2 Flora

4.2.1 FLORA INVENTORY

Including opportunistic observations, a total of 99 vascular plant taxa (species, subspecies and varieties) from 42 families and 82 genera were recorded within the study area. Due to the lack of reproductive material, five specimens were only identified to genus. A summary of the occurrence of flora taxa within floristic quadrats is provided in **Appendix Six**.

The families with greatest representation in the study area were Fabaceae (10 taxa), Myrtaceae (nine, five of which were planted), Poaceae (nine), Asteraceae (seven). The most taxa rich genera were *Acacia*, *Eucalyptus* (planted trees) and *Calandrinia*. Twenty five families and 73 genera were represented by a single taxon.

4.2.2 CONSERVATION SIGNIFICANT FLORA

No TF was found within the study area. Two Priority-listed flora were recorded within the study area, *Beyeria cinerea* subsp. *cinerea* (P4) and *Conostylis pauciflora* subsp. *pauciflora* (P4) (**Table 11**, **Map 1**).

Table 11: Locations of conservation significant flora within the study area

Species	Conservation Code	Number of plants	GDA_mE	GDA_mN
<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P4	3	383293	6407410
<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P4	1	383343	6407427
<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P4	1	383324	6407281
<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P4	1	383302	6407308
<i>Conostylis pauciflora</i> subsp. <i>pauciflora</i>	P4	1	383293	6407410
<i>Conostylis pauciflora</i> subsp. <i>pauciflora</i>	P4	1	383304	6407284
<i>Conostylis pauciflora</i> subsp. <i>pauciflora</i>	P4	1	383216	6407191
<i>Conostylis pauciflora</i> subsp. <i>pauciflora</i>	P4	5	383305	6407167
<i>Conostylis pauciflora</i> subsp. <i>pauciflora</i>	P4	18	383189	6407091

4.2.2.1 *Beyeria cinerea* subsp. *cinerea* (P4)

Beyeria cinerea subsp. *cinerea* is a low shrub to 0.9 m tall with small, cryptic flowers (**Plate 10**). There are 31 collections held at the Western Australian Herbarium with a coastal distribution stretching from Warroora Station to Madora Bay. Madora Bay is at the southernmost extent of the distribution of *Beyeria cinerea* subsp. *cinerea* with a specimen collected approximately 250 m south of the study area in 1983 (DEC 2011c). Six plants were recorded from a single population at the southeastern end of the study area (**Map 1**).



Plate 10. *Beyeria cinerea* subsp. *cinerea*

4.2.2.2 *Conostylis pauciflora* subsp. *pauciflora*

Conostylis pauciflora subsp. *pauciflora* is a sedge-like perennial herb to 0.35 m with yellow flowers from August to October (**Plate 11**). This taxon is known from 22 records (including 14 collections held at the Western Australian Herbarium). Its distribution is restricted to the Swan Coastal Plain from Dawesville to Yanchep. Twenty six individual plants were recorded from one population at the southeastern side of the study area (**Map 1, Appendix Seven**).



Plate 11. *Conostylis pauciflora* subsp. *pauciflora* inflorescence

4.2.3 OTHER SIGNIFICANT FLORA

The record of *Calandrinia* sp. Two Rocks (K. Richardson 211) within the study area represents a minor southern range extension of approximately five kilometres. *Calandrinia* sp. Two Rocks (K. Richardson 211) was recorded close to the coast within the **SgMS** and **ArSgTS** vegetation types.

4.2.4 INTRODUCED FLORA

Twenty nine, or approximately 29%, of taxa recorded within the study area from floristic quadrats and opportunistic observations were introduced (**Table 12**).

Table 12: Introduced flora recorded within the study area

Scientific Name	Common Names	Environmental Weeds Census and Prioritisation (EWCP)	DEC Swan region environmental weed list	Weeds of National Significance (WONS)	Agricultural and Related Resources Protection Act (ARRPA)
<i>*Ammophila arenaria</i>	Marram Grass	FAR	Unknown	-	-
<i>*Arctotheca calendula</i>	Cape Weed	High	High	-	-
<i>*Asphodelus fistulosus</i>	Wild Onion, Onion Weed	FAR	Unknown	-	-
<i>*Avena barbata</i>	Bearded Oat	Very High	High	-	-
<i>*Brassica tournefortii</i>	Mediterranean Turnip, Wild Turnip	High	High	-	-
<i>*Bromus diandrus</i>	Great Brome	Very High	High	-	-
<i>*Cakile maritima</i>	Sea Rocket	FAR	Unknown	-	-
<i>*Crassula glomerata</i>		Unrated	Unknown	-	-
<i>*Cuscuta epithymum</i>	Dodder	Moderate	Medium	-	-
<i>*Ehrharta calycina</i>	Perennial Veldt Grass	Very High	High	-	-
<i>*Erodium cicutarium</i>		FAR	Unknown	-	-
<i>*Euphorbia paralias</i>	Sea Spurge	Moderate	Medium	-	-
<i>*Euphorbia terracina</i>	Geraldton Carnation Weed	Very High	High	-	-
<i>*Fumaria capreolata</i>	Whiteflower Fumitory	Moderate/High	High	-	-
<i>*Gazania linearis</i>	Gazania	Unrated	High	-	-
<i>*Heliphila pusilla</i>		FAR	Unknown	-	-
<i>*Hypochoeris glabra</i>	Smooth Cat's Ear, Flat Weed	High	High	-	-
<i>*Lagurus ovatus</i>	Hares Tail Grass	High	High	-	-
<i>*Leptospermum laevigatum</i>	Victorian Tea Tree, Coast Teatree	Very High	High	-	-
<i>*Lupinus cosentinii</i>	Western Blue Lupin, Sandplain Lupin	Unrated	High	-	-
<i>*Lysimachia arvensis</i>	Pimpernel	FAR	Unknown	-	-
<i>*Oxalis pes-caprae</i>	Soursob	High	High	-	-
<i>*Pelargonium capitatum</i>	Rose Pelargonium	Moderate/High	High	-	-
<i>*Romulea rosea</i>	Guildford Grass, Onion Grass	FAR	Unknown	-	-
<i>*Schinus terebinthifolius</i>	Brazilian Pepper Tree, Japanese Pepper Tree	Very High	High	-	-
<i>*Solanum linnaeanum</i>	Apple of Sodom	High	High	-	P1, P4
<i>*Sonchus oleraceus</i>	Common Sowthistle	FAR	Unknown	-	-
<i>*Tetragonia decumbens</i>	Sea Spinach	Moderate/High	High	-	-
<i>*Trachyandra divaricata</i>	Onion Weed, Dune Onion Weed	FAR	Medium	-	-

4.2.4.1 Environmental Weeds

Environmental weeds include those listed as Declared Plants under the Government of Western Australia's *Agriculture and Related Resources Protection (ARRP) Act (1976)*. Declared Plants require a degree of control depending on their rating in the district they are encountered.

Solanum linnaeanum is classified as a Declared Plant (category P1, P4) for the City of Mandurah under the *ARRP Act (1976)* (Government of Western Australia 2009). P1 requirements prohibit the movement of plants or seeds within the state, whilst P4 requires that the infested area must be managed in such a way that prevents the spread of seed or plant parts within and from the property (Department of Agriculture and Food 2011). *Solanum linnaeanum* was recorded from three locations within the study area (**Map 1, Appendix Seven**)

Environmental weeds also include those listed as Weeds of National Significance (WONS) (Weeds Australia 2009). None of the introduced species recorded within the study area are listed as WONS.

Seventeen weeds rated as high ecological impact according to the Environmental Weeds list for the DEC Swan region (DEC 2011d) including **Arctotheca calendula*, **Avena barbata*, **Brassica tournefortii*, **Bromus diandrus*, **Ehrharta calycina*, **Euphorbia terracina*, **Fumaria capreolata*, **Gazania linearis*, **Hypochaeris glabra*, **Lagurus ovatus*, **Leptospermum laevigatum*, **Lupinus cosentinii*, **Oxalis pes-caprae*, **Pelargonium capitatum*, **Schinus terebinthifolius*, **Solanum linnaeanum* and **Tetragonia decumbens*.

4.3 Fauna

4.3.1 FAUNA INVENTORY

During the site visit, 26 vertebrate species were identified by sighting or other signs. None of these were conservation significant species, and all are common in the region and expected to be present based on previous records (2.2.3.3 above).

Table 13: Fauna observations

Family Name	Common Name	Species Name	Observation type
Mammals			
Bovidae	Cow (domestic)	<i>Bos taurus</i>	tracks, scats, bones, sightings
Leporidae	Rabbit	<i>Oryctolagus cuniculus</i>	digs, scats, tracks
Canidae	Dog (domestic)	<i>Canis lupus</i>	tracks, sighting
	Fox	<i>Vulpes vulpes</i>	scent, tracks, sighting
Felidae	Cat	<i>Felis catus</i>	track
Reptiles			
Gekkonidae	South-west Spiny-tailed Gecko	<i>Strophurus spinigerus</i>	sightings
Birds			
Columbidae	Laughing Turtle Dove	<i>Streptopelia senegalensis</i>	sightings
Pelecanidae	Australian Pelican	<i>Pelecanus conspicillatus</i>	flyover sightings
Accipitridae	Osprey	<i>Pandion cristatus</i>	flyover sighting (SK)
Falconidae	Australian Kestrel	<i>Falco cenchroides</i>	sighting
Cacatuidae	Galah	<i>Eolophus roseicapillus</i>	sighting
Psittacidae	Red-capped Parrot	<i>Purpureicephalus spurius</i>	sighting
	Australian Ringneck	<i>Barnardius zonarius</i>	sightings
Maluridae	Splendid Fairy Wren	<i>Malurus splendens</i>	calls, sightings
Acanthizidae	White-browed Scrubwren	<i>Sericornis frontalis</i>	calls, sightings
	Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>	sighting
Meliphagidae	Singing Honeyeater	<i>Lichenostomus virescens</i>	calls, sighting
	Red Wattlebird	<i>Anthochaera carunculata</i>	calls, sighting
	New Holland Honeyeater	<i>Phylidonyris novaehollandiae</i>	calls, sightings
Pachycephalidae	Rufous Whistler	<i>Pachycephala rufiventris</i>	calls, sighting
Artamidae	Australian Magpie	<i>Cracticus tibicen</i>	calls, sightings
	Grey Butcherbird	<i>Cracticus torquatus</i>	calls
Rhipiduridae	Grey Fantail	<i>Rhipidura albiscapa</i>	calls, sightings
	Willie Wagtail	<i>Rhipidura leucophrys</i>	calls, sightings
Corvidae	Australian Raven	<i>Corvus coronoides</i>	calls, sightings
Timaliidae	Grey-breasted White-eye	<i>Zosterops lateralis</i>	calls, sighting

Note: taxonomy and sequence for birds follows Christidis and Boles (2008)

The following observations were also made during the survey:

There was no evidence of fire in recent decades, but dense new growth of native vegetation, grass, and (in more disturbed areas) weeds in response to recent rain. Some building waste and rubbish is present close to residential development at the northern boundary, and lizards were found under waste items (planks, corrugated fibro-cement, broken concrete slabs, sheet iron) rather than natural items of cover (fallen wood is rare, limestone rocks mostly too deeply imbedded to be moved, very little leaf litter was present and raking was unproductive). Abundant invertebrates include centipedes, millipedes, ants and especially native land snails. The larger birds could usually be identified from calls, while smaller species (with quieter and/or less distinctive calls) are identified from sightings, suggesting some small species were probably present but not identified. Two bird species not seen clearly in the field were identified subsequently from photographs.

4.3.2 CONSERVATION SIGNIFICANT FAUNA

No conservation-significant fauna species were observed during the site visit. Such species are mostly unlikely to be detected because they are uncommon and inconspicuous (e.g. sand-swimming reptiles) or only intermittently present within a discrete area (e.g. black cockatoos).

4.3.3 COCKATOO HABITAT

The vegetation at the site was examined for potential habitat values for the threatened Black Cockatoo (*Calyptorhynchus*) species that may occur in the area. Carnaby's (*C. latirostris*) and Forest-Red-tailed Cockatoos (*C. banksii naso*), both known to occur nearby, have distinct but overlapping requirements for breeding, roosting, and foraging habitat, as does Baudin's (*C. baudinii*) which has not been recorded but may occur (Department of Sustainability Environment Water Population and Communities 2011a).

The remnant vegetation of the site is shrubland, scrub or heath, and does not provide breeding or roosting habitat for these cockatoo species. The eastern section of the study area contains established tree plantings including Marri (*Corymbia calophylla*), Tuart (*Eucalyptus gomphocephala*), and some other eucalypt species not locally native (**Appendix Six**). None of these trees have a diameter at breast height exceeding 0.5 m, or show development of hollows suitable for cockatoo nesting, so they are not considered to represent potential breeding habitat for any black cockatoo species. They are also unlikely to be used for roosting, which generally occurs in or near riparian environments or permanent water sources, or in tall trees within or on the edge of forests.

No signs of cockatoo presence or feeding activity were observed on site, but Red-capped Parrots (*Purpureicephalus varius*) were present and feeding in planted Marri, which may also be utilised by black cockatoos. The shrubland and heath vegetation also includes some potential cockatoo food plants (e.g. species of *Allocasuarina*, *Banksia*, *Hakea* and *Grevillea*) but they are a relatively minor component of the remnant vegetation on the site (4.1.1 and **Appendix Six**).

4.3.4 INTRODUCED FAUNA

Most of the study area is stocked with domestic cattle, and their tracks and other signs were found at high density through nearly all habitats including steep dune slopes and the *Acacia* thicket in the central northern part of the site.

Cattle have been excluded from a fenced area adjacent to the coastline. This fence was erected by Madora Bay Partnership to reflect the proposed foreshore reserve of the Peel Region Scheme. Abundant dog tracks were observed within the fenced area; these are mostly confined to paths and are presumably domestic dogs walked on leash. Fox presence was first detected by the characteristic scent at several locations in the *Acacia* thicket; shortly afterwards, one adult individual was seen in the open from about 20 m away. Tracks of fox, but not dogs, were observed in the pasture area (fox prints are medium-sized, relatively narrow, close to centreline of the trackway, and with pads of the middle two toes well separated from apex of centre pad (Triggs 1997); claws are usually short in fox, but in the photographed example (**Appendix Eight**) the claws are particularly prominent, which is attributed to the soft sand substrate at the site and consequent low wear).

Cats (likely feral as well as domestic) and rabbits are present throughout the site.

5.0 Discussion

5.1 Vegetation and Flora

5.1.1 VEGETATION CONSERVATION SIGNIFICANCE

Eight vegetation types were recorded from the study area, none of which match the description of any recognised TEC.

The FCT analysis indicates that several of the vegetation types recorded within the study area may be analogous with currently recognised PECs. The **OaLOS**, **SgMS** and **ArSgTS** vegetation types are most closely associated with SCP 29a, a Priority 3 listed ecological community. The **ArTS**, **ArTCS**, **AsMSS** and **AsMOS** vegetation types are most closely associated with SCP 29b, a Priority 3 listed ecological community. The **ArAhMS** vegetation type is best matched with SCP 24 (Priority 3). In all cases the reliability of the inferred FCTs is considered to be low as a result of degradation and relatively poor floristic diversity. Of the vegetation types occurring within the study area, only **ArTCS**, **ArSgTS** and part of **SgMS** can be potentially considered to be extant PECs as the vegetation condition was rated as ‘Good’. The remaining vegetation types were rated as ‘Degraded’ or ‘Completely degraded’ and consequently cannot be considered to be an extant PEC.

When compared against the PEC description (**Table 14**) it is apparent that SCP 29a (Coastal shrublands on shallow sands, southern Swan Coastal Plain) is broadly consistent with the descriptions of the **OaLOS**, **SgMS** and **ArSgTS** vegetation types. Similarly, SCP 29b (*Acacia* shrublands on taller dunes, southern Swan Coastal Plain) broadly matches the descriptions of the **ArTS**, **ArTCS**, **AsMSS** and **AsMOS** vegetation types. However, the SCP 24 (Northern Spearwood shrublands and woodlands) description does correlate well with the **ArAhMS** vegetation description.

Table 14: Descriptions of PECs potentially occurring within the study area based on the FCT analysis

Community name	Category
Northern Spearwood shrublands and woodlands ('community type 24') Heaths with scattered <i>Eucalyptus gomphocephala</i> occurring on deeper soils north from Woodman Point. Most sites occur on the Cottesloe unit of the Spearwood system. The heathlands in this group typically include <i>Dryandra sessilis</i> , <i>Calothamnus quadrifidus</i> , and <i>Schoenus grandiflorus</i> .	Priority 3
Coastal shrublands on shallow sands, southern Swan Coastal Plain ('community type 29a') Mostly heaths on shallow sands over limestone close to the coast. No single dominant but important species include <i>Spyridium globulosum</i> , <i>Rhagodia baccata</i> , and <i>Olearia axillaris</i> .	Priority 3
Acacia shrublands on taller dunes, southern Swan Coastal Plain ('community type 29b') Community is dominated by <i>Acacia</i> shrublands or mixed heaths on the larger dunes. This community stretches from Seabird to south of Mandurah. No consistent dominant but species such as <i>Acacia rostellifera</i> , <i>Acacia lasiocarpa</i> , and <i>Melaleuca acerosa</i> were important.	Priority 3

5.1.2 VEGETATION CONDITION

The vegetation condition of the study area, assessed using the Keighery (1994) Bushland Condition Scale, ranged from ‘Good’ to ‘Completely degraded’ depending of the density of weeds, erosion, impacts from grazing and previous clearing of vegetation. The majority of the vegetation of the

study area (77.6%) was rated as 'Degraded' or 'Completely degraded'. There was no evidence of recent fire history within the study area.

5.1.3 FLORA OF CONSERVATION SIGNIFICANCE

A total of 99 vascular flora taxa (29 introduced) were recorded within the study area from quadrats, relevé sites and opportunistic observations (**Appendix Six**). Species richness cannot be assessed with confidence because a Level 1 survey does not include intensive floristic sampling.

Two TF species were identified from the DEC database search request as occurring close to the study area (*Diuris drummondii* and *Drakaea elastica*). Both are known to be associated with winter wet depressions or swamps and as such are unlikely to occur within the study area. An additional seven TF species were identified by the *Protected Matters Search Tool*, three of which appear to be outside their natural distribution. None of the TF species identified by the desktop assessment were located during the field survey and are unlikely to occur within the study area based on natural distribution and known habitat preferences.

There were two PF (*Conostylis pauciflora* subsp. *pauciflora* and *Beyeria cinerea* subsp. *cinerea*) recorded within the study area, both of which are currently listed as Priority 4. Priority 4 species are typically considered to be rare but not threatened or in need of special protection (**Table 17**).

Priority-listed flora species do not have specific protection, however the DEC expects that the proponent of any clearing that will impact on these species demonstrates that they have taken appropriate action to minimise impacts.

Development of the site has the potential to impact on one population of *Beyeria cinerea* subsp. *cinerea* (minimum of six plants) and one population of *Conostylis pauciflora* subsp. *pauciflora* (minimum of 26 plants). Both populations are already heavily impacted by grazing and trampling.

5.1.4 INTRODUCED SPECIES

Twenty nine introduced flora species were recorded from the study area. All vegetation types experienced a significant level of weed invasion, particularly in the lower stratum.

Solanum linnaeanum is a Declared Plant recognised under the *Agriculture and Related Resources Protection Act* (1976), requiring control or prohibiting the movement of plants or seeds. It was recorded from three locations within the study area.

5.2 Fauna

5.2.1 CONSERVATION SIGNIFICANT AND SPECIALLY PROTECTED FAUNA

Habitat requirements, documented or potential presence at the site, and likely extent of impact are discussed for each listed species. Species and common names are followed by abbreviations denoting conservation status.

***Synemon gratiosa* (Graceful Sun-Moth) T - EN**

The Graceful Sun-Moth (Castniidae) is a short-range endemic occurring in south-west Western Australia from Leeman in the north to Preston Beach in the south. It has only been found associated with two species of the mat-rush genus *Lomandra* (Asparagaceae) on which the larvae feed. It is restricted to two vegetation types along the Swan Coastal Plain: (1) *Banksia* Woodland/woolly bush (*Adenanthos cygnorum*) on deep sands, in the northern suburbs of Perth on the Swan Coastal Plain, breeding on *Lomandra hermaphrodita*; and (2) open areas of herbland, heathland and scrubland on Quindalup soils (sands on limestone) close to the coast where it breeds on *Lomandra maritima* (Bishop *et al.* 2010). The study area is consistent with vegetation type (2), including the presence of *L. maritima*. Recent surveys (Terrestrial Ecosystems 2011) have recorded the Graceful Sun Moth within the study area and a survey of *Lomandra maritima* habitat was conducted in July 2011 (Ecoscape 2011). It is likely that the Graceful Sun Moth will be significantly impacted by clearing or other development of the site, and will necessitate referral of the action under the EPBC Act.

***Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo) T - VU**

The Forest Red-tailed Black Cockatoo (Cacatuidae) inhabits dense *Eucalyptus marginata* (Jarrah), *E. diversicolor* (Karri) and *Corymbia calophylla* (Marri) forests, and nests in the large hollows of these trees. This species has been recorded within 5 km of the study area (DEC 2011e) but suitable nesting or roosting habitat does not exist on the site. Some potential foraging habitat exists in the form of planted Marri and small quantities of *Allocasuarina* in the degraded eastern part of the site, but no feeding traces were observed and it is unlikely that they are dependent on the area for food resources. No impact is expected.

***Calyptorhynchus baudinii* (Baudin's Black Cockatoo) T - EN**

Baudin's Black Cockatoo (Cacatuidae) occurs in high-rainfall areas, usually at sites that are heavily forested and dominated by *Corymbia calophylla* (Marri) and *Eucalyptus* species, especially *E. diversicolor* (Karri) and *E. marginata* (Jarrah). It is claimed that the range of the species during the non-breeding season is determined by the distribution of Marri, and that nesting is confined to areas in which Karri occurs (Saunders 1974). This species has been recorded within 15 km of the study area (DEC 2011e) but suitable nesting or roosting habitat does not exist on the site. Some potential foraging habitat exists in the form of planted Marri in the degraded eastern part of the site and scattered proteaceous shrubs (species of *Banksia*, *Grevillea*, and *Hakea*) but no feeding traces were

observed and it is unlikely that they are dependent on the area for food resources. No impact is expected.

***Calyptorhynchus latirostris* (Carnaby's Cockatoo) T - EN**

Carnaby's Black Cockatoo (Cacatuidae) mainly occurs in uncleared or remnant native eucalypt woodlands, especially those that contain Salmon Gum (*Eucalyptus salmonophloia*) and Wandoo (*E. wandoo*), and in shrubland or kwongan heathland dominated by *Hakea*, *Banksia* and *Grevillea* species (Burbidge 2004). It is a seasonal visitor to plantations of exotic pines (*Pinus* spp.), and sometimes occurs in forests containing Marri (*Corymbia calophylla*), Jarrah (*E. marginata*) or Karri (*E. diversicolor*). Nesting occurs in tree hollows and has been recorded in Salmon Gum (*Eucalyptus salmonophloia*), Wandoo (*E. Wandoo*), Red Morrell (*E. longicornis*), York Gum (*E. loxophleba*), Tuart (*E. gomphocephala*), Swamp Yate (*E. occidentalis*), and Marri (*Corymbia calophylla*) (Johnstone & Storr 1998). Breeding occurs mainly in the Wheatbelt but has been reported to occur exceptionally in the northern Darling Range and parts of the Swan Coastal Plain (Johnstone *et al.*2002).

This species has been recorded within 5 km of the study area (DEC 2011e) but suitable nesting or roosting habitat does not exist on the site. Some potential foraging habitat exists in the form of planted Marri and eucalypts in the degraded eastern part of the site and scattered proteaceous shrubs (species of *Banksia*, *Grevillea*, and *Hakea*). No feeding signs were detected in the survey, but it is likely that Carnaby's Cockatoo is at least an occasional visitor to the site. Very limited and possibly no significant impact is expected due to clearing on the site.

***Dasyurus geoffroii* (Western Quoll, Chuditch) T - VU**

The Chuditch (Dasyuridae) formerly occurred through most of mainland Australia, but is now known only from Western Australia where it predominantly occurs in Jarrah (*E. marginata*) forest (DEC 2011b). The Chuditch is also highly mobile and utilises large home ranges. Although there are records of Chuditch (in 2010) and Jarrah from Paganoni Swamp, less than 4 km away (DEC 2011e), the study site does not contain suitable habitat and no direct impact is likely.

***Phascogale calura* (Red-tailed Phascogale) T - EN**

This species (Dasyuridae) inhabits Wandoo (*Eucalyptus wandoo*) and particularly Sheoak (*Allocasuarina huegeliana*) woodland associations, and shows a preference for long unburnt habitat with a continuous canopy, as well as tree hollows (DEC 2011b). Known or suspected threatening processes include predation by foxes and cats. Although there are no records from the Swan Coastal Plain, the EPBC search indicates that the species or its habitat is predicted to occur in the area. As there is no suitable habitat on the study site, it is unlikely that this species would be impacted by any action at Madora Bay.

***Phascogale tapoatafa* subsp. ssp. (WAM M434) (Brush-tailed Phascogale, Wambenger) T - VU**

Brush-tailed Phascogales (Dasyuridae) are usually classified as two subspecies of *P. tapoatafa*, but morphometric and molecular evidence has been published supporting distinction of the isolated south-western population from nominate *P. t. tapoatafa* of eastern Australia (Van Dyck & Strahan 2008) and the DEC treats it as a distinct but unnamed taxon endemic to WA. This subspecies has been observed in dry sclerophyll forests and open woodlands containing hollow-bearing trees but a sparse ground cover. Habitat destruction, in particular, the loss of hollow-bearing trees and predation by feral animals, are thought to be the major threats to surviving populations (DEC 2011b). There are no Phascogale locality records within 20 km of the site, but records on the coastal plain are widely scattered (DEC 2011e) and may not adequately reflect their real distribution, because phascogales are inconspicuous and not usually captured by standard trapping methods. The planted eucalypts in the eastern section of the study site may provide a small amount of suitable habitat, although few of the trees are likely to contain hollows at their current size. Further study may be required to assess the current status of the local Phascogale population in order to determine whether any impact will occur.

***Myrmecobius fasciatus* (Numbat, Walpurti) T – VU**

Numbats (Myrmecobiidae) once occurred in a wide variety of habitat types including eucalypt forest and woodland, and current populations (mostly reintroduced) occur in upland Jarrah forest, open eucalypt woodland, Banksia woodland and tall closed shrubland. Habitats usually have abundant soil termites, hollow logs and branches for shelter (DEC 2011b). There are few historic Numbat records from the coastal plain south of metropolitan Perth; one in 2002 from Mandurah is based on a sighting (ID ‘moderately certain’) and can probably be discounted. The EPBC *Protected Matters Search Tool* (**Appendix Two**) does not predict presence of this species or its habitat within 10 km of the study site. The lack of suitable shelter and presence of feral predators make the study site unsuitable for this species, and no impact is likely.

***Bettongia penicillata ogilbyi* (Brush-tailed Bettong, Woylie) T – EN**

Woylies (Potoroidae) are small nocturnal macropods that occur in open forest and woodland with a low understorey of tussock grasses or woody scrub, and formerly occurred in a wider range of habitats. Distribution has contracted severely in the last century, following the same pattern as the south-eastern subspecies *B. p. penicillata* which has been considered extinct since the 1920s (DEC 2011b). Threatening processes include predation by cats, habitat destruction and alteration, altered fire regimes, competition from domestic and feral herbivores, and possibly disease, however the major threat appears to be foxes. Like the Numbat, Woylies have been reintroduced to various parks and reserves from the few natural remnant populations east of the Darling Range, but there are very few records of the species on the coastal plain. One was reported in 1995 from near Port Kennedy, about 8 km north of the study site (DEC 2011e), and presence of the species or its habitat is predicted by the EPBC Report. However, there is little potentially suitable habitat on the study site (eucalypt woodland, mostly planted rather than remnant), and disturbance by cattle and rabbits, as

well as the presence of cats and foxes, make it very unlikely that a population could be sustained in the area. No impact is expected.

***Setonix brachyurus* (Quokka) T - VU**

Quokkas (Potoroidae) are most familiar and best-studied in island populations, especially on Rottnest Island. On the mainland, the Quokka mainly inhabits densely vegetated swamps and sometimes tea-tree thickets on sandy soils along creek systems and dense heath on slopes (DEC 2011b). There are no historical records of this species from the coastal plain between Bibra Lake and Gelorup; mainland populations declined severely before 1960 and are now relictual, with scattered populations mostly confined to the Darling Range. Potential habitat may exist in the study area, but there is no local population and any future establishment of the species (e.g. through reintroduction) would probably depend on control of feral predators. No impact is likely.

***Falco peregrinus* (Peregrine Falcon) S**

This species (Falconidae) is uncommon but wide-ranging throughout Australia, preferring areas with rocky ledges, cliffs, watercourses, open woodland or margins with cleared land. Ledges, cliff faces, large tree hollows and spouts, or abandoned nests of other raptors are used for nesting. Individual Peregrines are occasionally sighted throughout the region and may use the general area as part of a much larger foraging range. The lack of suitable nest sites makes it unlikely that any impact would occur to this species.

***Isodon obesulus fusciventer* (Southern Brown Bandicoot, Quenda) P5**

Quenda (Peramelidae) prefer dense scrubby, often swampy, vegetation with dense cover up to one metre high, often feeding in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover (DEC 2011b). Despite no evidence of burning, the patchwork of dense scrub and open woodland/pasture in the study area may be able to support this species, and there are numerous recent records in the vicinity, both from beachside locations and the chain of lakes about 2.5 km inland (DEC 2011e). No signs of Quenda presence were observed in the survey, but they are likely to occur there although their ability to utilise the habitat would be hampered by the presence of introduced predators, especially foxes. However, the habitat on the study area seems marginal compared to the nearby Paganoni Swamp; little or no impact on populations is expected.

***Macropus irma* (Western Brush Wallaby) P4**

This grazing kangaroo (Macropodidae) species occurs in open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets. It is also found in some areas of mallee and heathland, and is uncommon in Karri forest (DEC 2011b). Predation of juveniles by foxes seems to be a major factor in its decline. Parts of the study area could provide suitable habitat, however there are few records in the area (one from Mandurah in 1979, DEC 2011).

No evidence of macropods was observed in the survey, while foxes seem to be common. The species is unlikely to be present and no impact is expected.

***Lerista lineata* (Perth Lined Lerista) P3**

Little has been reported on the biology of this skink (Scincidae), but like other sand-swimming species of *Lerista*, it would typically be found close to the interface of loose sandy soil and overlying leaf-litter. Coastal heath with loose sand has been described as 'ideal habitat' (ENV 2010). There are several records from the coastal strip between Mandurah and Port Kennedy (DEC 2011e), and although not observed on the survey it should be considered a resident. This species appears to be able to persist in disturbed and fragmented areas such as suburban gardens, and impact is expected to be minor.

***Neelaps calonotos* (Black-striped Snake) P3**

The Black-striped Snake (Elapidae) is restricted to deep sands of coastal heaths and low shrublands on the Swan Coastal Plain (Cogger 2000; Wilson & Swan 2008). It is found mostly at long-unburnt sites, with leaf-litter favouring the small burrowing lizards on which it feeds, and is vulnerable to habitat fragmentation. There are specimen records on or close to the study site from the 1960s and '70s, which apparently represent the most southerly localities known for this species (DEC 2011e). As the study site is a relatively large block of sandy heath habitat that has remained unburnt for many years, and has a range of vegetation types including litter-producing trees, it could be expected that a population continues to exist there. However, the lack of more recent records and the presence of cattle (known to degrade habitat for other leaf-litter-dependent, sand-swimming reptiles) make it plausible that this snake has already become locally extinct. Further surveys during warmer months (using fenced pitfall and/or funnel traps) might demonstrate presence, but the trappability of this species is very low, less than one capture per 1000 trap-nights (How & Shine 1999) so it would be practically impossible to demonstrate if it is actually absent. It should therefore be assumed to be present, and that local extinction at the limit of its range could result from further development. The site is already separated from other likely habitat to the north by urban development, so that a remnant population of this species (if present) is likely to be genetically isolated and no longer functionally connected to the main population.

***Morelia spilota imbricata* (Carpet Python) S**

This moderately large constrictor (Pythonidae) is found in semi-arid coastal and inland habitats, Banksia woodland, eucalypt woodlands, and grasslands, sheltering in hollow logs, rock crevices, and burrows made by other animals. It declines in areas disturbed for urban and agricultural development and where feral predators are present, but has persisted in relatively undisturbed bushland remnants around Perth and on some offshore islands (Bush et al. 1995). There are recent (2006) records from about 10 km to the north at Port Kennedy (DEC 2011e). Some suitable habitat may exist on the study area, so Carpet Pythons may be found there at least occasionally. However,

as there is limited woodland habitat, disturbance by cattle, and foxes present, the habitat is already marginal and little impact on populations is likely to occur.

5.2.2 MIGRATORY AND MARINE SPECIES

Numerous listed migratory bird species are expected to occur in the area (**Appendix Two**) and known to utilise the Peel-Yalgorup estuary, beaches and/or oceanic waters in the vicinity. None were observed during the survey, and they are not discussed in detail here. No impact on these species is likely as the only part of the site suitable as habitat is the beachfront.

6.0 Recommendations

The following actions are recommended based on the survey results:

- vegetation in 'Good' condition may be considered a Priority Ecological Community and should be preferentially retained as public open space if feasible
- Priority flora do not have any specific protection status, however conservation of the populations within the study area is recommended if feasible
- *Solanum linnaeanum* is a Declared Plant and movement of plants or seeds is prohibited. Infestations should be controlled prior to any disturbance or soil movement
- clearing of *Lomandra maritima* will impact a population of the Endangered Graceful Sun-moth (*Synemon gratiosa*) and will require referral to Commonwealth DSEWPC under the EPBC Act
- consultation with OEPA regarding the possible requirement for targeted surveys to determine whether impacts could occur to Threatened and Priority fauna species including Black Cockatoos (*Calyptorhynchus* spp.), Brush-tailed Phascogale (*Phascogale tapoatafa*), Quenda (*Isoodon obesulus fusciventer*), and Black-striped Snake (*Neelaps calonotos*). It is Ecoscape's opinion that no further survey would be required for these species although we recommend that this be confirmed through consultation.

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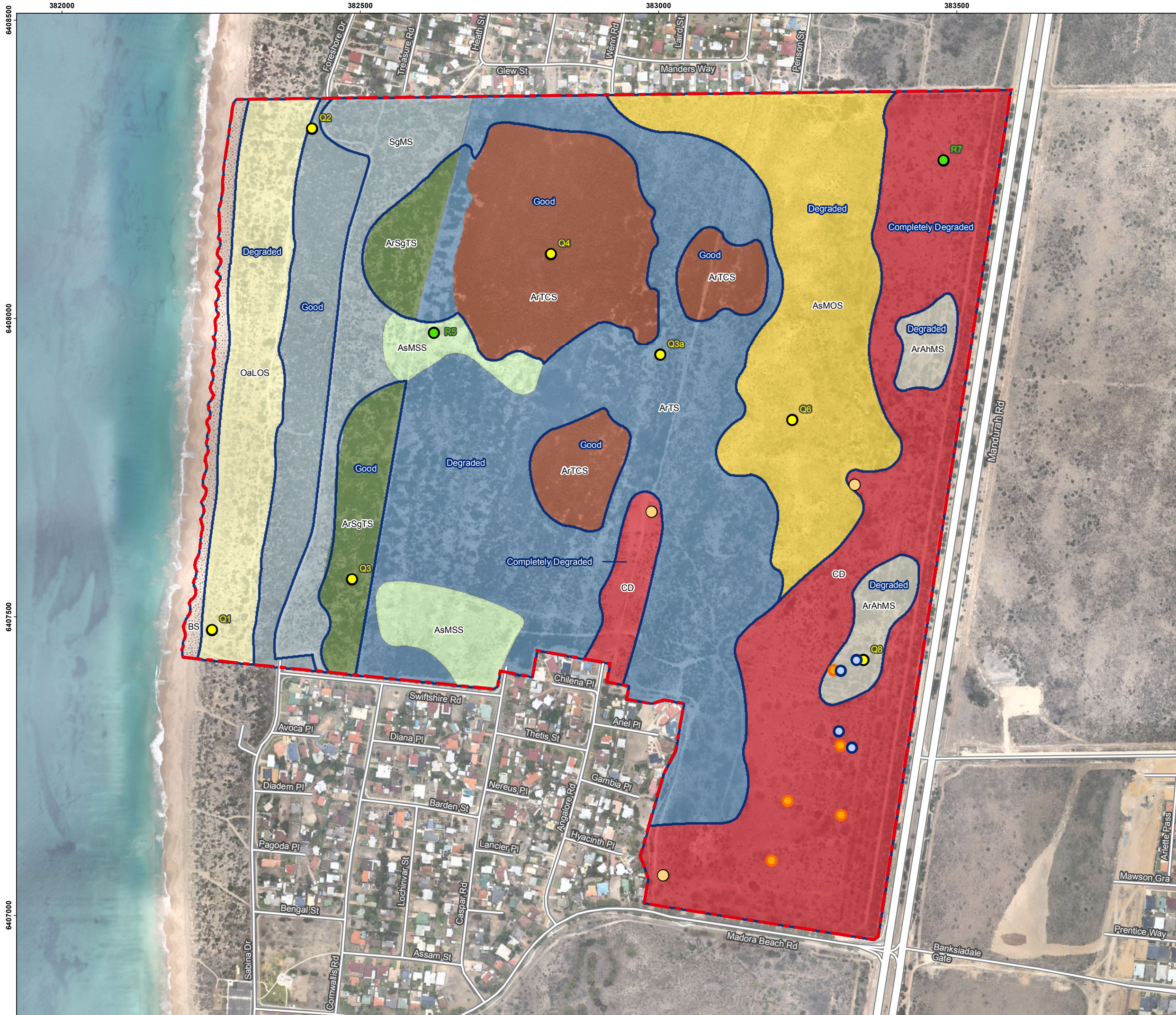
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Maps



Legend

- Quadrat
- Releve
- Conservation Significant Flora**
- *Beyeria cinerea* subsp. *cinerea* (P4)
- *Conostylis pauciflora* subsp. *pauciflora* (P4)
- Declared Weeds**
- *Solanum linnaeanum*
- Study Area
- Vegetation Condition
- Vegetation Type**
- ArAhMS: *Acacia rostellifera*, *Allocasuarina humilis* mid-high shrubland over *Poaceae* spp., *Trachyandra divaricata*, *Hypochoeris glabra* low grassland/forbland.
- ArSgTS: *Acacia rostellifera*, *Spyridium globulosum*, *Alyxia buxifolia* tall shrubland over *Acanthocarpus preissii*, *Bromus diandrus*, *Senecio pinnatifolius* var. *latilobus* low forbland/grassland.
- ArTCS: *Acacia rostellifera* tall closed shrubland over *Calandrinia brevipedata*, *Crassula glomerata*, *Apium annuum* low forbland.
- ArTS: *Acacia rostellifera* tall strubland over *Acanthocarpus preissii*, *Trachyandra divaricata*, *Senecio pinnatifolius* var. *latilobus* low forbland.
- AsMOS: *Acacia saligna*, *Adriana quadripartita* mid-high open shrubland over *Trachyandra divaricata*, *Acanthocarpus preissii*, *Senecio pinnatifolius* var. *latilobus* low forbland.
- AsMSS: *Acacia saligna*, *A. rostellifera* mid-high sparse shrubland over *Acanthocarpus preissii*, *Trachyandra divaricata*, *Conostylis candicans* low forbland.
- CD: Completely degraded: *Hakea prostrata*, *Allocasuarina humilis* mid-high sparse shrubland over *Lupinus cosentinii*, *Poaceae* spp., *Euphorbia terracina* low grassland/forbland.
- OaLOS: *Olearia axillaris*, *Scaevola crassifolia* low open shrubland over *Trachyandra divaricata*, *Pelargonium capitatum*, *Gazania linearis* low open forbland.
- SgMS: *Spyridium globulosum*, *Olearia axillaris*, *Acacia saligna* mid-high shrubland over *Acanthocarpus preissii*, *Carpobrotus virescens*, *Trachyandra divaricata* low shrubland/forbland.
- BS: Bare sand

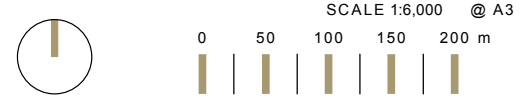
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AUTHOR: JN CHECKED: SB
 DATE: NOV-11 PROJECT NO: 2646-11

LOT 100 MANDURAH RD
 CLIENT: MADORA BAY PARTNERSHIP

SURVEY RESULTS
MAP 01



Imagery: NearMap (28-06-2011)

Appendix One: Definitions and Criteria

Table 15: DEC definitions and criteria for TECs and PECs (DEC 2010a)

Criteria		Definition
Threatened Ecological Communities		
Presumed Destroyed (PD)	Totally	<p>An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.</p> <p>An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B):</p> <p>A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or</p> <p>B) All occurrences recorded within the last 50 years have since been destroyed</p>
Critically (CR)	Endangered	<p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.</p> <p>An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):</p> <p>A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii):</p> <p>i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years);</p> <p>ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.</p> <p>B) Current distribution is limited, and one or more of the following apply (i, ii or iii):</p> <p>i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years);</p> <p>ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;</p> <p>iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.</p> <p>C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).</p>
Endangered (EN)		<p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.</p> <p>An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C):</p> <p>D) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either</p>

Criteria	Definition
	<p>or both of the following apply (i or ii):</p> <ul style="list-style-type: none"> i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years); ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated. <p>E) Current distribution is limited, and one or more of the following apply (i, ii or iii):</p> <ul style="list-style-type: none"> i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years); ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes; iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes. <p>F) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).</p>
Vulnerable (VU)	<p>An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.</p> <p>An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C):</p> <ul style="list-style-type: none"> G) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated. H) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. I) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.
Priority Ecological Communities	
Priority One	Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority Two	Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, state forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities, but do not meet adequacy of survey requirements, and / or are not well defined, and appear to be under threat from known threatening processes.
Priority Three	<ul style="list-style-type: none"> i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or; ii) Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; iii) Communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of

Criteria	Definition
	<p>modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.</p> <p>Communities may be included if they are comparatively well known from several localities, but do not meet adequacy of survey requirements and / or are not well defined, and known threatening processes exist that could affect them.</p>
Priority Four	<p>Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.</p> <p>J) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change These communities are usually represented on conservation lands.</p> <p>K) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</p> <p>L) Ecological communities that have been removed from the list of threatened communities during the past five years.</p>
Priority Five	<p><i>Conservation Dependent Ecological Communities</i></p> <p>Ecological Communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.</p>

Table 16: EPBC Act categories for TECs (DSEWPC 2011a)

EPBC Act Category	Definition
Critically Endangered (CR)	An ecological community that is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered (EN)	An ecological community that is not critically endangered, and is facing a very high risk of extinction in the wild in the new future.
Vulnerable (VU)	An ecological community that is not critically endangered or endangered, and is facing a high risk of extinction in the medium-term future.

Table 17: DEC conservation codes for flora and fauna (DEC 2011b)

Conservation Codes for Western Australian Flora and Fauna
T: Schedule 1 under the <i>Wildlife Conservation Act 1950</i>
<ul style="list-style-type: none"> • Threatened Fauna (Fauna that is rare or is likely to become extinct) • Threatened Flora (Declared Rare Flora – Extant) <p>Taxa* that have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.</p>
X: Schedule 2 under the <i>Wildlife Conservation Act 1950</i>
<ul style="list-style-type: none"> • Presumed Extinct Fauna • Presumed Extinct Flora (Declared Rare Flora – Extinct) <p>Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such.</p>
1A: Schedule 3 under the <i>Wildlife Conservation Act 1950</i>
<ul style="list-style-type: none"> • Birds protected under an international agreement <p>Birds that are subject to an agreement between governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction.</p>
S: Schedule 4 under the <i>Wildlife Conservation Act 1950</i>
<ul style="list-style-type: none"> • Other specially protected fauna <p>Fauna that is in need of special protection, otherwise than for the reasons mentioned in the above schedules.</p>
<p>Threatened fauna and flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria.</p> <p>CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild.</p> <p>EN: Endangered – considered to be facing a very high risk of extinction in the wild.</p> <p>VU: Vulnerable – considered to be facing a high risk of extinction in the wild.</p>
<p>Taxa that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora and Priority Fauna Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna. Taxa that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These taxa require regular monitoring. Conservation Dependent species are placed in Priority 5.</p>
1: Priority One: Poorly-known taxa
<p>Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.</p>
2: Priority Two: Poorly-known taxa
<p>Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.</p>
3: Priority Three: Poorly-known taxa

Conservation Codes for Western Australian Flora and Fauna

Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.

4: Priority Four: Rare, Near Threatened and other taxa in need of monitoring

(a) **Rare.** Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands.

(b) **Near Threatened.** Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.

(c) Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

5: Priority Five: Conservation Dependent taxa

Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxa becoming threatened within five years.

Table 18: EPBC Act categories

EPBC Act Category	Definition
Extinct	A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
Extinct in the wild	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time: it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered	A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	A native species is eligible to be included in the endangered category at a particular time if, at that time: it is not critically endangered; and it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	A native species is eligible to be included in the vulnerable category at a particular time if, at that time: it is not critically endangered or endangered; and it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation Dependent	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time: the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or the following subparagraphs are satisfied: the species is a species of fish; the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; the plan of management is in force under a law of the Commonwealth or of a State or Territory; cessation of the plan of management would adversely affect the conservation status of the species.

Table 19: Keighery (1994) Bushland Structural Classification

Life Form/Height Class	Canopy Cover (%)			
	100 – 70	70 – 30	30 – 10	10 – 2
Trees over 30m	Tall Closed Forest	Tall Open Forest	Tall Woodland	Tall Open Woodland
Trees 10 – 30m	Closed Forest	Open Forest	Woodland	Open Woodland
Trees under 10m	Low Closed Forest	Low Open Forest	Low Woodland	Low Open Woodland
Tree Mallee	Closed Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
Shrub Mallee	Closed Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
Shrubs over 2m	Closed Tall Scrub	Tall Open Scrub	Tall Shrubland	Tall Open Shrubland
Shrubs 1 – 2m	Closed Heath	Open Heath	Shrubland	Open Shrubland
Shrubs under 1m	Closed Low Heath	Open Low Heath	Low Shrubland	Low Open Shrubland
Grasses	Closed Grassland	Grassland	Open Grassland	Very Open Grassland
Herbs	Closed Herbland	Herbland	Open Herbland	Very Open Herbland
Sedges	Closed Sedgeland	Sedgeland	Open Sedgeland	Very Open Sedgeland

Table 20: Keighery (1994) Bushland Condition Scale

Condition	Description
Pristine	No obvious signs of disturbance
Excellent	Vegetation structure intact, disturbance only affecting individual species and weeds are non-aggressive species
Very Good	Vegetation structure altered, obvious signs of disturbance e.g. repeated fires, aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure altered, obvious signs of disturbance. Retains basic vegetation structure or ability to regenerate it. The presence of very aggressive weeds at high density, partial clearing, dieback, logging and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Requires intensive management. The presence of very aggressive weeds at high density, partial clearing, dieback, logging and grazing.
Completely Degraded	Vegetation structure is no longer intact and the area is completely or almost completely without native flora. 'Parkland Cleared'.

Appendix Two: Protected Matters Search Tool Report



EPBC Act Protected Matters Report: Coordinates

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information about the EPBC Act including significance guidelines, forms and application process details can be found at <http://www.environment.gov.au/epbc/assessmentsapprovals/index.html>

Report created: 19/05/11 13:38:09



[Summary](#)

[Details](#)

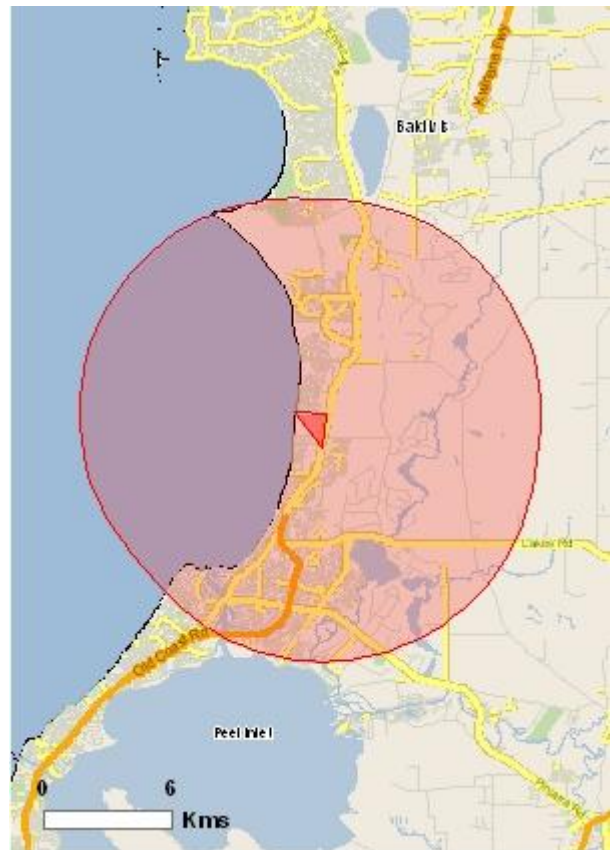
[Matters of NES](#)

[Other matters protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

Buffer: 10.0Km

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see <http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html>.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Significance (Ramsar Wetlands):	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	Relevant
Threatened Ecological Communities:	1
Threatened Species:	38
Migratory Species:	49

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage/index.html>

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at <http://www.environment.gov.au/epbc/permits/index.html>.

Commonwealth Lands:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	78
Whales and Other Cetaceans:	13

Critical Habitats:	None
Commonwealth Reserves:	None

Report Summary for Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

Place on the RNE:	12
State and Territory Reserves:	6
Regional Forest Agreements:	None
Invasive Species:	16
Nationally Important Wetlands:	1

Details

Matters of National Environmental Significance

Wetlands of International Significance (RAMSAR Sites) [\[Resource Information \]](#)

Name	Proximity
Peel-yalgorup system	Within Ramsar site
Becher point wetlands	Within Ramsar site

Commonwealth Marine Areas [\[Resource Information \]](#)

Approval may be required for a proposed activity that is likely to have a significant impact on the environment in a Commonwealth Marine Area, when the action is outside the Commonwealth Marine Area, or the environment anywhere when the action is taken within the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

EEZ and Territorial Sea

Threatened Ecological Communities [\[Resource Information \]](#)

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Sedgelands in Holocene dune swales of the southern Swan Coastal Plain	Endangered	Community known to occur within area

Threatened Species [\[Resource Information \]](#)

Name	Status	Type of Presence
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BIRDS

Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo [67034] Calyptorhynchus baudinii	Vulnerable	Species or species habitat may occur within area

Baudin's Black-Cockatoo, Long-billed Black-Cockatoo [769] Calyptrorhynchus latirostris	Vulnerable	Species or species habitat likely to occur within area
Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523] Diomedea exulans amsterdamensis	Endangered	Breeding likely to occur within area
Amsterdam Albatross [82330] Diomedea exulans exulans	Endangered	Species or species habitat may occur within area
Tristan Albatross [82337] Diomedea exulans gibsoni	Endangered	Foraging, feeding or related behaviour may occur within area
Gibson's Albatross [82271] Diomedea exulans (sensu lato)	Vulnerable	Species or species habitat may occur within area
Wandering Albatross [1073] Halobaena caerulea	Vulnerable	Species or species habitat may occur within area
Blue Petrel [1059] Macronectes giganteus	Vulnerable	Species or species habitat may occur within area
Southern Giant-Petrel [1060] Macronectes halli	Endangered	Species or species habitat may occur within area
Northern Giant-Petrel [1061] Pterodroma mollis	Vulnerable	Species or species habitat may occur within area
Soft-plumaged Petrel [1036] Thalassarche carteri	Vulnerable	Species or species habitat may occur within area
Indian Yellow-nosed Albatross [64464] Thalassarche cauta cauta	Vulnerable	Foraging, feeding or related behaviour may occur within area
Shy Albatross, Tasmanian Shy Albatross [82345] Thalassarche melanophris	Vulnerable	Species or species habitat may occur within area
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area

INSECTS

Synemon gratiosa Graceful Sun Moth [66757]	Endangered	Species or species habitat likely to occur within area
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MAMMALS

Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat known to occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Neophoca cinerea		

Australian Sea-lion [22] Phascogale calura	Vulnerable	Species or species habitat may occur within area
Red-tailed Phascogale [316] Setonix brachyurus	Endangered	Species or species habitat may occur within area
Quokka [229]	Vulnerable	Species or species habitat may occur within area

PLANTS

Andersonia gracilis		
Slender Andersonia [14470] Caladenia huegelii	Endangered	Species or species habitat may occur within area
King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309] Centrolepis caespitosa	Endangered	Species or species habitat likely to occur within area
[6393]	Endangered	Species or species habitat likely to occur within area
Darwinia foetida		
Muchea Bell [83190]	Critically Endangered	Species or species habitat likely to occur within area
Drakaea elastica		
Glossy-leaved Hammer-orchid, Praying Virgin [16753] Lasiopetalum pterocarpum	Endangered	Species or species habitat likely to occur within area
Wing-fruited Lasiopetalum [64922]	Endangered	Species or species habitat likely to occur within area
Lepidosperma rostratum		
Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Synaphea sp. Fairbridge Farm (D.Papenfus 696)		
Selena's Synaphea [82881]	Critically Endangered	Species or species habitat may occur within area

REPTILES

Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat likely to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area

SHARKS

Carcharias taurus (west coast population)		
Grey Nurse Shark (west coast population) [68752] Carcharodon carcharias	Vulnerable	Species or species habitat may occur within area
Great White Shark [64470] Rhincodon typus	Vulnerable	Species or species habitat may occur within area
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Migratory Species

[**Resource Information**]

Name	Status	Type of Presence
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Migratory Marine Birds

Apus pacificus			Species or species habitat may occur within area
Fork-tailed Swift [678]			
Ardea alba			Species or species habitat may occur within area
Great Egret, White Egret [59541]			
Ardea ibis			Species or species habitat may occur within area
Cattle Egret [59542]			
Diomedea amsterdamensis			Species or species habitat may occur within area
Amsterdam Albatross [64405]			
Diomedea dabbenena			Foraging, feeding or related behaviour may occur within area
Tristan Albatross [66471]			
Diomedea exulans (sensu lato)			Species or species habitat may occur within area
Wandering Albatross [1073]	Vulnerable		
Diomedea gibsoni			Species or species habitat may occur within area
Gibson's Albatross [64466]			
Macronectes giganteus			Species or species habitat may occur within area
Southern Giant-Petrel [1060]	Endangered		
Macronectes halli			Species or species habitat may occur within area
Northern Giant-Petrel [1061]	Vulnerable		
Thalassarche carteri			Foraging, feeding or related behaviour may occur within area
Indian Yellow-nosed Albatross [64464]	Vulnerable		
Thalassarche cauta (sensu stricto)			Species or species habitat may occur within area
Shy Albatross, Tasmanian Shy Albatross [64697]			
Thalassarche chlororhynchos			Foraging, feeding or related behaviour may occur within area
Yellow-nosed Albatross, Atlantic Yellow-nosed Albatross, Indian Yellow-nosed Albatross [66481]			
Thalassarche melanophris			Species or species habitat may occur within area
Black-browed Albatross [66472]	Vulnerable		
Migratory Marine Species			
Balaenoptera edeni			Species or species habitat may occur within area
Bryde's Whale [35]			
Balaenoptera musculus			Species or species habitat may occur within area
Blue Whale [36]	Endangered		
Caperea marginata			Species or species habitat may occur within area
Pygmy Right Whale [39]			
Carcharodon carcharias			Species or species habitat may occur within area
Great White Shark [64470]	Vulnerable		
Caretta caretta			Species or species habitat likely to occur within area
Loggerhead Turtle [1763]	Endangered		
Chelonia mydas			Species or species habitat likely to occur within area
Green Turtle [1765]	Vulnerable		
Dermochelys coriacea			Species or species habitat likely to occur within area
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered		
Eubalaena australis			

Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Lagenorhynchus obscurus		
Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca		
Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres		
Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba		
Sanderling [875]		Roosting known to occur within area
Calidris canutus		
Red Knot, Knot [855]		Roosting known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]		Roosting known to occur within area
Calidris ruficollis		
Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris		
Great Knot [862]		Roosting known to occur within area
Charadrius leschenaultii		
Greater Sand Plover, Large Sand Plover [877]		Roosting known to occur within area
Charadrius mongolus		
Lesser Sand Plover, Mongolian Plover [879]		Roosting known to occur within area
Heteroscelus brevipes		
Grey-tailed Tattler [59311]		Roosting known to occur within area
Limicola falcinellus		
Broad-billed Sandpiper [842]		Roosting known to occur within area
Limosa lapponica		
Bar-tailed Godwit [844]		Roosting known to occur within area
Limosa limosa		
Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis		

Eastern Curlew [847] Numenius minutus	Roosting known to occur within area
Little Curlew, Little Whimbrel [848] Numenius phaeopus	Roosting likely to occur within area
Whimbrel [849] Pluvialis fulva	Roosting known to occur within area
Pacific Golden Plover [25545] Tringa glareola	Roosting known to occur within area
Wood Sandpiper [829] Tringa nebularia	Roosting known to occur within area
Common Greenshank, Greenshank [832] Tringa stagnatilis	Roosting known to occur within area
Marsh Sandpiper, Little Greenshank [833]	Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [[Resource Information](#)]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land -

Listed Marine Species [[Resource Information](#)]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops		
Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres		
Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba		
Sanderling [875]		Roosting known to occur within area
Calidris canutus		
Red Knot, Knot [855]		Roosting known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]		Roosting known to occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Roosting known to occur within area
Calidris ruficollis		
Red-necked Stint [860]		Roosting known to occur within area

Calidris subminuta		Roosting known to occur within area
Long-toed Stint [861]		
Calidris tenuirostris		Roosting known to occur within area
Great Knot [862]		
Catharacta skua		Species or species habitat may occur within area
Great Skua [59472]		
Charadrius leschenaultii		Roosting known to occur within area
Greater Sand Plover, Large Sand Plover [877]		
Charadrius mongolus		Roosting known to occur within area
Lesser Sand Plover, Mongolian Plover [879]		
Charadrius ruficapillus		Roosting known to occur within area
Red-capped Plover [881]		
Diomedea amsterdamensis		Species or species habitat may occur within area
Amsterdam Albatross [64405]		
Diomedea dabbenena		Foraging, feeding or related behaviour may occur within area
Tristan Albatross [66471]		
Diomedea exulans (sensu lato)		Species or species habitat may occur within area
Wandering Albatross [1073]	Vulnerable	
Diomedea gibsoni		Species or species habitat may occur within area
Gibson's Albatross [64466]		
Gallinago megala		Roosting likely to occur within area
Swinhoe's Snipe [864]		
Gallinago stenura		Roosting likely to occur within area
Pin-tailed Snipe [841]		
Haliaeetus leucogaster		Species or species habitat likely to occur within area
White-bellied Sea-Eagle [943]		
Halobaena caerulea		Species or species habitat may occur within area
Blue Petrel [1059]	Vulnerable	
Heteroscelus brevipes		Roosting known to occur within area
Grey-tailed Tattler [59311]		
Himantopus himantopus		Roosting known to occur within area
Black-winged Stilt [870]		
Limicola falcinellus		Roosting known to occur within area
Broad-billed Sandpiper [842]		
Limosa lapponica		Roosting known to occur within area
Bar-tailed Godwit [844]		
Limosa limosa		Roosting known to occur within area
Black-tailed Godwit [845]		
Macronectes giganteus		Species or species habitat may occur within area
Southern Giant-Petrel [1060]	Endangered	
Macronectes halli		Species or species habitat may occur within area
Northern Giant-Petrel [1061]	Vulnerable	
Merops ornatus		Species or species habitat may occur within area
Rainbow Bee-eater [670]		
Numenius madagascariensis		Roosting known to occur within area
Eastern Curlew [847]		
Numenius minutus		Roosting likely to occur within area
Little Curlew, Little Whimbrel		

[848]		
Numenius phaeopus		
Whimbrel [849]		Roosting known to occur within area
Philomachus pugnax		
Ruff (Reeve) [850]		Roosting known to occur within area
Pluvialis fulva		
Pacific Golden Plover [25545]		Roosting known to occur within area
Pterodroma mollis		
Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Recurvirostra novaehollandiae		
Red-necked Avocet [871]		Roosting known to occur within area
Thalassarche carteri		
Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta (sensu stricto)		
Shy Albatross, Tasmanian Shy Albatross [64697]		Species or species habitat may occur within area
Thalassarche chlororhynchos		
Yellow-nosed Atlantic Albatross, Indian Yellow-nosed Albatross [66481]		Foraging, feeding or related behaviour may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thinornis rubricollis		
Hooded Plover [59510]		Roosting known to occur within area
Tringa glareola		
Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Roosting known to occur within area
Tringa stagnatilis		
Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Tringa totanus		
Common Redshank, Redshank [835]		Roosting known to occur within area
Fish		
Acentronura australe		
Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Campichthys galei		
Gale's Pipefish [66191]		Species or species habitat may occur within area
Heraldia nocturna		
Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus angustus		
Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus breviceps		

Short-head Seahorse, Short-snouted Seahorse [66235] Hippocampus subelongatus	Species or species habitat may occur within area
West Australian Seahorse [66722] Histiogamphelus cristatus	Species or species habitat may occur within area
Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243] Lissocampus caudalis	Species or species habitat may occur within area
Australian Smooth Pipefish, Smooth Pipefish [66249] Lissocampus fatiloquus	Species or species habitat may occur within area
Prophet's Pipefish [66250] Lissocampus runa	Species or species habitat may occur within area
Javelin Pipefish [66251] Maroubra perserrata	Species or species habitat may occur within area
Sawtooth Pipefish [66252] Mitotichthys meraculus	Species or species habitat may occur within area
Western Crested Pipefish [66259] Nannocampus subosseus	Species or species habitat may occur within area
Bonyhead Pipefish, Bony-headed Pipefish [66264] Phycodurus eques	Species or species habitat may occur within area
Leafy Seadragon [66267] Phyllopteryx taeniolatus	Species or species habitat may occur within area
Common Seadragon, Weedy Seadragon [66268] Pugnaso curtirostris	Species or species habitat may occur within area
Pugnose Pipefish, Pug-nosed Pipefish [66269] Solegnathus lettiensis	Species or species habitat may occur within area
Gunther's Pipehorse, Indonesian Pipefish [66273] Stigmatopora argus	Species or species habitat may occur within area
Spotted Pipefish, Gulf Pipefish [66276] Stigmatopora nigra	Species or species habitat may occur within area
Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277] Urocampus carinirostris	Species or species habitat may occur within area
Hairy Pipefish [66282] Vanacampus margaritifer	Species or species habitat may occur within area
Mother-of-pearl Pipefish [66283] Vanacampus phillipi	Species or species habitat may occur within area
Port Phillip Pipefish [66284] Vanacampus poecilolaemus	Species or species habitat may occur within area
Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]	Species or species habitat may occur within area

Mammals

Arctocephalus forsteri	New Zealand Fur-seal [20]		Species or species habitat may occur within area
Neophoca cinerea	Australian Sea-lion [22]	Vulnerable	Species or species habitat may occur within area
Reptiles			
Caretta caretta	Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas	Green Turtle [1765]	Vulnerable	Species or species habitat likely to occur within area
Dermochelys coriacea	Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Disteira kingii	Spectacled Seasnake [1123]		Species or species habitat may occur within area
Whales and Other Cetaceans			[Resource Information]
Name	Status	Type of Presence	
Mammals			
Balaenoptera acutorostrata	Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni	Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus	Blue Whale [36]	Endangered	Species or species habitat may occur within area
Caperea marginata	Pygmy Right Whale [39]		Species or species habitat may occur within area
Delphinus delphis	Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis	Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Grampus griseus	Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus	Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae	Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca	Killer Whale, Orca [46]		Species or species habitat may occur within area
Stenella attenuata	Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus	Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str.	Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

Places on the RNE

[[Resource Information](#)]

Note that not all Indigenous sites may be listed.

Name	Status
Natural	
Anstey Swamp WA	Indicative Place
Beenyup Swamp WA	Indicative Place
Churcher Swamp WA	Indicative Place
Goegrup Lakes Area WA	Indicative Place
Stakehill Swamp WA	Indicative Place
Lakes Coo loongup and Walyungup and Surrounds WA	Registered
Paganoni Swamp and Adjacent Areas WA	Registered
Peel - Harvey Estuarine System WA	Registered
Port Kennedy Area WA	Registered
Historic	
Christ's Church and Churchyard WA	Indicative Place
Halls Cottage WA	Registered
James Service Shipwreck WA	Registered

State and Territory Reserves

[[Resource Information](#)]

Goegrup Lake, WA
Unnamed WA35283, WA
Shoalwater Islands, WA
Unnamed WA44986, WA
Port Kennedy Scientific Park, WA
Unnamed WA46661, WA

Invasive Species

[[Resource Information](#)]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Mammals		
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat may occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area

Plants

[Asparagus asparagoides](#)
Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus

Species or species habitat likely to occur within area

[22473] Brachiaria mutica Para Grass [5879]	Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]	Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]	Species or species habitat may occur within area
Genista sp. X Genista monspessulana Broom [67538]	Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]	Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]	Species or species habitat may occur within area
Olea europaea Olive, Common Olive [9160]	Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]	Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]	Species or species habitat may occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtiji Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]	Species or species habitat may occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]	Species or species habitat may occur within area

Nationally Important Wetlands

[Resource Information]

[Becher Point Wetlands, WA](#)

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to

consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites;
- seals which have only been mapped for breeding sites near the Australian continent.

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.45556 115.76139,-32.46972 115.75944,-32.455 115.74694,-32.45556 115.76139

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Department of Environment, Climate Change and Water, New South Wales](#)
- [-Department of Sustainability and Environment, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment and Natural Resources, South Australia](#)
- [-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts](#)
- [-Environmental and Resource Management, Queensland](#)
- [-Department of Environment and Conservation, Western Australia](#)
- [-Department of the Environment, Climate Change, Energy and Water](#)
- [-Birds Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-SA Museum](#)
- [-Queensland Museum](#)

- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Atherton and Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [-State Forests of NSW](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

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Appendix Three: NatureMap Fauna Report

NatureMap Species Report

Created By Guest user on 19/06/2011

Kingdom Animalia
Current Names Only Yes
Data Source Atlas of Australian Birds or Fauna Survey Returns Database or WA Threatened Fauna
Method Database or WA Museum Specimen Database
Centre 'By Circle'
Buffer 115°45' 11" E,32°27' 33" S
Group By 10km
Conservation Status

Conservation Status	Species	Records
Rare or likely to become extinct	10	26
Other specially protected fauna	1	1
Priority 3	2	10
Priority 4	2	6
Priority 5	1	128
Non-conservation taxon	199	2158
TOTAL	215	2329

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
Rare or likely to become extinct				
1.	24050 <i>Balaenoptera physalus</i> (Fin Whale)		T	
2.	24162 <i>Bettongia penicillata</i> subsp. <i>ogilbyi</i> (Brush-tailed Bettong, Woylie)		T	
3.	24731 <i>Calyptorhynchus banksii</i> subsp. <i>naso</i> (Forest Red-tailed Black-Cockatoo)		T	
4.	24734 <i>Calyptorhynchus latirostris</i> (Carnaby's Cockatoo)		T	
5.	25335 <i>Caretta caretta</i> (Loggerhead Turtle)		T	
6.	24092 <i>Dasyurus geoffroii</i> (Western Quoll, Chuditch)		T	
7.	24690 <i>Macronectes giganteus</i> (Southern Giant Petrel)		T	
8.	24146 <i>Myrmecobius fasciatus</i> (Numbat, Walpurti)		T	
9.	24462 <i>Phoebastria fusca</i> (Sooty Albatross)		T	
10.	33992 <i>Synemon gratiosa</i> (Graceful Sunmoth)		T	
Other specially protected fauna				
11.	25240 <i>Morelia spilota</i> subsp. <i>imbricata</i> (Carpet Python)		S	
Priority 3				
12.	25147 <i>Lerista lineata</i>		P3	
13.	25249 <i>Neelaps calonotos</i> (Black-striped Snake)		P3	
Priority 4				
14.	24133 <i>Macropus irma</i> (Western Brush Wallaby)		P4	
15.	24798 <i>Numenius madagascariensis</i> (Eastern Curlew)		P4	
Priority 5				
16.	24153 <i>Isodon obesulus</i> subsp. <i>fusciventer</i> (Southern Brown Bandicoot, Quenda)		P5	
Non-conservation taxon				
17.	24260 <i>Acanthiza apicalis</i> (Broad-tailed Thornbill (Inland Thornbill))			
18.	24261 <i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)			
19.	24262 <i>Acanthiza inornata</i> (Western Thornbill)			
20.	24560 <i>Acanthorhynchus superciliosus</i> (Western Spinebill)			
21.	25535 <i>Accipiter cirrocephalus</i> (Collared Sparrowhawk)			
22.	25536 <i>Accipiter fasciatus</i> (Brown Goshawk)			
23.	25011 <i>Acritoscincus trilineatum</i>			
24.	24310 <i>Anas castanea</i> (Chestnut Teal)			
25.	24312 <i>Anas gracilis</i> (Grey Teal)			
26.	24313 <i>Anas platyrhynchos</i> (Mallard)			
27.	24315 <i>Anas rhynchotis</i> (Australasian Shoveler)			
28.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
29.	24332 <i>Anhinga melanogaster</i> subsp. <i>novaeollandiae</i>			
30.	24561 <i>Anthochaera carunculata</i> (Red Wattlebird)			
31.	24562 <i>Anthochaera lunulata</i> (Western Little Wattlebird)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
32.	24991 <i>Aprasia repens</i>			
33.	24334 <i>Apus pacificus</i> subsp. <i>pacificus</i>			
34.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
35.	24209 <i>Arctocephalus tropicalis</i> (Sub-antarctic Fur Seal)			
36.	25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)			
37.	24319 <i>Biziura lobata</i> (Musk Duck)			
38.	25715 <i>Cacatua roseicapilla</i> (Galah)			
39.	25716 <i>Cacatua sanguinea</i> (Little Corella)			
40.	24729 <i>Cacatua tenuirostris</i> (Eastern Long-billed Corella)	Y		
41.	25598 <i>Cacomantis flabelliformis</i> (Fan-tailed Cuckoo)			
42.	24779 <i>Calidris acuminata</i> (Sharp-tailed Sandpiper)			
43.	25738 <i>Calidris canutus</i> (Red Knot)			
44.	24784 <i>Calidris ferruginea</i> (Curlew Sandpiper)			
45.	24788 <i>Calidris ruficollis</i> (Red-necked Stint)			
46.	24790 <i>Calidris tenuirostris</i> (Great Knot)			
47.	25717 <i>Calyptorhynchus banksii</i> (Red-tailed Black-Cockatoo)			
48.	24086 <i>Cercartetus concinnus</i> (Western Pygmy-possum, Mundarda)			
49.	25575 <i>Charadrius leschenaultii</i> (Greater Sand Plover)			
50.	24372 <i>Charadrius leschenaultii</i> subsp. <i>leschenaultii</i>			
51.	25576 <i>Charadrius mongolus</i> (Lesser Sand Plover)			
52.	24377 <i>Charadrius ruficapillus</i> (Red-capped Plover)			
53.	25337 <i>Chelodina oblonga</i> (Oblong Turtle)			
54.	24321 <i>Chenonetta jubata</i> (Australian Wood Duck (Wood Duck))			
55.	24980 <i>Christinus marmoratus</i> (Marbled Gecko)			
56.	24431 <i>Chrysococcyx basalis</i> (Horsfield's Bronze Cuckoo)			
57.	24833 <i>Cincloramphus cruralis</i> (Brown Songlark)			
58.	24288 <i>Circus approximans</i> (Swamp Harrier)			
59.	24774 <i>Cladorhynchus leucocephalus</i> (Banded Stilt)			
60.	25675 <i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
61.	24613 <i>Colluricincla harmonica</i> subsp. <i>rufiventris</i>			
62.	24399 <i>Columba livia</i> (Domestic Pigeon)	Y		
63.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
64.	25592 <i>Corvus coronoides</i> (Australian Raven)			
65.	24417 <i>Corvus coronoides</i> subsp. <i>perplexus</i>			
66.	24671 <i>Coturnix pectoralis</i> (Stubble Quail)			
67.	24420 <i>Cracticus nigrogularis</i> (Pied Butcherbird)			
68.	25595 <i>Cracticus tibicen</i> (Australian Magpie)			
69.	24422 <i>Cracticus tibicen</i> subsp. <i>dorsalis</i> (White-backed Magpie)			
70.	25596 <i>Cracticus torquatus</i> (Grey Butcherbird)			
71.	25399 <i>Crinia glauerti</i> (Clicking Frog)			
72.	25400 <i>Crinia insignifera</i> (Squelching Froglet)			
73.	30893 <i>Cryptoblepharus buchananii</i>			
74.	25027 <i>Ctenotus australis</i>			
75.	24322 <i>Cygnus atratus</i> (Black Swan)			
76.	30901 <i>Dacelo novaeguineae</i> (Laughing Kookaburra)	Y		
77.	25673 <i>Daphoenositta chrysoptera</i> (Varied Sittella)			
78.	24606 <i>Daphoenositta chrysoptera</i> subsp. <i>pileata</i> (Varied Sittella (Black-capped Sittella))			
79.	25296 <i>Demansia psammophis</i> subsp. <i>reticulata</i>			
80.	25607 <i>Dicaeum hirundinaceum</i> (Mistletoebird)			
81.	24470 <i>Dromaius novaehollandiae</i> (Emu)			
82.	25251 <i>Echiopsis curta</i> (Bardick)			
83.	25096 <i>Egernia kingii</i> (King's Skink)			
84.	25100 <i>Egernia napoleonis</i>			
85.	25250 <i>Elapognathus coronatus</i> (Crowned Snake)			
86.	24651 <i>Eopsaltria australis</i> subsp. <i>griseogularis</i> (Western Yellow Robin)			
87.	24567 <i>Epthianura albifrons</i> (White-fronted Chat)			
88.	24379 <i>Erythronyctis cinctus</i> (Red-kneed Dotterel)			
89.	25746 <i>Eudyptula minor</i> (Little Penguin)			
90.	25622 <i>Falco cenchroides</i> (Australian Kestrel)			
91.	25623 <i>Falco longipennis</i> (Australian Hobby)			
92.	24041 <i>Felis catus</i> (Cat)	Y		
93.	25727 <i>Fulica atra</i> (Eurasian Coot)			
94.	25729 <i>Gallinula tenebrosa</i> (Dusky Moorhen)			
95.	25730 <i>Gallirallus philippensis</i> (Buff-banded Rail)			
96.	25530 <i>Gerygone fusca</i> (Western Gerygone)			
97.	24271 <i>Gerygone fusca</i> subsp. <i>fusca</i>			
98.	24054 <i>Globicephala macrorhynchus</i> (Short-finned Pilot Whale)			
99.	24443 <i>Grallina cyanoleuca</i> (Magpie-lark)			
100.	24487 <i>Haematopus longirostris</i> (Pied Oystercatcher)			
101.	24293 <i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
102.	24295 <i>Haliastur sphenurus</i> (Whistling Kite)			
103.	24689 <i>Halobaena caerulea</i> (Blue Petrel)			
104.	25410 <i>Heleioporus eyrei</i> (Moaning Frog)			
105.	25119 <i>Hemiergis quadrilineata</i>			
106.	25734 <i>Himantopus himantopus</i> (Black-winged Stilt)			
107.	24491 <i>Hirundo neoxena</i> (Welcome Swallow)			
108.	25366 <i>Hydrophis elegans</i>			
109.	24367 <i>Lalage tricolor</i> (White-winged Triller)			
110.	24511 <i>Larus novaehollandiae</i> subsp. <i>novaehollandiae</i>			
111.	25638 <i>Larus pacificus</i> (Pacific Gull)			
112.	25133 <i>Lerista elegans</i>			
113.	25005 <i>Lialis burtonis</i>			
114.	24577 <i>Lichenostomus ornatus</i> (Yellow-plumed Honeyeater)			
115.	24581 <i>Lichenostomus virescens</i> (Singing Honeyeater)			
116.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
117.	24582 <i>Lichmera indistincta</i> subsp. <i>indistincta</i>			
118.	25415 <i>Limnodynastes dorsalis</i> (Western Banjo Frog)			
119.	30932 <i>Limosa lapponica</i> (Bar-tailed Godwit)			
120.	25378 <i>Litoria adelaidensis</i> (Slender Tree Frog)			
121.	25388 <i>Litoria moorei</i> (Motorbike Frog)			
122.	24326 <i>Malacorhynchus membranaceus</i> (Pink-eared Duck)			
123.	25654 <i>Malurus splendens</i> (Splendid Fairy-wren)			
124.	25758 <i>Megalurus gramineus</i> (Little Grassbird)			
125.	24838 <i>Megalurus gramineus</i> subsp. <i>gramineus</i>			
126.	24587 <i>Melithreptus chloropsis</i> (Western White-naped Honeyeater)			
127.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)			
128.	25191 <i>Morethia lineocellata</i>			
129.	24223 <i>Mus musculus</i> (House Mouse)	Y		
130.	25248 <i>Neelaps bimaculatus</i> (Black-naped Snake)			
131.	24738 <i>Neophema elegans</i> (Elegant Parrot)			
132.	30941 <i>Nephruros milii</i> (Barking Gecko)			
133.	24820 <i>Ninox novaeseelandiae</i> subsp. <i>boobook</i>			
134.	25252 <i>Notechis scutatus</i> (Tiger Snake)			
135.	25742 <i>Numenius phaeopus</i> (Whimbrel)			
136.	25564 <i>Nycticorax caledonicus</i> (Rufous Night Heron)			
137.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
138.	24085 <i>Oryctolagus cuniculus</i> (Rabbit)	Y		
139.	24328 <i>Oxyura australis</i> (Blue-billed Duck)			
140.	25679 <i>Pachycephala pectoralis</i> (Golden Whistler)			
141.	24623 <i>Pachycephala pectoralis</i> subsp. <i>fuliginosa</i>			
142.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
143.	25253 <i>Parasuta gouldii</i>			
144.	25681 <i>Pardalotus punctatus</i> (Spotted Pardalote)			
145.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
146.	24630 <i>Pardalotus striatus</i> subsp. <i>westraliensis</i>			
147.	25370 <i>Pelamis platura</i> (Yellow-bellied Sea-snake)			
148.	24648 <i>Pelecanus conspicillatus</i> (Australian Pelican)			
149.	24660 <i>Petroica multicolor</i> subsp. <i>campbelli</i>			
150.	25697 <i>Phalacrocorax carbo</i> (Great Cormorant)			
151.	24664 <i>Phalacrocorax carbo</i> subsp. <i>novaehollandiae</i> (Great Cormorant)			
152.	24666 <i>Phalacrocorax melanoleucos</i> subsp. <i>melanoleucos</i>			
153.	24667 <i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)			
154.	25699 <i>Phalacrocorax varius</i> (Pied Cormorant)			
155.	24409 <i>Phaps chalcoptera</i> (Common Bronzewing)			
156.	25587 <i>Phaps elegans</i> (Brush Bronzewing)			
157.	24099 <i>Phascogale tapoatafa</i> subsp. <i>tapoatafa</i> (Southern Brush-tailed Phascogale, Wambenger)			
158.	25669 <i>Phylidonyris nigra</i> (White-cheeked Honeyeater)			
159.	24596 <i>Phylidonyris novaehollandiae</i> (New Holland Honeyeater)			
160.	24841 <i>Platalea flavipes</i> (Yellow-billed Spoonbill)			
161.	25720 <i>Platycercus icterotis</i> (Western Rosella)			
162.	24747 <i>Platycercus spurius</i> (Red-capped Parrot)			
163.	25721 <i>Platycercus zonarius</i> (Australian Ringneck (Ring-necked Parrot))			
164.	24383 <i>Pluvialis squatarola</i> (Grey Plover)			
165.	25703 <i>Podargus strigoides</i> (Tawny Frogmouth)			
166.	25704 <i>Podiceps cristatus</i> (Great Crested Grebe)			
167.	24680 <i>Podiceps cristatus</i> subsp. <i>australis</i>			
168.	25510 <i>Pogona minor</i>			
169.	24907 <i>Pogona minor</i> subsp. <i>minor</i>			
170.	24681 <i>Poliocephalus poliocephalus</i> (Hoary-headed Grebe)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
171.	25722 <i>Polytelis anthopeplus</i> (Regent Parrot)			
172.	25731 <i>Porphyrio porphyrio</i> (Purple Swamphen)			
173.	24771 <i>Porzana tabuensis</i> (Spotless Crake)			
174.	25259 <i>Pseudonaja affinis</i> subsp. <i>affinis</i> (Dugite)			
175.	25264 <i>Pseudonaja nuchalis</i> (Gwardar)			
176.	25433 <i>Pseudophryne guentheri</i> (Crawling Toadlet)			
177.	24702 <i>Pterodroma brevirostris</i> (Kerguelen Petrel)			
178.	24716 <i>Puffinus pacificus</i> (Wedge-tailed Shearwater)			
179.	25271 <i>Ramphotyphlops australis</i>			
180.	24243 <i>Rattus fuscipes</i> (Western Bush Rat)			
181.	24245 <i>Rattus rattus</i> (Black Rat)	Y		
182.	24776 <i>Recurvirostra novaehollandiae</i> (Red-necked Avocet)			
183.	25613 <i>Rhipidura fuliginosa</i> (Grey Fantail)			
184.	24452 <i>Rhipidura fuliginosa</i> subsp. <i>preissi</i>			
185.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
186.	24454 <i>Rhipidura leucophrys</i> subsp. <i>leucophrys</i>			
187.	25534 <i>Sericornis frontalis</i> (White-browed Scrubwren)			
188.	25266 <i>Simoselaps bertholdi</i> (Jan's Banded Snake)			
189.	30948 <i>Smicromis brevirostris</i> (Weebill)			
190.	24517 <i>Stercorarius parasiticus</i> (Arctic Skua)			
191.	25642 <i>Sterna hirundo</i> (Common Tern)			
192.	24529 <i>Sterna leucoptera</i> (White-winged Black Tern)			
193.	24530 <i>Sterna nereis</i> subsp. <i>nereis</i>			
194.	24533 <i>Sterna paradisaea</i> (Arctic Tern)			
195.	25597 <i>Strepera versicolor</i> (Grey Currawong)			
196.	25589 <i>Streptopelia chinensis</i> (Spotted Turtle-Dove)	Y		
197.	25590 <i>Streptopelia senegalensis</i> (Laughing Turtle-Dove)	Y		
198.	25705 <i>Tachybaptus novaehollandiae</i> (Australasian Grebe (Black-throated Grebe))			
199.	24331 <i>Tadorna tadornoides</i> (Australian Shelduck (Mountain Duck))			
200.	24844 <i>Threskiornis molucca</i> (Australian White Ibis)			
201.	24845 <i>Threskiornis spinicollis</i> (Straw-necked Ibis)			
202.	25519 <i>Tiliqua rugosa</i>			
203.	25207 <i>Tiliqua rugosa</i> subsp. <i>rugosa</i>			
204.	25549 <i>Todiramphus sanctus</i> (Sacred Kingfisher)			
205.	24309 <i>Todiramphus sanctus</i> subsp. <i>sanctus</i>			
206.	25723 <i>Trichoglossus haematodus</i> (Rainbow Lorikeet)			
207.	25521 <i>Trichosurus vulpecula</i>			
208.	24158 <i>Trichosurus vulpecula</i> subsp. <i>vulpecula</i> (Common Brushtail Possum)			
209.	24803 <i>Tringa brevipes</i> (Grey-tailed Tattler)			
210.	24808 <i>Tringa nebularia</i> (Common Greenshank)			
211.	24809 <i>Tringa stagnatilis</i> (Marsh Sandpiper)			
212.	24069 <i>Tursiops truncatus</i> (Bottlenose Dolphin)			
213.	25218 <i>Varanus gouldii</i> (Bungarra or Sand Monitor)			
214.	25765 <i>Zosterops lateralis</i> (Grey-breasted White-eye (Silvereye))			
215.	24856 <i>Zosterops lateralis</i> subsp. <i>gouldi</i>			

Conservation Codes

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

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

Appendix Four: DIA Aboriginal Heritage Inquiry System Report



Search Criteria

1 sites in a search box. The box is formed by these diagonally opposed corner points:

MGA Zone 50	
Northing	Easting
6407112	381947
6408660	383682



Disclaimer

Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist. Consultation with Aboriginal communities is on-going to identify additional sites. The AHA protects all Aboriginal sites in Western Australia whether or not they are registered.

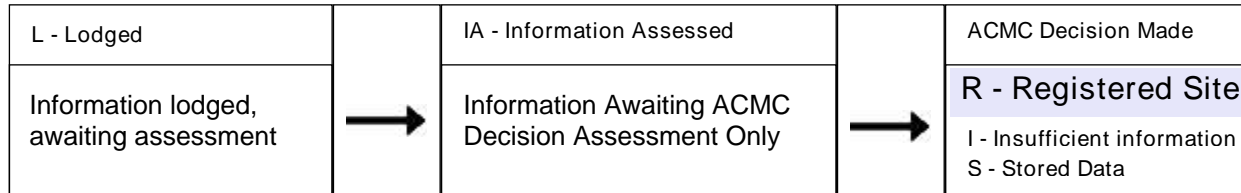
Copyright

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Legend

Restriction	Access	Coordinate Accuracy
N No restriction	C Closed	Accuracy is shown as a code in brackets following the site coordinates.
M Male access only	O Open	[Reliable] The spatial information recorded in the site file is deemed to be reliable, due to methods of capture.
F Female access	V Vulnerable	[Unreliable] The spatial information recorded in the site file is deemed to be unreliable due to errors of spatial data capture and/or quality of spatial information reported.

Status



*Explanation of Assessment

Sites lodged with the Department are assessed under the direction of the Registrar of Aboriginal Sites. These are not the final assessment.

Final assessment and decisions will be determined by the Aboriginal Cultural Material Committee (ACMC).

Spatial Accuracy

Index coordinates are indicative locations and may not necessarily represent the centre of sites, especially for sites with an access code "closed" or "vulnerable". Map coordinates (Lat/Long) and (Easting/Northing) are based on the GDA 94 datum. The Easting / Northing map grid can be across one or more zones. The zone is indicated for each Easting on the map, i.e. '5000000:Z50' means Easting=5000000, Zone=50.

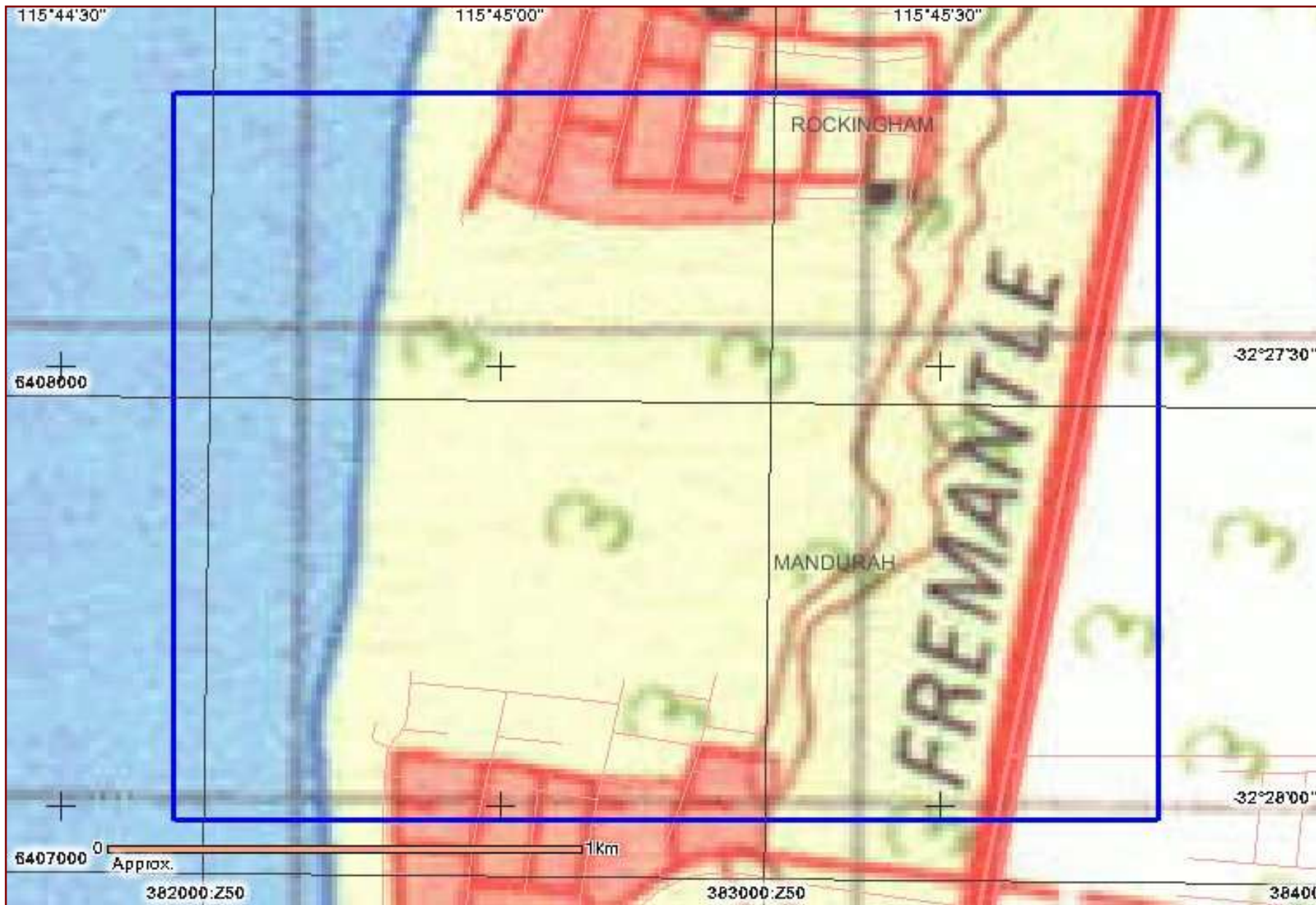
Sites Shown on Maps

Site boundaries may not appear on maps at low zoom levels







List of Registered Aboriginal Sites with Map

No results



Legend

Selected Heritage Sites

-  Registered Sites
-  Town
-  Map Area
-  Search Area

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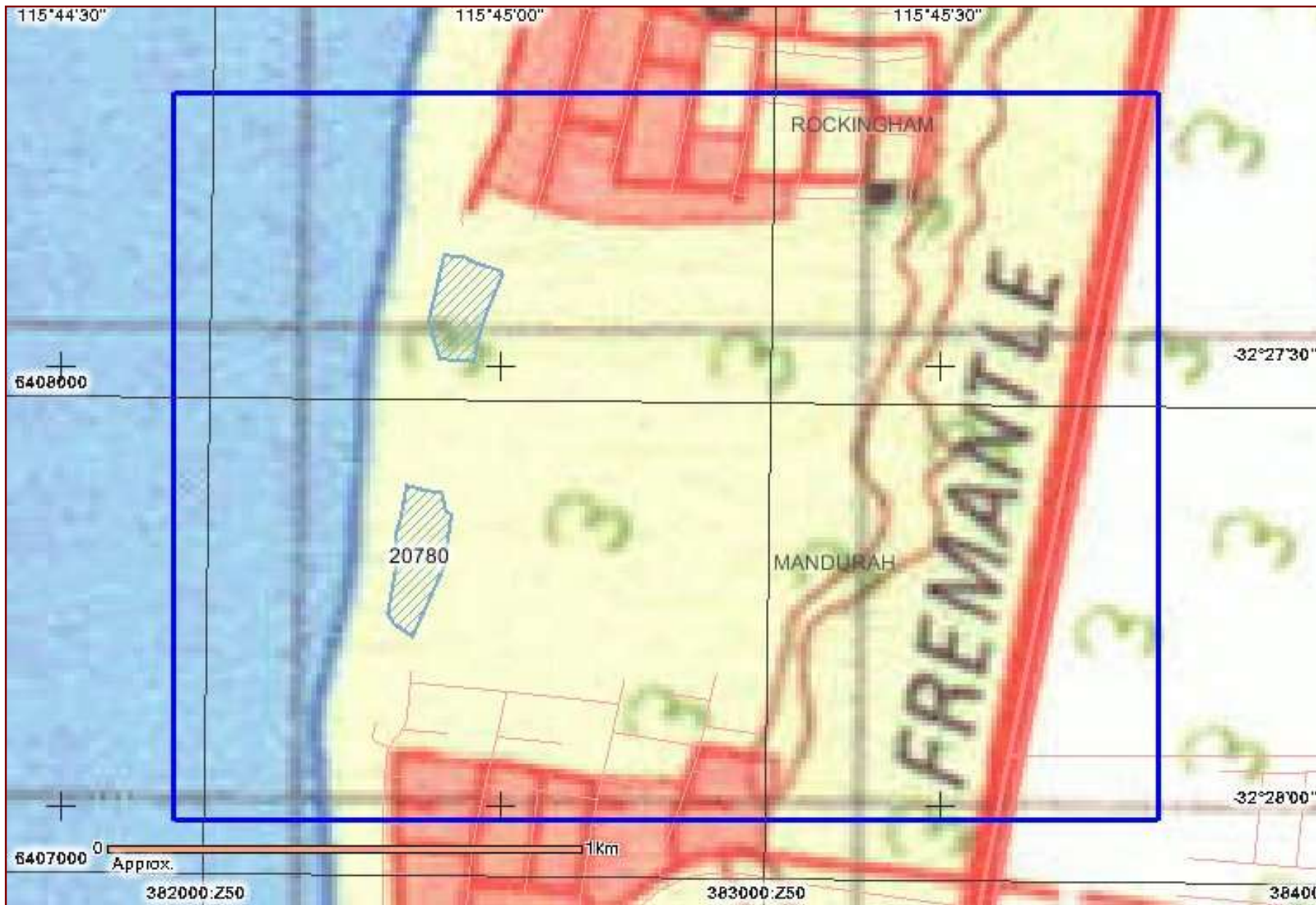
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For further important information on using this information please see the Department of Indigenous Affairs' Terms of Use statement at <http://www.dia.wa.gov.au/Terms-Of-Use/>



List of 1 Other Heritage Places with Map

Site ID	Status	Access	Restriction	Site Name	Site Type	Additional Info	Informants	Coordinates	Site No.
20780	L	O	N	Madora Bay Foreshore Reserve - Bush Tucker Area		Plant Resource, [Other: Bush Tucker Area]	*Registered Informant names available from DIA.	382409mE 6407916mN Zone 50 [Reliable]	



Legend

- Selected Heritage Sites
- Other Heritage Places
- Town
- Map Area
- Search Area

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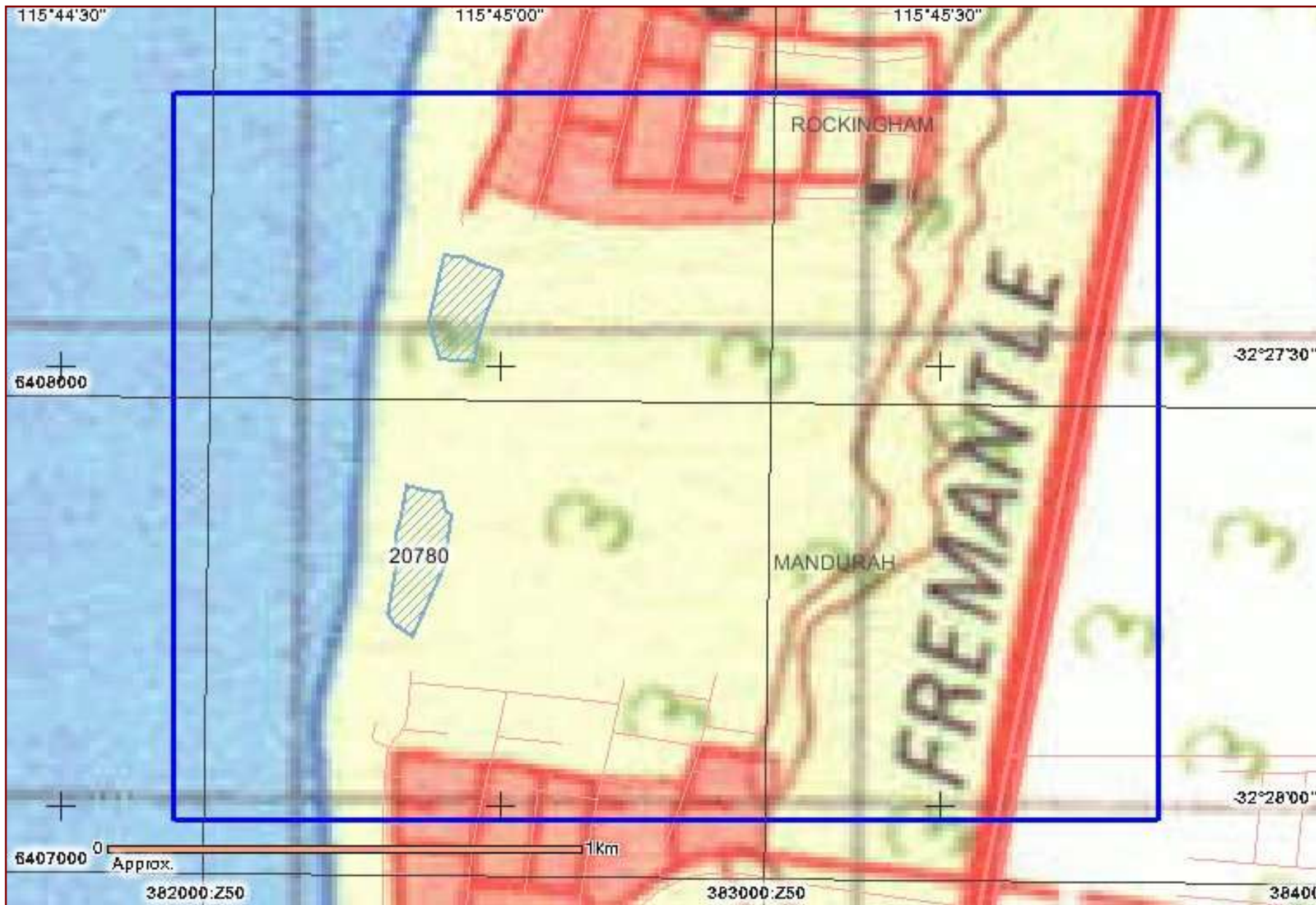
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Map Showing Registered Aboriginal Sites and Other Heritage Places



Legend

- Selected Heritage Sites
 - Registered Sites
 - Other Heritage Places
- Town
- Map Area
- Search Area

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Appendix Five: Quadrat Data

Site		1	
Described by	SK	7/09/2011	Quadrat 10 m x 10 m
Season	Good		
MGA Zone	50	382253mE	6407486mN
Habitat	Primary dunes		
Soil	Light grey sand		
Rock Type	Nil		
Vegetation	<i>Olearia axillaris</i> , <i>Scaevola crassifolia</i> low shrubland over <i>*Trachyandra divaricata</i> , <i>*Pelargonium capitatum</i> , <i>*Gazania linearis</i> open herbland.		
Vegetation Condition	Good		
Fire Age	No evidence		
Notes	Disturbed by weeds and erosion		



Species	Cover (%)	Height (m)	Species	Cover (%)	Height (m)
<i>Acanthocarpus preissii</i>		0.3	<i>*Pelargonium capitatum</i>	5	0.3
<i>Carpobrotus virescens</i>	1	0.2	Poaceae sp.		0.2
<i>Cassytha racemosa</i> forma <i>racemosa</i>	1	1	<i>Scaevola crassifolia</i>	2	0.6
<i>Crassula glomerata</i>	2	0.1	<i>Spinifex longifolius</i>	2	1
<i>*Euphorbia paralias</i>		0.4	<i>Spyridium globulosum</i>		0.5
<i>*Gazania linearis</i>	5	0.3	<i>*Tetragonia decumbens</i>	1	0.3
<i>*Lagurus ovatus</i>		0.3	<i>*Trachyandra divaricata</i>	10	0.3
<i>Olearia axillaris</i>	8	0.8			

Site		2	
Described by	SK	7/09/2011	Quadrat 10 m x 10 m
Season	Good		
MGA Zone	50	382419mE	6408318mN
Habitat	Undulating dunes		
Soil	Light grey sand		
Rock Type	Nil		
Vegetation	<i>Spyridium globulosum</i> , <i>Olearia axillaris</i> , <i>Acacia saligna</i> open heath over <i>Acanthocarpus preissii</i> , <i>Carpobrotus virescens</i> , <i>*Trachyandra divaricata</i> shrubland/herbland.		
Vegetation Condition	Good		
Fire Age	No evidence		
Notes			



Species	Cover (%)	Height (m)	Species	Cover (%)	Height (m)
<i>Acacia saligna</i>	5	1.5	<i>Hibbertia cuneiformis</i>		0.8
<i>Acanthocarpus preissii</i>	20	0.4	<i>Isolepis cernua</i> var. <i>cernua</i>	1	0.1
<i>Alyxia buxifolia</i>	1	1.2	<i>Hemiandra pungens</i>	2	0.1
<i>Apium annuum</i>	2	0.1	<i>*Lagurus ovatus</i>	2	0.3
<i>*Bromus diandrus</i>	10	0.4	<i>Leptomeria preissiana</i>	2	1
<i>Calandrinia brevipedata</i>		0.1	<i>Olearia axillaris</i>	5	1.5
<i>Carpobrotus virescens</i>	10	0.2	<i>Parietaria debilis</i>		0.2
<i>Cassytha racemosa</i> forma <i>racemosa</i>	2	1.2	<i>*Pelargonium capitatum</i>	1	0.4
<i>Conostylis candicans</i>		0.4	<i>Rhagodia baccata</i> subsp. <i>baccata</i>	1	1.3
<i>Crassula glomerata</i>		0.1	<i>Senecio pinnatifolius</i> var. <i>latilobus</i>		0.3
<i>*Cuscuta epithymum</i>		0.1	<i>Spyridium globulosum</i>	20	1.5
<i>Hardenbergia comptoniana</i>	2	0.8	<i>*Trachyandra divaricata</i>	10	0.3

Site		3	
Described by	SK	7/09/2011	Quadrat 10 m x 10 m
Season	Good		
MGA Zone	50	382487mE	6407562mN
Habitat	Undulating dunes		
Soil	Light grey sand		
Rock Type	Nil		
Vegetation	<i>Acacia rostellifera</i> , <i>Spyridium globulosum</i> , <i>Alyxia buxifolia</i> tall open scrub over <i>Acanthocarpus preissii</i> , <i>*Bromus diandrus</i> , <i>Senecio pinnatifolius</i> var. <i>latilobus</i> herbland/grassland.		
Vegetation Condition	Good		
Fire Age	No evidence		
Notes			



Species	Cover (%)	Height (m)	Species	Cover (%)	Height (m)
<i>Acacia rostellifera</i>	30	2.5	<i>Crassula glomerata</i>		0.1
<i>Acanthocarpus preissii</i>	10	0.4	<i>*Euphorbia terracina</i>		0.4
<i>Alyxia buxifolia</i>	10	2	<i>Hardenbergia comptoniana</i>		0.8
<i>Apium annuum</i>		0.1	<i>Isolepis cernua</i> var. <i>cernua</i>		0.1
<i>*Bromus diandrus</i>	10	0.4	<i>Parietaria debilis</i>		0.3
<i>Calandrinia brevipedata</i>		0.1	<i>Senecio pinnatifolius</i> var. <i>latilobus</i>		0.4
<i>Calandrinia</i> sp. SW coastal (J. Dodd 753)		0.1	<i>Spyridium globulosum</i>	25	2.5
<i>Conostylis candicans</i>		0.4	<i>*Trachyandra divaricata</i>		0.4

Site		3a	
Described by	SK	8/09/2011	Quadrat 10 m x 10 m
Season	Good		
MGA Zone	50	383002mE	6407676mN
Habitat	Undulating dunes		
Soil	Light grey sand		
Rock Type	Nil		
Vegetation	<i>Acacia rostelifera</i> tall open scrub over <i>Acanthocarpus preissii</i> , * <i>Trachyandra divaricata</i> , <i>Senecio pinnatifolius</i> var. <i>latilobus</i> forbland.		
Vegetation Condition	Degraded		
Fire Age	No evidence		
Notes	Possibly a degraded version of the vegetation at Quadrat 3.		



Species	Cover (%)	Height (m)	Species	Cover (%)	Height (m)
<i>Acacia rostelifera</i>	20	2.5	<i>Crassula glomerata</i>	2	0.1
<i>Acacia saligna</i>	1	1.5	* <i>Euphorbia terracina</i>		0.4
<i>Acanthocarpus preissii</i>	10	0.4	<i>Isolepis cernua</i> var. <i>cernua</i>		0.1
<i>Adriana quadripartita</i>	2	0.8	<i>Lepidosperma</i> sp.		0.2
<i>Alyxia buxifolia</i>		1.5	<i>Leucopogon parviflorus</i>		1
* <i>Avena barbata</i>	5	0.5	<i>Senecio pinnatifolius</i> var. <i>latilobus</i>	10	0.4
* <i>Bromus diandrus</i>	5	0.4	<i>Spyridium globulosum</i>		1.5
<i>Clematis linearifolia</i>	1	1	* <i>Trachyandra divaricata</i>	10	0.4
<i>Conostylis candicans</i>		0.3			

Site		4	
Described by	SK	8/09/2011	Quadrat 10 m x 10 m
Season	Good		
MGA Zone	50	382815mE	6408104mN
Habitat	Slight depression in landscape		
Soil	Brown loamy sand, highly organic		
Rock Type	Nil		
Vegetation	<i>Acacia rostellifera</i> closed tall scrub over <i>Calandrinia brevipedata</i> , <i>Crassula glomerata</i> , <i>Apium annuum</i> forbland.		
Vegetation Condition	Good		
Fire Age	No evidence		
Notes	Disturbed by grazing and weeds.		



Species	Cover (%)	Height (m)
<i>Acacia rostellifera</i>	75	4
<i>Acanthocarpus preissii</i>	1	0.4
<i>Alyxia buxifolia</i>	1	1.5
<i>Apium annuum</i>	5	0.1
* <i>Bromus diandrus</i>		0.3
<i>Caladenia latifolia</i>		0.4
<i>Calandrinia brevipedata</i>	10	0.1
<i>Clematis linearifolia</i>	10	4
<i>Crassula glomerata</i>	10	0.1
<i>Lomandra maritima</i>	1	0.2
<i>Parietaria debilis</i>	2	0.2
<i>Spyridium globulosum</i>		2

Site		5	
Described by	SK	7/09/2011	Releve
Season	Good		
MGA Zone	50	382623mE	6407975mN
Habitat	Dunes		
Soil	Light grey brown sand		
Rock Type	Nil		
Vegetation	<i>Acacia saligna</i> , <i>A. rostellifera</i> open shrubland over <i>Acanthocarpus preissii</i> , * <i>Trachyandra divaricata</i> , <i>Conostylis candicans</i> herbland.		
Vegetation Condition	Degraded		
Fire Age	No evidence		
Notes	Heavily disturbed by grazing, erosion and weeds.		



Species	Cover (%)	Height (m)
<i>Acacia lasiocarpa</i> var. <i>lasiocarpa</i>		0.4
<i>Acacia rostellifera</i>	2	1.5
<i>Acacia saligna</i>	2	1.5
<i>Acanthocarpus preissii</i>	25	0.4
<i>Conostylis candicans</i>	8	0.4
<i>Leucopogon parviflorus</i>		1
<i>Santalum acuminatum</i>		1
<i>Senecio pinnatifolius</i> var. <i>latilobus</i>		0.4
* <i>Trachyandra divaricata</i>	25	0.4

Site 6			
Described by	SK	8/09/2011	Quadrat 10 m x 10 m
Season	Good		
MGA Zone	50	383223mE	6407829mN
Habitat	Tall dunes		
Soil	Grey sand		
Rock Type	Nil		
Vegetation	<i>Acacia saligna</i> , <i>Adriana quadripartita</i> shrubland over <i>*Trachyandra divaricata</i> , <i>Acanthocarpus preissii</i> , <i>Senecio pinnatifolius</i> var. <i>latilobus</i> herbland.		
Vegetation Condition	Degraded		
Fire Age	No evidence		
Notes	Disturbed by grazing, weeds, erosion.		



Species	Cover (%)	Height (m)	Species	Cover (%)	Height (m)
<i>Acacia cochlearis</i>	1	0.5	<i>*Euphorbia terracina</i>		0.3
<i>Acacia lasiocarpa</i> var. <i>lasiocarpa</i>	2	0.5	<i>*Heliophila pusilla</i>		0.3
<i>Acacia rostellifera</i>	1	0.6	<i>Isolepis cernua</i> var. <i>cernua</i>	2	0.1
<i>Acacia saligna</i>	5	1	<i>Jacksonia furcellata</i>		2
<i>Acanthocarpus preissii</i>	10	0.3	<i>Lepidosperma</i> sp.		0.1
<i>Adriana quadripartita</i>	5	1	<i>Leucopogon parviflorus</i>	1	0.6
<i>*Bromus diandrus</i>	5	0.3	<i>Phyllanthus calycinus</i>		0.5
<i>Conostylis candicans</i>		0.3	<i>Senecio pinnatifolius</i> var. <i>latilobus</i>	10	0.4
<i>Crassula glomerata</i>	1	0.1	<i>*Trachyandra divaricata</i>	20	0.4
<i>Desmodcladus flexuosus</i>		0.2			

Site 7			
Described by	SK	8/09/2011	Releve
Season	Good		
MGA Zone	50	383477mE	6408265mN
Habitat	Flat		
Soil	Yellow brown sand		
Rock Type	Limestone		
Vegetation	<i>Hakea prostrata</i> , <i>Allocasuarina humilis</i> mid-high sparse shrubland over <i>*Lupinus cosentinii</i> , <i>*Poaceae</i> spp., <i>*Euphorbia terracina</i> grassland/herbland.		
Vegetation Condition	Completely degraded		
Fire Age	No evidence		
Notes	Vegetation structure almost completely modified, mostly paddock dominated by weeds. Lots of planted eucalypts and various other species.		



Species	Cover (%)	Height (m)
<i>Allocasuarina humilis</i>	2	1
<i>*Euphorbia terracina</i>	10	0.4
<i>Hakea prostrata</i>	2	1
<i>*Lupinus cosentinii</i>	10	0.5
<i>*Poaceae</i> spp.	50	0.4

Site 8			
Described by	SK	8/09/2011	Quadrat 10 m x 10 m
Season	Good		
MGA Zone	50	383343mE	6407427mN
Habitat	Slight rise, mostly flat		
Soil	Yellow brown sand		
Rock Type	Limestone		
Vegetation	<i>Acacia rostellifera</i> , <i>Allocasuarina humilis</i> open heath over * <i>Poaceae</i> spp., * <i>Trachyandra divaricata</i> , * <i>Hypochaeris glabra</i> grassland/herbland.		
Vegetation Condition	Degraded		
Fire Age	No evidence		
Notes	Disturbed by cattle and weeds.		



Species	Cover (%)	Height (m)	Species	Cover (%)	Height (m)
<i>Acacia rostellifera</i>	35	1.8	<i>Grevillea preissii</i> subsp. <i>preissii</i>	1	0.5
<i>Allocasuarina humilis</i>	3	1.5	* <i>Hypochaeris glabra</i>	5	0.3
* <i>Avena barbata</i>	5	0.3	<i>Kennedia prostrata</i>		0.1
<i>Banksia dallanneyi</i> var. <i>dallanneyi</i>	1	0.1	<i>Lepidosperma</i> sp.		0.2
<i>Beyeria cinerea</i> subsp. <i>Cinerea</i>		0.2	* <i>Lupinus cosentinii</i>		0.5
* <i>Brassica tournefortii</i>	1	0.4	* <i>Lysimachia arvensis</i>	2	0.1
<i>Conostylis pauciflora</i> subsp. <i>pauciflora</i>	1	0.3	<i>Melaleuca systema</i>	2	0.6
<i>Desmodcladus flexuosus</i>	1	0.2	* <i>Sonchus oleraceus</i>	1	0.2
* <i>Ehrharta calycina</i>	2	0.8	* <i>Trachyandra divaricata</i>		0.4
* <i>Euphorbia terracina</i>	2	0.4			

Appendix Six: Species Matrix

Table 21: Flora Taxa within Floristic Quadrats

* denotes species that were recorded outside the quadrat/relevé site, but within the same vegetation unit

Family	Intro.	DEC Status	Species Name	Q1	Q2	Q3	Q3a	Q4	R5	Q6	R7	Q8
Aizoaceae			<i>Carpobrotus virescens</i>	1	1							
Aizoaceae	Y		<i>Tetragonia decumbens</i>	1								
Anacardiaceae	Y		<i>Schinus terebinthifolius</i>								*	
Apiaceae			<i>Apium annuum</i>		1	1		1				
Apocynaceae			<i>Alyxia buxifolia</i>	*	1	1	1	1				
Asparagaceae			<i>Acanthocarpus preissii</i>	1	1	1	1	1	1	1		
Asparagaceae			<i>Lomandra maritima</i>			*	*	1		*		
Asphodelaceae	Y		<i>Asphodelus fistulosus</i>								*	
Asphodelaceae	Y		<i>Trachyandra divaricata</i>	1	1	1	1	*	1	1	*	1
Asteraceae	Y		<i>Arctotheca calendula</i>				*			*	*	
Asteraceae	Y		<i>Gazania linearis</i>	1								
Asteraceae	Y		<i>Hypochaeris glabra</i>									1
Asteraceae			<i>Olearia axillaris</i>	1	1							
Asteraceae			<i>Ozothamnus cordatus</i>	*								
Asteraceae			<i>Senecio pinnatifolius</i> var. <i>latilobus</i>	*	1	1	1		1	1		
Asteraceae	Y		<i>Sonchus oleraceus</i>									1
Brassicaceae	Y		<i>Brassica tournefortii</i>							*		1
Brassicaceae	Y		<i>Cakile maritime</i>	*								
Brassicaceae	Y		<i>Heliophila pusilla</i>							1		
Casuarinaceae			<i>Allocasuarina humilis</i>								1	1
Chenopodiaceae			<i>Rhagodia baccata</i> subsp. <i>baccata</i>		1	*						
Chenopodiaceae			<i>Salsola tragus</i>	*								
Convolvulaceae	Y		<i>Cuscuta epithymum</i>		1							
Crassulaceae	Y		<i>Crassula glomerata</i>	1	1	1	1	1		1		
Cupressaceae			<i>Callitris preissii</i>				*	*				
Cyperaceae			<i>Ficinia nodosa</i>	*								
Cyperaceae			<i>Isolepis cernua</i> var. <i>cernua</i>		1	1	1			1		
Cyperaceae			<i>Lepidosperma gladiatum</i>		*	*		*				
Cyperaceae			<i>Lepidosperma</i> sp.				1			1		1
Cyperaceae			<i>Schoenus grandiflorus</i>			*						
Dilleniaceae			<i>Hibbertia cuneiformis</i>	*	1	*						
Ericaceae			<i>Acrotriche cordata</i>		*							
Ericaceae			<i>Leucopogon insularis</i>							*		
Ericaceae			<i>Leucopogon parviflorus</i>		*	*	1	*	1	1		
Euphorbiaceae			<i>Adriana quadripartita</i>				1			1		

Family	Intro.	DEC Status	Species Name	Q1	Q2	Q3	Q3a	Q4	R5	Q6	R7	Q8
Euphorbiaceae		P4	<i>Beyeria cinerea</i> subsp. <i>cinerea</i>									1
Euphorbiaceae	Y		<i>Euphorbia paralias</i>	1								
Euphorbiaceae	Y		<i>Euphorbia terracina</i>			1	1		*	1	1	1
Fabaceae			<i>Acacia cochlearis</i>							1		
Fabaceae			<i>Acacia cyclops</i>	*	*						*	
Fabaceae			<i>Acacia lasiocarpa</i> var. <i>lasiocarpa</i>		*	*			1	1	*	
Fabaceae			<i>Acacia rostelifera</i>			1	1	1	1	1	*	1
Fabaceae			<i>Acacia saligna</i>		1	*	1		1	1		
Fabaceae			<i>Daviesia physodes</i>								*	
Fabaceae			<i>Hardenbergia comptoniana</i>		1	1		*				
Fabaceae			<i>Jacksonia furcellata</i>			*				1		
Fabaceae			<i>Kennedia prostrata</i>							*		1
Fabaceae	Y		<i>Lupinus cosentinii</i>								1	1
Geraniaceae	Y		<i>Erodium cicutarium</i>							*		
Geraniaceae	Y		<i>Pelargonium capitatum</i>	1	1							
Goodeniaceae			<i>Scaevola crassifolia</i>	1	*							
Haemodoraceae			<i>Conostylis candicans</i>		1	1	1		1	1		
Haemodoraceae		P4	<i>Conostylis pauciflora</i> subsp. <i>pauciflora</i>									1
Iridaceae	Y		<i>Romulea rosea</i>								*	
Lamiaceae			<i>Hemiandra pungens</i>		1							
Lauraceae			<i>Cassythia racemosa</i> forma <i>racemosa</i>	1	1							
Myrtaceae			<i>Agonis flexuosa</i>				*				*	
Myrtaceae			<i>Eucalyptus conferruminata</i>								*	
Myrtaceae			<i>Eucalyptus erythrocorys</i>								*	
Myrtaceae			<i>Eucalyptus gomphocephala</i>								*	
Myrtaceae			<i>Eucalyptus platypus</i>								*	
Myrtaceae			<i>Eucalyptus</i> sp.								*	
Myrtaceae	Y		<i>Leptospermum laevigatum</i>							*		
Myrtaceae			<i>Melaleuca huegelii</i> subsp. <i>huegelii</i>								*	
Myrtaceae			<i>Melaleuca systema</i>			*				*	*	1
Orchidaceae			<i>Caladenia latifolia</i>		*			1				
Orchidaceae			<i>Cyrtostylis</i> sp.					*				
Oxalidaceae	Y		<i>Oxalis pes-caprae</i>			*					*	
Papaveraceae	Y		<i>Fumaria capreolata</i>								*	
Phyllanthaceae			<i>Phyllanthus calycinus</i>							1		
Poaceae	Y		<i>Ammophila arenaria</i>	*								
Poaceae	Y		<i>Avena barbata</i>				1					1
Poaceae	Y		<i>Bromus diandrus</i>		1	1	1	1		1	*	
Poaceae	Y		<i>Ehrharta calycina</i>								*	1
Poaceae	Y		<i>Lagurus ovatus</i>	1	1	*	*			*	*	

Family	Intro.	DEC Status	Species Name	Q1	Q2	Q3	Q3a	Q4	R5	Q6	R7	Q8
Poaceae			Poaceae sp.								1	
Poaceae			Poaceae sp.	1								
Poaceae			<i>Spinifex hirsutus</i>	*								
Poaceae			<i>Spinifex longifolius</i>	1	*							
Portulacaceae			<i>Calandrinia brevipedata</i>		1	1		1		*		
Portulacaceae			<i>Calandrinia</i> sp. SW coastal (J. Dodd 753)			1						
Portulacaceae			<i>Calandrinia</i> sp. Two Rocks (K. Richardson 211)		*	*						
Primulaceae	Y		<i>Lysimachia arvensis</i>								*	1
Proteaceae			<i>Banksia dallanneyi</i> var. <i>dallanneyi</i>								*	1
Proteaceae			<i>Grevillea preissii</i> subsp. <i>preissii</i>							*	*	1
Proteaceae			<i>Hakea prostrata</i>			*					1	
Ranunculaceae			<i>Clematis linearifolia</i>			*	1	1		*		
Restionaceae			<i>Desmodcladus flexuosus</i>							1	*	1
Rhamnaceae			<i>Spyridium globulosum</i>	1	1	1	1	1	*	*		
Rutaceae			<i>Diplolaena dampieri</i>			*						
Santalaceae			<i>Exocarpos sparteus</i>							*		
Santalaceae			<i>Leptomeria preissiana</i>		1							
Santalaceae			<i>Santalum acuminatum</i>		*	*			1			
Scrophulariaceae			<i>Eremophila glabra</i> subsp. <i>albicans</i>							*		
Scrophulariaceae			<i>Myoporum insulare</i>	*								
Solanaceae	Y		<i>Solanum linnaeanum</i>								*	
Urticaceae			<i>Parietaria debilis</i>		1	1		1				
Violaceae			<i>Hybanthus calycinus</i>				*				*	
Xanthorrhoeaceae			<i>Xanthorrhoea preissii</i>								*	

Appendix Seven: Conservation significant flora, Declared plants

Table 22: Conservation significant flora locations within the study area

Species	Cons. status	Northing	Easting	No. plants
<i>Conostylis pauciflora</i> subsp. <i>pauciflora</i>	P4	6407410	383294	1
<i>Conostylis pauciflora</i> subsp. <i>pauciflora</i>	P4	6407284	383305	1
<i>Conostylis pauciflora</i> subsp. <i>pauciflora</i>	P4	6407191	383216	1
<i>Conostylis pauciflora</i> subsp. <i>pauciflora</i>	P4	6407168	383306	5
<i>Conostylis pauciflora</i> subsp. <i>pauciflora</i>	P4	6407091	383189	18
<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P4	6407410	383294	3
<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P4	6407428	383343	1
<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P4	6407281	383324	1
<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P4	6407309	383302	1

Table 23: Declared Plant locations within the study area

Species	Northing	Easting	No. of plants
<i>Solanum linnaeanum</i>	6407676	382988	2
<i>Solanum linnaeanum</i>	6407067	383007	1
<i>Solanum linnaeanum</i>	6407721	383329	1

Appendix Eight: Fauna and habitat photographs



Plate 12. South-west Spiny-tailed Gecko *Strophurus spinigerus*

Two individuals from under rubbish near northern boundary of study site.



Plate 13. Open woodland in south-east part of study site, and some birds associated with this habitat

Magpie *Cracticus tibicen*, Red-capped parrot *Purpureicephalus spurius* (on Marri), Rufous Whistler *Pachycephala rufiventris*.



Plate 14. Cattle feeding on steep dune



Plate 15. Dune habitat in western part of site at location of Fox sighting; fresh Rabbit dig with hind-foot tracks at same location; Fox tracks from another location near southern boundary of site.

APPENDIX 5

**EPA DETERMINATION LOT 101 MANDURAH ROAD, MADORA BAY
(Source: Environmental Protection Authority, 2012)**



Environmental Protection Authority

The Atrium,
Level 8, 168 St Georges Terrace,
Perth, Western Australia 6000.
Telephone: (08) 6467 5000.
Facsimile: (08) 6467 5557.

Postal Address: Locked Bag 33,
Cloisters Square, Perth, Western Australia 6850.
Website: www.epa.wa.gov.au

Secretary
Western Australian Planning Commission
Unit 2B, 11-13 Pinjarra Road
MANDURAH WA 6210

Your Ref RLS/0251 0294/1
Our Ref A539701
Enquiries Gerard O'Brien
Phone 6467 5459

ATTENTION: Brett Pye

DECISION UNDER SECTION 48A(1)(a) *Environmental Protection Act 1986*

SCHEME AMENDMENT TITLE: Peel Region Scheme Amendment 035/57 -
to transfer about 61 hectares of land from
Rural zone to Urban zone
LOCATION: Madora Bay (North)
LOCALITY: City of Mandurah
RESPONSIBLE AUTHORITY: Western Australian Planning Commission
DECISION: Scheme Amendment Not Assessed -
Advice Given (no appeals)

Thank you for referring the above scheme amendment to the Environmental Protection Authority (EPA).

After consideration of the information provided by you, the Environmental Protection Authority (EPA) considers that the proposed scheme amendment should not be assessed under Part IV Division 3 of the *Environmental Protection Act 1986* (EP Act) but nevertheless provides the following advice and recommendations.

ADVICE AND RECOMMENDATIONS

1. Environmental Issues

- Vegetation and Landform

2. Advice and recommendations regarding Environmental Issues

Vegetation and Landform

In its recommendations on Conservation Reserves for Western Australia in *The Darling System 6 Part II: Recommendations for Specific Localities 1983* the EPA considered the land which is the subject of Amendment 035/57 (M107).



The EPA noted that the area has extensive coastal dunes which are very valuable for their coastal vegetation and for recreational and aesthetic reasons. The EPA recommended vegetated buffer zones and the provision of an east-west link of vegetation between Mandurah Road and the coast.

The EPA notes that majority of the site is in a degraded condition due to the rural nature of the property. However, the EPA advises that an east-west vegetation linkage should be considered during future planning stages to provide an ecological corridor between developments.

The EPA supports the retention of the highest dune at the northern end of the site and remaining good quality vegetation during the preparation of an outline development plan. The EPA also supports the retention of Priority flora species, and *Lomandra maritima* habitat (for the Graceful Sun-moth) within Public Open Space areas and the Foreshore Reserve.

3. General Advice

- For the purposes of Part IV of the EP Act, the scheme amendment is defined as an assessed scheme amendment. In relation to the implementation of the scheme amendment, please note the requirements of Part IV Division 4 of the EP Act.
- There is no appeal right in respect of the EPA's decision on the level of assessment of scheme amendments.
- A copy of this advice will be sent to relevant authorities and made available to the public on request.



Anthony Sutton
Director
Assessment and Compliance Division

24 September 2012

APPENDIX 6

**EPBC 2012/6466 REFERRAL DECISION
(Source: Department of the Environment, 2013)**



Notification of

REFERRAL DECISION – not controlled action

Residential Development Lot 100 Mandurah Road, Madora Bay WA (EPBC 2012/6466)

This decision is made under Section 75 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Proposed action

person named in the referral BH Perry, JD Perry & PR Perry & the trustee for the Nancy Grace Perry Testamentary Trust

ABN: 96 347 949 440

proposed action To undertake a residential subdivision and associated infrastructure works on Lot 100 Mandurah Road, Madora Bay, Western Australia; as described in the referral received by the Department on 16 July 2012.

(See EPBC Act referral 2012/6466)

Referral decision: Not a controlled action

status of proposed action The proposed action is not a controlled action.

Person authorised to make decision

Name and position Barbara Jones
Assistant Secretary
North, West and Offshore Assessment Branch

signature

date of decision 3 January 2013

APPENDIX 7

**ENVIRONMENTAL ASSESSMENT – LOT 9013 MANDURAH ROAD
(Source: ATA Environmental, 2005)**

2004/204

Version 3

MADORA PARTNERSHIP

**MADORA BAY EAST (LOT 9013)
ENVIRONMENTAL ASSESSMENT**



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VERSION 3

APRIL 2005

REPORT NO: 2004/204

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Document No: MPU-2004-002-VEAS_001_sg_V3

Report No: 2004/204

Checked by: Signed:



Name: Shaun Grein

Date: 12 April 2005

Approved by: Signed:



Name: Paul van der Moezel

Date: 12 April 2005

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1. INTRODUCTION

1.1 Background and Location

This report presents information on the environmental features of Lot 9013 (Madora East) which is adjacent to the township of Madora in the City of Mandurah. Madora is a small settlement on the coast located just south of the boundary of the Perth Metropolitan Region. The area around the settlement is owned by the Madora Partnership and is referred to as the Madora Bay East property in this report.

The Madora Bay East property that is the subject of this report is in the City of Mandurah adjacent to the existing township of Madora and to the immediate south of Madora Beach Road (Figure 1). The study area is 61.53ha in area.

The Madora Bay East property is currently undeveloped and includes some remnant vegetation between the Madora townsite and Fremantle Road. The area has a long history of the grazing up to the present day and is currently zoned Urban Deferred in the Peel Region Scheme.

The report includes an assessment of the physical and biological features of the Madora Bay East property and provides a description of the geomorphology, landform and landscape, and vegetation and flora of the area. The report also provides supporting information to assist in the preparation of the Outline Development Plan for the area.

2. EXISTING ENVIRONMENT

2.1 Land Use

Lot 9013 Madora Bay East has been historically grazed for the past 80-100 years and remains the current land use over the area. Adjacent land uses includes urban developments at Madora townsite to the immediate west.

2.2 Physical Features

There are two major geological units associated with Lot 9013 Madora Bay East. These are the Safety Bay Sand and the Tamala Limestone units. The Safety Bay Sand unit is the youngest unit and typically occurs on and relatively close to the present coastline. It is composed of shell fragments (mainly foraminifers and molluscs) and variable quantities of quartz and minor feldspar.

The Tamala Limestone is a unit of friable to hard, medium grain, eolian calcarenite composed of wind blown shell fragments with variable amounts of quartz sand. It is older than the Safety Bay Sand (Pleistocene/early Holocene compared to Holocene) and at Madora Bay East is located inland of the Safety Bay Sand adjacent to Fremantle Rd.

Both the Safety Bay Sand and the Tamala Limestone units occur as various types of surface landforms (geomorphic units). These landforms each aligned roughly north-west to south-east and parallel to the coast. The oldest landforms are adjacent to Fremantle Road. The sequence of landforms from youngest to oldest is as follows:

- A series of parabolic dunes with peak elevations of 20 to 30m AHD through the central portion of the property. These dunes are between 200m and 400m in width south of Madora Beach Road but are narrower in southernmost part of the Madora Bay East where they are relatively narrow with a width of about 100m west to east.
- A limestone plain that extends from the base of the parabolic dune system (described above) to Fremantle Road. This plain is relatively flat and has a large quantity of limestone rocks on its surface (Tamala Limestone).

3. VEGETATION AND FLORA

3.1 Methodology

A qualified botanist from ATA Environmental conducted a flora and vegetation survey of the Lot 9013 on 20 September 2004. A further survey of an additional small area in the southeastern portion of Lot 9013 was conducted on 4 March 2005. The surveys were undertaken to determine if any of the significant species identified by CALM actually occur or are likely to occur on the site. This was based on sampling within quadrats of 10m x 10m dimension as well as a thorough site walkover to record all plant species present at the time of the survey. This method complies with the EPA's guidelines for flora surveys as outlined in the recently released Guidance Statement No. 51 *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004).

Apart from perimeter access tracks and firebreaks, vehicle access was limited to the perimeter of the site and much of the survey was conducted by traversing the area by foot. The major vegetation types and associated flora were surveyed and delineated using a 1:3,500 colour orthophotograph. The vegetation was described and mapped according to the structure and species composition of the dominant stratum using the system adopted in Bush Forever (2000). A total of ten hours was spent surveying the site. This is considered an adequate survey period considering the relatively size of the study area and ease of access through the vegetation.

A search of CALM's Declared Rare and Priority Flora database was undertaken by ATA Environmental. The database search found that four Priority taxa had been previously recorded from the vicinity of the study area but not from the Madora Bay East property itself. These are:

- *Conostylis pauciflora* ssp. *pauciflora* (Priority 4);
- *Eucalyptus rudis* ssp. *cratyantha* (Priority 4);
- *Jacksonia sericea* (Priority 3); and
- *Lasiopetalum membranaceum* (Priority 3).

3.2 Vegetation Complexes

The study area consists of vegetation belonging to two Vegetation Complexes: the Quindalup Vegetation Complex, which occurs over the western half of the Madora Bay East property and the Cottesloe Vegetation Complex – Central and South (Hedde *et al.*, 1980) which is associated with the eastern half of the property.

The Quindalup Vegetation Complex is described as a coastal dune complex consisting mainly of new foredunes and stable dunes (Hedde *et al.*, 1980). This Complex extends in an almost continuous thin strip along the coast from Dongara in the north to Busselton in the south. There is considerable variation in the vegetation that comprises the Quindalup Complex both at the local and regional level. For example, at the local level an area of the Quindalup Complex can include strand vegetation through to heathlands, woodlands and forests on the older and less exposed dunes

further inland. At the regional level there are noticeable changes in the species composition of the vegetation along the geographic range of the complex.

The Cottesloe Vegetation Complex – Central and South which is associated with a mosaic of woodland of Tuart (*Eucalyptus gomphocephala*) and open forest of Tuart - Jarrah (*Eucalyptus marginata*)-Marri (*Corymbia calophylla*) and closed heaths on limestone (Hedde *et al.*, 1980).

3.3 Vegetation Types

Vegetation can be described and mapped at a finer level than the vegetation complexes (i.e vegetation types). The vegetation types occurring on Lot 9013 are related to the soil types and landforms and are described as follows:

- Quindalup Dune Vegetation
 - Older beach ridge dune vegetation.
 - Tall linear dune vegetation.
- Spearwood Dune Vegetation
 - Limestone outcrop vegetation.

Older Beach Ridge Dunes

The distinctive vegetation unit on the older beach ridge plain is an *Acacia rostellifera* Shrubland and Heath with some dense *Acacia rostellifera* Scrub. Other shrub species common on the plain are *Hemiandra pungens*, *Conostylis candicans*, *Lomandra maritima*, *Acanthocarpus preissii* and *Schoenus grandiflorus*.

Tall Linear Dunes

The characteristic vegetation association on the tall eastern linear dunes is a *Melaleuca systena*/*Lomandra maritima* Shrubland with areas of *Jacksonia furcellata* dominated Shrubland in the southern half. Other vegetation associations include a *Santalum acuminatum* Shrubland and *Acacia rostellifera* Shrublands. *Acacia cochlearis* also forms dense stands on some slopes.

Limestone Outcrops

Between the tall linear dunes and the eastern property boundary (Fremantle Road) is a low flat area with large areas of exposed limestone. The main vegetation unit occurring on the limestone is *Allocasuarina humilis*/*Grevillea preissii* and *Hakea prostrata* Heath to Shrubland. *Eucalyptus platypus* var. *heterophylla* has been previously planted along the eastern and northern boundaries of Lot 9013. The species composition of the limestone areas is very different from that of the Quindalup Dune vegetation types and includes typical limestone indicator species such as *Dryandra lindleyana* and *Petrophile serracea*. Some large areas of *Acacia rostellifera* Heath and Scrub also occur on outcropping limestone areas.

Twelve vegetation types associated with the Madora Bay East property were identified and described during the flora and vegetation survey undertaken by ATA Environmental on 20 September 2004 and 4 March 2005. These are:

- *Acacia rostellifera* Tall Open Scrub.
- *Acacia rostellifera*/*Acacia saligna* Shrubland.
- Mixed *Acacia saligna*, *Acacia rostellifera*, *Jacksonia furcellata* and *Hibbertia cuneiformis* Low Open Shrubland.
- *Acacia saligna* Low Open Shrubland.
- *Acacia rostellifera*/*Spyridium globulosum* Open Shrubland.
- *Acacia rostellifera* Tall Open Shrubland over *Santalum acuminatum* Low Open Shrubland.
- *Acacia rostellifera* Shrubland.
- *Acacia rostellifera*, *Allocasuarina humilis* and planted *Eucalyptus platypus* subsp. *heterophylla* Tall Shrubland.
- *Hakea prostrata* Open Shrubland.
- *Eucalyptus gomphocephala* Open Woodland(planted).
- Low Open Forest of planted *Eucalyptus platypus* subsp. *heterophylla* and *Agonis flexuosa*.
- Planted *Eucalyptus platypus* subsp. var. *heterophylla*.

The location and extent of each of the vegetation types recorded is shown in Figure 2. Floristic data collected from each of the ten quadrats surveyed on the Madora Bay East property is provided in Appendix 2. The vegetation types that were identified and mapped during this assessment are described below:

- *Acacia rostellifera* Tall Open Scrub – This vegetation type occurs through the central portions of the Madora Bay East property over the lower slopes of east-west linear older dunes, with some smaller isolated remnants on the limestone outcrops adjacent to Fremantle Rd. A larger area of this vegetation type with scattered plantings of Tuart (*Eucalyptus gomphocephala*) trees (to 20m in height) occurs over the southwestern corner of the study area. There was evidence of heavy grazing and a high level of the Declared Weed Geraldton Carnation (*Euphorbia terracina*) infestation associated with this vegetation type and according to the bushland condition rating scale provided in Bush Forever (2000) the condition was considered to range from Degraded to Good. The dense cover of the *Acacia rostellifera* canopy has resulted in the almost total exclusion of native understorey species. This vegetation type is dominated by *Acacia rostellifera* to 2.5m over *Phyllanthus calycinus* Low Open Shrubland

with herb species including *Acanthocarpus preissii* and *Conostylis candidans*. Weed species, including *Euphorbia terracina* and *Cynadon dactylon* form a significant component of the understorey.

- *Acacia rostellifera*/*Acacia saligna* Shrubland – This vegetation type (to 1.5m in height) occurs as a relatively small remnant on the limestone outcropping adjacent to Fremantle Rd. This area has been heavily grazed and is consequently in a Degraded to Good condition. Coastal Moort *Eucalyptus platypus* var. *heterophylla* has been sporadically planted within this vegetation type. The vegetation is dominated by *Acacia rostellifera* and *Acacia saligna* to 1.5m in height over *Jacksonia furcellata*, *Spyridium globulosum* *Grevillea preissii* subsp. *preissii* Open Shrubland over an Open Herbland dominated by Geraldton Carnation, *Acanthocarpus preissii*, *Trachyandra divaricata* and *Romulea rosea*.
- Mixed *Acacia saligna*, *Acacia rostellifera*, *Jacksonia furcellata* and *Hibbertia cuneiformis* Low Open Shrubland - This vegetation type, to 1.5m in height, occurs over a small area over the crest of the tallest east-west dunes that runs through the central portion of the study area. The vegetation has experienced a significant level of grazing and is in a Good to Degraded condition with further disturbance resulting from weed invasion, including *Trachyandra divaricata* and *Romulea rosea*.
- *Acacia saligna* Low Open Shrubland – This vegetation type is the most prominent occurring within the study area, extending from Madora Beach Rd in the north through to the linear east-west dunes that intersect the central portion of the lot. *Acacia saligna* to 1.5m over a degraded understorey of *Trachyandra divaricata* and *Euphorbia terracina* dominates this vegetation type. Few other plant species, native or introduced were associated with this vegetation type. As a result of the extensive historic grazing of the site, this vegetation type is classified as being in Degraded condition.
- *Acacia rostellifera*/*Spyridium globulosum* Open Shrubland– This vegetation type occurs as a small remnant in the northwestern corner of the Lot adjacent to an area of planted Tuart (*Eucalyptus gomphocephala*) Open Woodland. This vegetation is in a Good to Degraded condition. *Acacia rostellifera* and *Spyridium globulosum* to 2m in height dominate this vegetation type. Other species recorded from this vegetation type include *Senecio lautus* and *Acanthocarpus preissii*, with scattered *Jacksonia furcellata*. Weeds are a prominent component of this vegetation type and include *Trachyandra divaricata* and *Euphorbia terracina*.
- *Acacia rostellifera* Tall Open Shrubland over *Santalum acuminatum* Low Open Shrubland. This vegetation type, which is to 4m in height, was recorded from the crest of a low dune in the southeastern corner of the study area. The vegetation is associated with scattered Japanese Pepper (**Schinus terebinthifolia*) and *Jacksonia furcellata* over *Acanthocarpus preissii*, *Lagurus ovatus*, *Avena fatua* Grassland. This vegetation type was considered to be in Degraded condition.

- *Acacia rostellifera* Shrubland - This vegetation type occurs as small remnants in the southeastern portion and as a larger remnant in the central western portion of the site. This vegetation is generally in Degraded to Good Condition and is dominated by *Acacia rostellifera* to 2.5m in height with occasional *Spyridium globulosum* over a herb layer dominated by *Euphorbia terracina*, *Trachyandra divaricata*, *Phyllanthus calycinus* and *Acanthocarpus preissii*.
- *Acacia rostellifera*, *Allocasuarina humilis* and *Eucalyptus platypus* subsp. var. *heterophylla* Tall Shrubland – This vegetation type to 3m in height occurs over *Grevillea preissii*, *Solanum linnaeanum*, *Conostephium pendulum* and *Acacia lasiocarpa* Low Open Shrubland to 1m in height over *Avena fatua* dominated Grassland. This vegetation type was recorded from the southeastern portion of site on north-south limestone ridge that runs along the eastern portion of the study area. The condition of this vegetation type was considered to be Good.
- *Hakea prostrata* Open Shrubland - This vegetation type is associated with the northeastern portion of the limestone ridge than runs in a north-south direction along the eastern boundary of the study area. This vegetation is generally in Degraded condition and is dominated by *Hakea prostrata* to 2m in height with scattered *Acacia rostellifera* and planted *Eucalyptus platypus* over a weed infested understorey dominated by *Euphorbia terracina*, *Trachyandra divaricata* and *Cynadon dactylon*. Other species recorded include *Acacia saligna*, *Melaleuca systena*, *Conostylis candicans*, *Clematis pubescens*, *Dryandra lindleyana* and *Allocasuarina humilis*.
- *Eucalyptus gomphocephala* Open Woodland (planted) – This vegetation type, which extends south from the northwestern corner of the Lot is dominated by rows of planted Tuart (*Eucalyptus gomphocephala*) to 20m in height over Tall Open Shrubland Peppermint (*Agonis flexuosa*) and *Jacksonia furcellata*. This vegetation type has been historically grazed and as a consequence is in a Good to Degraded condition. Other native understorey species recorded includes *Acacia saligna*, *Spyridium globulosum*, *Acanthocarpus preissii* and *Conostylis candicans*.
- Low Open Forest of planted *Eucalyptus platypus* subsp. *heterophylla* and *Agonis flexuosa* - This vegetation type, to 6m in height with scattered *Eucalyptus gomphocephala* over Open Shrubland of *Acacia rostellifera* and *Jacksonia furcellata* to 2m in height over *Acanthocarpus preissii*, *Avena fatua* and *Lagurus ovatus* Open Grassland, occurs at the base of the western side of a low dune in the southeastern corner of the study area. The condition of this vegetation type was considered to be Good.
- Planted *Eucalyptus platypus* var. *heterophylla* – This vegetation type, which extends around the northern and eastern boundary of the site, consists of planted Coastal Moort (*Eucalyptus platypus* var. *heterophylla*) to 4m.

3.4 Vegetation Condition

The condition of the vegetation was assessed according to the system devised by Keighery and described in Bush Forever (2000). Keighery's condition rating scale ranges from Pristine (which the vegetation exhibits no visible signs of disturbance) to Completely Degraded (where the vegetation structure is no longer intact and without native plant species). Vegetation condition for the Madora Bay East area is mapped in Figure 2 and ranges from Good to Degraded (which is in the lower range of the scale). The area has been historically grazed by cattle which have adversely affected areas of native vegetation through grazing, trampling, introducing and spreading weeds, and nutrient enrichment. Frequent burning to encourage new shoots for grazing has also resulted in an altered vegetation structure and plant species composition resulting in degradation and weed invasion.

A description of the vegetation condition ratings for those conditions identified during the site visit are outlined below.

Good (4)

Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate to it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing. This condition rating corresponds with the Poor rating that was used to rate condition prior to the Bush Forever Strategy.

Degraded (5)

Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing. This condition rating corresponds with the Very Poor rating that was used to rate condition prior to the Bush Forever Strategy.

3.5 Flora

A total of 72 plant species were recorded from the study area from the September 2004 and March 2005 surveys. The total includes 20 Monocotyledons and 52 Dicotyledons. The initial flora assessment was conducted on 20 September 2004, a time when the majority of ephemeral species such as lilies and orchids would have been recorded. As such the flora list is considered to represent at least 90% of the species likely to occur on the property. A full list of flora species recorded from the Madora Bay East property during both surveys is provided in Appendix 1, while a list of all plant species recorded from each of the ten quadrats (10m x 10m) is provided in Appendix 2.

Of the 72 plant species recorded, 44 (61%) were native and 28 (39%) were introduced or non-endemic planted species. Families with the highest representation of taxa were

the Asteraceae (Daisy family - 9 taxa; 4 native, 5 introduced), the Poa (grass family – 6 taxa; 1 native, 5 introduced) and the Myrtaceae (Eucalyptus family- 5 taxa; 3 native, 2 non-endemic). This family composition is typical of the flora of the coastal region of the southwest of Western Australia, and similar to that of the Mandurah coast region, which has the same dominant families.

Given the historic grazing of the area, the total number of plant species recorded from the 2004 survey is comparable with the 103 plant species recorded from the area during a flora survey undertaken of the significantly larger overall Madora area by Alan Tingay and Associates in September 1991. This included 85 native and 18 introduced species. It should also be noted that the 1991 survey mostly covered vegetation associated with the floristically more diverse Spearwood Dunes soils.

No Declared Rare Flora, Priority Flora or Commonwealth Listed species were recorded from the study area.

The four priority species listed by CALM as occurring in the vicinity of the site could all have been identified during the period that the survey was undertaken. As such the timing of the survey would not have precluded these species from being identified on the site.

3.6 Vegetation Significance

The majority of the vegetation over the western two thirds of Madora Bay East property is typical of the near coastal environment of the Mandurah coastline, being representative of the Quindalup Dune vegetation association (Hedde *et al.*, 1980). Approximately 48% of the original extent of the Quindalup Vegetation Complex remains on the Southern Swan Coastal Plain, while approximately 39% of the original extent of the Cottesloe Complex – Central and South remains in the Southern Swan Coastal Plain (EPA 2002).

The EPA's objective is to retain at least 30% of the original extent of the vegetation complexes in unconstrained area and 10% in constrained areas (i.e. urban zoned regions). While most of the vegetation complexes on the Southern Swan Coastal Plain do not to meet the 30% target, the Quindalup and Cottesloe Complexes compare favourably with 48% and 39% of the original extent of each remaining on the Southern Swan Coastal Plain, of which approximately 30% and 42% respectively is currently protected.

The vegetation types on the Madora Bay East property are inferred to be representative of two Floristic Community Types (FTC) (Gibson *et al.*, 1994):

- Floristic Community Type 29a – Coastal Shrublands on Shallow Sands.
- Floristic Community Type 29b – *Acacia* Shrublands on Taller Dunes.

Neither of these Floristic Community Types are listed as Threatened Ecological Communities by English and Blythe (1997), nor do they appear on CALM's list of TECs.

The Quindalup vegetation communities or variations of the vegetation communities found on the Madora Bay East site are well represented to the north within the Bush Forever Site 377 (Port Kennedy). Limestone vegetation communities, in significantly better condition than found on the Madora Bay East property occur within Bush Forever Site 395 which is situated to the east of Fremantle Rd.

A site visit by the City of Mandurah's Environmental Officer Jane O'Malley in February 2005 identified as significant a stand of low Quandong associated with the low dune in the southeastern corner of the study area. As a consequence this area has been recommended for retention as Public Open Space (POS) in any proposed future urban development of the site.

3.6.1 System 6

The Environmental Protection Authority's System Six recommendations for Conservation Reserves in Western Australia (DCE, 1983) stated that land in the vicinity of Madora (M107) has "extensive coastal dunes which are very valuable for their coastal vegetation and for recreational and aesthetic reasons" The recommended area is situated on the coast approximately 10km north of Mandurah, and comprises Reserve C25043, for Recreation, and part Reserve 27066, for Recreation, both not vested; Lots 2 to 9, 15 and 16 (Fremantle Rd subdivision), Pt Lot 7 (now referred to as Lot 9013), 492 and 688, and parts of Lots 2, 3, 4, 10 to 12 and 101, all privately owned freehold land. The System 6 Report recommended that buffer zones of uncleared land should be left to preserve some segments of the scenery and vegetation near the main Fremantle Road and between areas of housing. The buffer zones would restrict housing to the west of the dune ridge, and provide east-west links of vegetation between Fremantle Rd and the coast.

The Peel Region Scheme rezoned Lot 9013 from Rural to Urban Deferred. On the basis that it reflects the System 6 recommendations and it would protect wildlife habitats and remnant vegetation, several submissions were submitted to the Western Australian Planning Commission (WAPC) requesting the east-west wedge between Madora and Singleton be included as Regional Open Space. However the Department of Environment advised that a significant proportion of M107 had become degraded through historic grazing and burning and the WAPC advised that although retention of these types of wedges are important to the local community, it was considered that they can be provided for in local open space (or Foreshore Reserve) and appropriate residential design. The Environmental Protection Authority (EPA) supported this and recommended that the Urban Deferred zoning for Lot 9013 be lifted (EPA, 2000).

3.7 Fauna

Opportunistic fauna sightings were recorded during the three previous site investigations. Numerous diggings that were noted from the dunes are most likely attributed to rabbits.

Additionally, as a condition of Council Approval to develop the Madora subdivision to the south, ATA Environmental conducted a bird survey in conjunction with Western Wildlife on 5 June 2001. All bird species heard or seen during the survey

were recorded, including species occurring in immediately neighbouring areas of bushland and development. The survey identified a total of 22 species occurring within the foreshore reserve, beach, nearshore waters and adjoining development and bushland areas. These are listed in Appendix 3. All of the species recorded are typical of the habitats available within the nearshore and foreshore areas, although some are reliant on other habitats nearby such as eucalypt woodland areas. All of these species are expected to occur in neighbouring portions of the coastal Foreshore Reserve, which support similar habitats.

No birds of national or state conservation significance are expected to occur in the area. Carnaby's Black Cockatoo may occasionally use small areas of Tuart for feeding. However the absence of mature Marri and *Banksia* trees or Parrot Bush (*Dryandra sessilis*) on the site would probably preclude the use of the majority of the site by this species.

3.8 Aboriginal

An Aboriginal site survey of the Madora Bay East landholding, between Madora Bay and Singleton, was commissioned by Madora Partnership in September 2003. The survey was conducted by Dr Amanda Yates and Senior Aboriginal Elder Joseph Walley of Yates Heritage Consultants (Yates Heritage Consultants, 2003).

The designated survey area comprises an area of approximately 61.53ha to the immediate east of the existing Madora Town Site.

No previously recorded Aboriginal sites are located within the designated survey area, and none were identified as a result of this survey. The Aboriginal elders were concerned that some undiscovered subsurface sites may exist within the dunes, and recommended that there should be an Archaeological/Aboriginal monitor during the excavation of these dunes.

During the survey there was some concern regarding the remnant bush tucker, mainly *Santalum acuminatum* (Quandong) stands, within the survey area. A stand of Quandongs were identified from the site by Senior Aboriginal Elder Joseph Walley (Figure 2). These stands have subsequently been fenced off from stock by the proponent. An additional survey of the adjacent Madora Bay North area has also established that stands of Quandongs are located within the coastal reserve in the survey area. The proponent has given a commitment to preserve any significant stands of Quandongs in this area.

4. CONCLUSIONS AND RECOMMENDATIONS

A significant proportion of the remnant vegetation associated with the Madora Bay East property is in degraded condition, which can be attributed to the historic grazing and burning of the site. The vegetation associated with the site is relatively well represented on the Swan Coastal Plain to the south of Perth. The vegetation types associated with the area are also represented within Bush Forever Site 377 (Kennedy Park) to the north of the site and Bush Forever Site 395 (i.e Paganoni Swamp and Adjacent Bushland, Karnup) to the east.

The following recommendations have been made with respect to vegetation and flora:

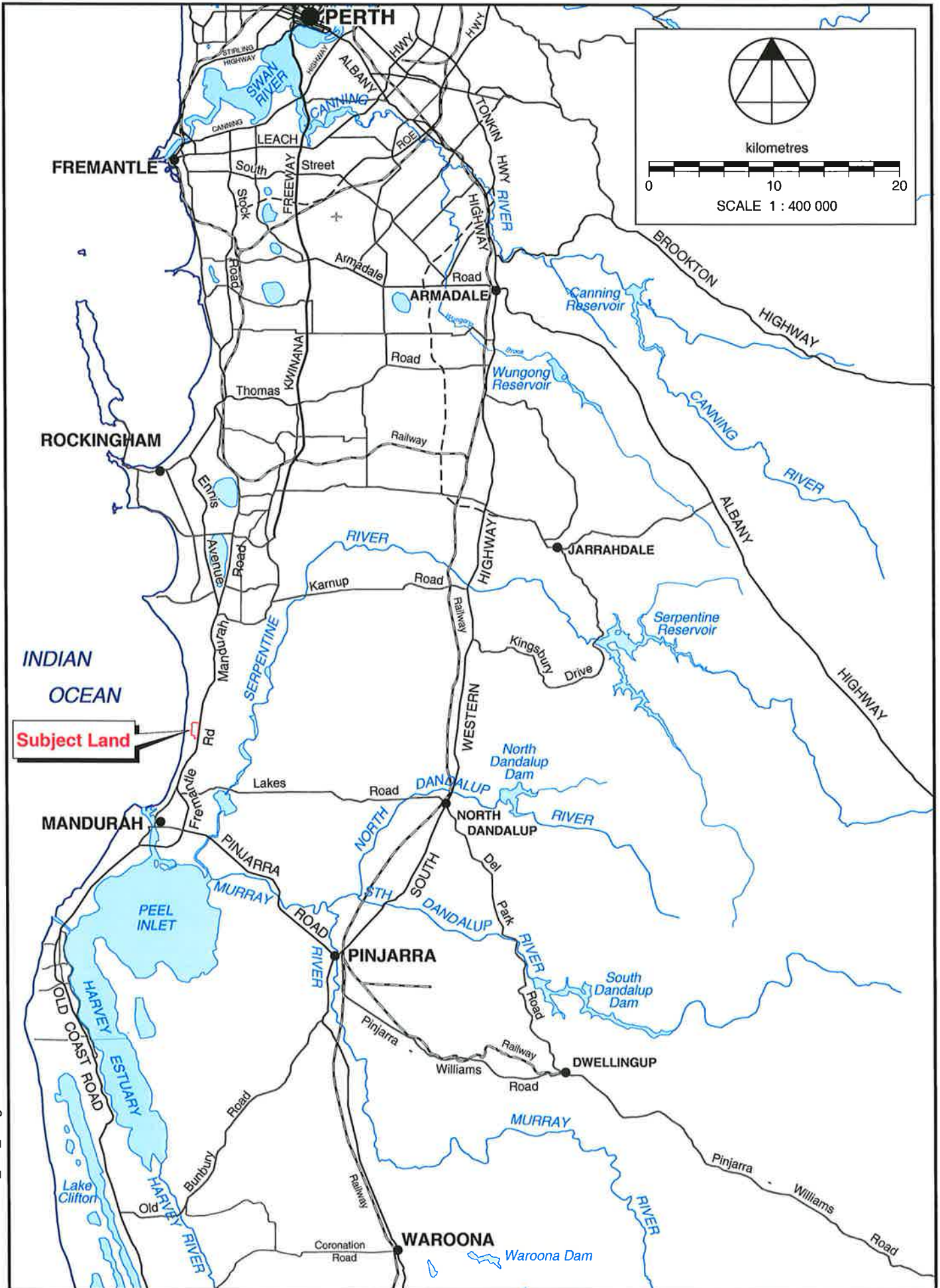
- the vegetation on the property is not considered regionally significant;
- no Threatened Ecological Communities, at either the State or Commonwealth level, were identified from the site;
- no Declared Rare Flora, Priority Flora or Commonwealth listed flora were identified from the site;
- it is recommended that the issue of the System 6 area M107 that occurs on the Madora Bay East property should be discussed with the Department of Environment with the aim of delisting the site from the System 6 recommendations;
- retention of stand of low Quandongs over low dune in southeastern corner of site within future POS;
- the best quality vegetation within the Madora Bay East area will be considered for retention within areas of POS in the proposed structure planning for the site; and
- any landscaping or rehabilitation of disturbed areas within the POS should use species native to the area where possible.

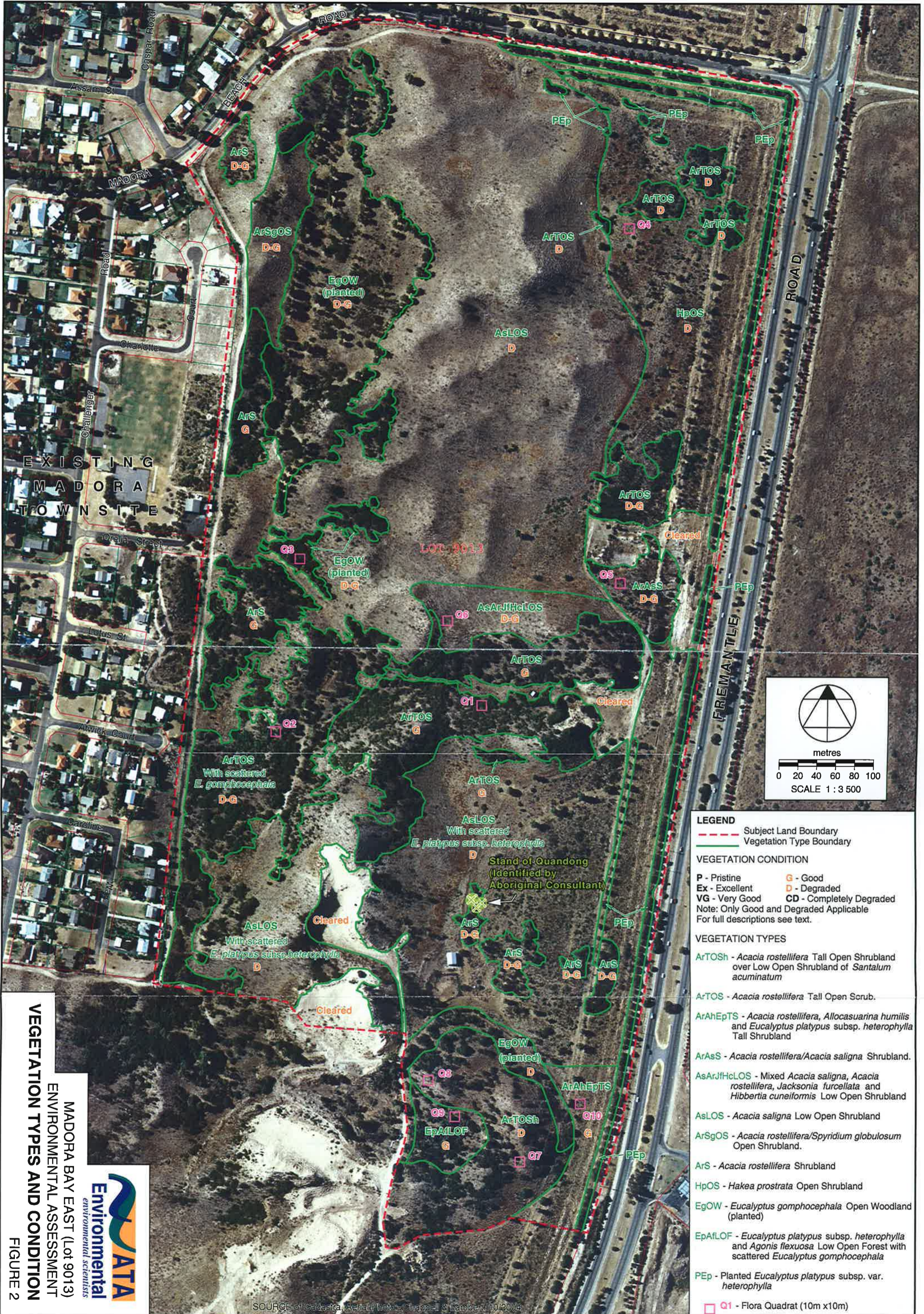
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FIGURES





LEGEND

- Subject Land Boundary
- Vegetation Type Boundary

VEGETATION CONDITION

P - Pristine	G - Good
Ex - Excellent	D - Degraded
VG - Very Good	CD - Completely Degraded

Note: Only Good and Degraded Applicable
For full descriptions see text.

VEGETATION TYPES

- ArtOSh** - *Acacia rostellifera* Tall Open Shrubland over Low Open Shrubland of *Santalum acuminatum*
- ArtOS** - *Acacia rostellifera* Tall Open Scrub.
- ArAhEpTS** - *Acacia rostellifera*, *Allocasuarina humilis* and *Eucalyptus platypus* subsp. *heterophylla* Tall Shrubland
- ArAsS** - *Acacia rostellifera*/*Acacia saligna* Shrubland.
- AsArJfHcLOS** - Mixed *Acacia saligna*, *Acacia rostellifera*, *Jacksonia furcellata* and *Hibbertia cuneiformis* Low Open Shrubland
- AsLOS** - *Acacia saligna* Low Open Shrubland
- ArSgOS** - *Acacia rostellifera*/*Spyridium globulosum* Open Shrubland.
- ArS** - *Acacia rostellifera* Shrubland
- HpOS** - *Hakea prostrata* Open Shrubland
- EgOW** - *Eucalyptus gomphocephala* Open Woodland (planted)
- EpAfLOF** - *Eucalyptus platypus* subsp. *heterophylla* and *Agonis flexuosa* Low Open Forest with scattered *Eucalyptus gomphocephala*
- PEp** - Planted *Eucalyptus platypus* subsp. var. *heterophylla*

Q1 - Flora Quadrat (10m x10m)

VEGETATION TYPES AND CONDITION
 MADORA BAY EAST (Lot 9013)
 ENVIRONMENTAL ASSESSMENT
 FIGURE 2



SOURCE of Cadastra, Aerial Photo's, Chapell & Lambert, 10/2004

APPENDICES

APPENDIX 1

FLORA LIST

APPENDIX 1
LOT 9013 MADORA BAY EAST FLORA LIST

FAMILY	SPECIES
MONOCOTYLEDONS	
ASPHODELACEAE	<i>*Trachyandra divaricata</i>
COLCHICACEAE	<i>Burchardia umbellata</i>
CYPERACEAE	<i>Isolepis nodosa</i> <i>Lepidosperma gracile</i> <i>Lepidosperma longitudinale</i> <i>Schoenus grandifolius</i>
DASYPOGONACEAE	<i>Acanthocarpus preissii</i> <i>Lomandra maritima</i>
HAEMODORACEAE	<i>Conostylis candicans</i>
IRIDACEAE	<i>*Romulea rosea</i>
ORCHIDACEAE	<i>Caladenia flava</i>
PHORMIACEAE	<i>Dianella divaricata</i>
POACEAE	<i>*Avena fatua</i> <i>*Ehrharta calycina</i> <i>*Cynadon dactylon</i> <i>*Lagurus ovatus</i> <i>Neurachne alopecuroidea</i> <i>*Poa annua</i>
RESTIONACEAE	<i>Desmocladus flexuosus</i>
XANTHORRHOEACEA	<i>Xanthorrhoea preissii</i>
DICOTYLEDONS	
ANACARDIACEAE	<i>*Schinus terebinthifolia</i>
APOCYNACEAE	<i>Alyxia buxifolia</i>
ASTERACEAE	<i>*Arctotheca calendula</i> <i>*Dimorphotheca ecklonis</i> <i>*Hypochoeris sp.</i> <i>Olearia axillaris</i>

FAMILY	SPECIES
	<i>Ozothamnus cordatus</i> <i>Podolepis gracilis</i> <i>Senecio lautus</i> * <i>Taraxacum officinale</i> * <i>Ursinia anthemoides</i>
AIZOACEAE	* <i>Carpobrotus edulis</i> <i>Carpobrotus virescens</i>
CASUARINACEAE	<i>Allocasuarina humilis</i>
CHENOPODIACEAE	<i>Rhagodia baccata</i>
CUSCUTACEAE	* <i>Cuscuta campestris</i>
DILLENACEAE	<i>Hibbertia cuneiformis</i>
EPACRIDACEAE	<i>Conostephium pendulum</i> <i>Leucopogon parviflorus</i>
EUPHORBIACEAE	* <i>Euphorbia terracina</i> <i>Phyllanthus calycinus</i>
GERANIACEAE	* <i>Geranium molle</i> * <i>Pelargonium capitatum</i>
IRIDACEAE	* <i>Romulea rosea</i>
LAMIACEAE	<i>Hemiandra pungens</i>
LAURACEAE	<i>Cassytha racemosa</i>
MIMOSACEAE	<i>Acacia lasiocarpa</i> <i>Acacia pulchella</i> * <i>Acacia pycnantha</i> <i>Acacia rostellifera</i> <i>Acacia saligna</i>
MORACEAE	* <i>Ficus carica</i>
MYRTACEAE	<i>Agonis flexuosa</i> <i>Eucalyptus gomphocephala</i> * <i>Eucalyptus platypus</i> var. <i>heterophylla</i> * <i>Leptospermum laevigatum</i> <i>Melaleuca systema</i>
OXALIDACEAE	* <i>Oxalis pes-caprae</i>

FAMILY	SPECIES
PAPILIONACEAE	<i>Hardenbergia comptoniana</i> <i>Jacksonia furcellata</i> <i>Kennedia prostrata</i> * <i>Trifolium campestre</i>
PHYTOLACCACEAE	* <i>Phytolacca octandra</i>
PRIMULACEAE	* <i>Anagalis arvensis</i>
PROTEACEAE	<i>Dryandra lindleyana</i> <i>Grevillea preissii</i> subsp. <i>preissii</i> <i>Hakea prostrata</i> <i>Hakea amplexicaulis</i> <i>Petrophile serruriae</i>
RANUNCULACEAE	<i>Clematis pubescens</i>
RHAMNACEAE	<i>Spyridium globulosum</i>
RUTACEAE	<i>Philotheca spicatus</i>
SANTALACEAE	<i>Santalum acuminatum</i>
SOLANACEAE	* <i>Solanum linnaeanum</i>
Total: Native	44
Non-native/Introduced	28

* Introduced/cultivated Species

APPENDIX 2

QUADRAT FLORA DATA

QUADRAT Q1

Acacia rostellifera Closed Shrubland over *Euphorbia terracina* dominated understorey. Condition: Degraded to Good



QUADRAT Q1 (10x10m)

SPECIES	% COVER	HEIGHT (M)
<i>Acacia rostellifera</i>	60	2.5
* <i>Euphorbia terracina</i>	20	0.2
<i>Phyllanthus calycinus</i>	10	0.4
<i>Acanthocarpus preissii</i>	5	0.3
<i>Ozothamnus cordatus</i>	2	1.5
<i>Podolepis gracilis</i>		
* <i>Cuscuta campestris</i>	<1	climber
* <i>Trachyandra divaricata</i>	<1	0.4
<i>Conostylis candicans</i>	<1	0.3
* <i>Cynadon dactylon</i>	<1	0.2
<i>Caladenia flava</i>	<1	0.2

QUADRAT Q2

Acacia rostellifera Shrubland over *Euphorbia terracina* and *Trachyandra divaricata* dominated understorey. Condition: Degraded to Good



QUADRAT Q2 (10x10m)

SPECIES	% COVER	HEIGHT (M)
<i>Acacia rostellifera</i>	50	2.5
* <i>Euphorbia terracina</i>	20	0.2
<i>Phyllanthus calycinus</i>	5	0.5
<i>Acanthocarpus preissii</i>	5	0.3
<i>Spyridium globulosum</i>	5	1.5
* <i>Trachyandra divaricata</i>	5	0.4
<i>Conostylis candicans</i>	<1	0.2
* <i>Cynadon dactylon</i>	5	0.3

QUADRAT Q3

Eucalyptus gomphocephala Open Woodland over *Agonis flexuosa*, *Acacia saligna* and *Jacksonia furcellata* Open Shrubland over *Euphorbia terracina*, *Phyllanthus calycinus*, *Trachyandra divaricata*, *Cynodon dactylon* dominated understorey

Condition: Degraded to Good



QUADRAT Q3 (10x10m)

SPECIES	% COVER	HEIGHT (M)
<i>Eucalyptus gomphocephala</i>	20	15
* <i>Euphorbia terracina</i>	10	0.3
<i>Agonis flexuosa</i>	4	10
<i>Spyridium globulosum</i>	2	1.2
<i>Acacia saligna</i>	5	1.5
<i>Jacksonia furcellata</i>	2	2
<i>Phyllanthus calycinus</i>	2	0.4
* <i>Trachyandra divaricata</i>	2	0.3
* <i>Cynodon dactylon</i>	5	0.2
* <i>Trifolium campestre</i>	<1	Ground cover
<i>Conostylis candicans</i>	<1	0.2

QUADRAT Q4
***Hakea prostrata* Open Shrubland**
Over degraded weed infested understorey
Condition: Degraded to Good



QUADRAT Q4(10x10m)

SPECIES	% COVER	HEIGHT (M)
<i>Hakea prostrata</i>	30	2
<i>Acacia rostelifera</i>	5	0.5
* <i>Euphorbia terracina</i>	10	0.3
* <i>Cynadon dactylon</i>	30	03
* <i>Lupinus cosentinii</i>	<1	0.4
<i>Acacia saligna</i>	<1	2
<i>Xanthorrhoea preissii</i>	<1	0.6
* <i>Trachyandra divaricata</i>	5	0.4
<i>Clematis pubescens</i>	2	Creeper
* <i>Trifolium campestre</i>	<1	Ground Cover
<i>Melaleuca systena</i>	<1	1
* <i>Arctotheca calendula</i>	<1	0.3

QUADRAT Q5

Acacia rostellifera/*Acacia saligna* Shrubland with scattered planted *Eucalyptus platypus* var. *heterophylla*

Condition: Degraded to Good



QUADRAT Q5 (10x10m)

SPECIES	% COVER	HEIGHT (M)
<i>Acacia rostellifera</i>	20	2
<i>Acacia saligna</i>	20	2
<i>Acanthocarpus preissii</i>	5	0.3
* <i>Euphorbia terracina</i>	10	0.4
* <i>Ficus carica</i>	5	3
* <i>Cynadon dactylon</i>	5	0.2
* <i>Trachyandra divaricata</i>	1	0.5
<i>Spyridium globulosum</i>	2	1.5
<i>Jacksonia furcellata</i>	<1	1.5
<i>Grevillea preissii</i> subsp. <i>preissii</i>	<1	0.3
* <i>Romulea rosea</i>	<1	0.1
<i>Neurachne alopecuroidea</i>	<1	0.3
<i>Clematis pubescens</i>	<1	Creeper

QUADRAT Q6
**Mixed *Acacia saligna*, *Acacia rostellifera*, *Jacksonia furcellata*, *Hibbertia*
cuneiformis Low Open Shrubland**
Condition: Good



QUADRAT Q6(10x10m)

SPECIES	% COVER	HEIGHT (M)
<i>Acacia rostellifera</i>	20	0.8
<i>Acacia saligna</i>	10	1.2
<i>Hibbertia cuneiformis</i>	5	1.2
<i>Jacksonia furcellata</i>	5	0.3
<i>Phyllanthus calycinus</i>	1	0.5
* <i>Trachyandra divaricata</i>	5	0.3
<i>Acanthocarpus preissii</i>	5	0.4
<i>Senecio lautus</i>	<1	0.3
* <i>Romulea rosea</i>	<1	0.1
<i>Conostylis candicans</i>	<1	0.3
<i>Spyridium globulosum</i>	<1	1.3
<i>Neurachne alopecuroidea</i>	15	0.2
* <i>Euphorbia terracina</i>	<1	0.4

QUADRAT Q7

50383088E; 6405797N

Tall Open Shrubland of *Acacia rostellifera* to 4m in height over *Santalum acuminatum* Low Open Shrubland to 1m in height with scattered *Schinus terebinthifolia* and *Jacksonia furcellata* over *Acanthocarpus preissii*, *Lagurus ovatus*, *Avena fatua* Grassland

Condition: Degraded



QUADRAT Q7 (10x10m)

SPECIES	% COVER	HEIGHT (M)
<i>Acacia rostellifera</i>	20	4
* <i>Avena fatua</i>	30	0.5
<i>Acanthocarpus preissii</i>	10	0.3
* <i>Lagurus ovatus</i>	10	0.2
* <i>Schinus terebinthifolia</i>	5	4
<i>Santalum acuminatum</i>	5	1.2
<i>Jacksonia furcellata</i>	2	2
<i>Conostephium pendulum</i>	1	0.4
<i>Melaleuca systema</i>	1	2
<i>Alyxia buxifolia</i>	1	1
<i>Spyridium globulosum</i>	1	1
<i>Lepidosperma longitudinale</i>	<1	0.3
* <i>Phytolacca octandra</i>	1	1
<i>Desmocladius flexuosus</i>	<1	0.3

QUADRAT Q8

50382990E; 6405882N

Tall Open Shrubland of *Acacia rostellifera* to 3m in height over *Jacksonia furcellata*, *Phyllanthus calycinus* and *Santalum acuminatum* Open Shrubland to 1m in height over *Acanthocarpus preissii*, *Hemiandra pungens*, and *Conostylis candicans* Open Herbland

Condition: Good



QUADRAT Q8 (10x10m)

SPECIES	% COVER	HEIGHT (M)
<i>Acacia rostellifera</i>	20	3
<i>Jacksonia furcellata</i>	10	1.5
<i>Santalum acuminatum</i>	10	1.2
<i>Acanthocarpus preissii</i>	10	0.3
<i>Hemiandra pungens</i>	2	groundcover
<i>Conostylis candicans</i>	2	0.2
* <i>Avena fatua</i>	2	0.5
<i>Phyllanthus calycinus</i>	1	0.5
<i>Eremophila glabra</i>	<1	1
* <i>Lagurus ovatus</i>	1	0.3
<i>Lepidosperma longitudinale</i>	<1	0.3
<i>Melaleuca systema</i>	1	1

QUADRAT Q9

50383032E; 64058562N

Low Open Forest of *Eucalyptus platypus* subsp. *heterophylla* and *Agonis flexuosa* to 6m in height with scattered *Eucalyptus gomphocephala* over Open Shrubland of *Acacia rostellifera* and *Jacksonia furcellata* to 2m in height over *Acanthocarpus preissii*, *Avena fatua* and *Lagurus ovatus* Open Grassland

Condition: Good



QUADRAT Q9 (10x10m)

SPECIES	% COVER	HEIGHT (M)
* <i>Eucalyptus platypus</i> subsp. <i>heterophylla</i>	20	6
<i>Agonis flexuosa</i>	20	4
<i>Acacia rostellifera</i>	20	2
<i>Jacksonia furcellata</i>	10	1
<i>Eucalyptus gomphocephala</i>	5	20
* <i>Avena fatua</i>	2	0.5
<i>Spyridium globulosum</i>	2	1.5
<i>Santalum acuminatum</i>	2	1
<i>Acanthocarpus preissii</i>	2	0.2
<i>Hemiandra pungens</i>	2	groundcover
<i>Phyllanthus calycinus</i>	1	0.2
<i>Dianella divaricata</i>	1	1
* <i>Lagurus ovatus</i>	1	0.3
<i>Desmocladius flexuosus</i>	<1	groundcover

QUADRAT Q10

50383151E; 6405859N

Tall Shrubland of *Acacia rostellifera*, *Allocasuarina humilis* and *Eucalyptus platypus* subsp. *heterophylla* to 3m in height over *Grevillea preissii*, *Solanum linnaeanum*, *Conostephium pendulum* and *Acacia lasiocarpa* Low Open Shrubland to 1m in height over *Avena fatua* Grassland

Condition: Good



QUADRAT Q10 (10x10m)

SPECIES	% COVER	HEIGHT (M)
* <i>Avena fatua</i>	50	0.5
<i>Acacia rostellifera</i>	30	3
<i>Allocasuarina humilis</i>	10	1.2
<i>Grevillea preissii</i>	5	0.5
* <i>Eucalyptus platypus</i> subsp. <i>heterophylla</i>	5	3
<i>Spyridium globulosum</i>	1	1.5
<i>Santalum acuminatum</i>	1	1.5
* <i>Solanum linnaeanum</i>	1	0.6
<i>Conostephium pendulum</i>	1	0.5
<i>Xanthorrhoea preissii</i>	1	0.8
<i>Melaleuca systema</i>	1	0.2
<i>Hakea amplexicaulis</i>	<1	0.5
<i>Dianella divaricata</i>	<1	1

APPENDIX 3
BIRD SPECIES LIST

APPENDIX 8

**LOT 101 MANDURAH ROAD, MADORA BAY (NORTH)
LOCAL WATER MANAGEMENT STRATEGY
(Source: Hyd₂o Hydrology, 2015)**

Lot 101 Mandurah Road Madora Bay North
Local Water Management Strategy

March 2015



Client: Madora Bay Partnership

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Executive Summary

This local water management strategy (LWMS) has been prepared by Hyd2o on behalf of Madora Bay Partnership in support of the Lot 101 Mandurah Road, Madora Bay North Outline Development Plan (ODP). The developable area is herein referred to as the site, whilst the ODP boundary also includes the foreshore reserve. The ODP as prepared by CLE is attached as Appendix H. The site address has recently been redefined from Lot 100 Mandurah Road Madora Bay North as per Deposited Plan 73957, issued 15/1/2014.

Understanding the key hydrological considerations has informed the development of the structure plan and LWMS for the site. The site is characterised by coastal dunes with sandy soils with some limestone present, and has good clearance to groundwater. The site is bound by existing and future urban development to the north, future development to the south and the coast to the west.

This LWMS has been prepared in accordance with the principles, objectives, and key criteria of *Better Urban Water Management (BUWM)* (Western Australian Planning Commission, 2008). Implementation of the strategy will be undertaken in accordance with BUWM through the development and implementation of urban water management plans for individual stages of development within the site.

Local Water Management Strategy Summary

Strategy Elements	LWMS Method & Approach
Water Use Sustainability	
Water Efficiency	<ul style="list-style-type: none"> 5 Star building standards (water efficient fixtures and fittings). Use of native plantings in wetland buffer and rehabilitation areas.
Water Supply	<ul style="list-style-type: none"> Water Corporation IWSS and rainwater tanks.
Wastewater	<ul style="list-style-type: none"> Water Corporation reticulated sewerage.
Stormwater	
Flood Protection	<ul style="list-style-type: none"> Habitable building levels set at 0.5m above 100 year flood level. Overland flow paths within road reserves identified for safe conveyance of flows exceeding pipe drainage system capacity. Infiltration storages integrated within POS. Total storage volume 16526m³.
Serviceability	<ul style="list-style-type: none"> 1 in 5 year ARI event to be infiltrated. Total storage volume 6388m³.
Ecological Protection	<ul style="list-style-type: none"> Rehabilitation of wetland buffer areas Bioretention established as 2% (min) of equivalent impervious area. Non structural control commitment, details at UWMP stage. Use of soakwells at lot scale. 1 in 1 year ARI event to be infiltrated. Total storage volume 3277m³.
Groundwater	
Fill & Subsoil Drainage	<ul style="list-style-type: none"> Site earthworks to be cut to fill, minimal imported fill required. No subsoil drainage required due to depth to groundwater.
ASS & Contamination	<ul style="list-style-type: none"> Acid Sulphate Soils to be investigated as a separate process (if required) and reported in UWMP.

1. Introduction

1.1 Background

This local water management strategy (LWMS) has been prepared by Hyd2o on behalf of Madora Bay Partnership to support the development of the Lot 101 Mandurah Road, Madora Bay North Local Structure Plan (LSP) area (herein referred to as the site).

The site is approximately 123 ha and located approximately 60 km south of the Perth central business district within the suburb of Madora Bay in the City of Mandurah (Figure 1).

This LWMS provides an integrated total water cycle management approach to the development of the local structure plan, with an assessment of the pre-development environment, development of water use sustainability initiatives, a stormwater management strategy, a groundwater management strategy and a post development monitoring program.

The *Lot 100 Mandurah Rd, Madora Bay North District Water Management Strategy* was prepared by JDA Consultant Hydrologists in 2011 and approved by the Department of Water. This document has been prepared consistent with the DWMS.

This document has been prepared in accordance with the principles and objectives of *Better Urban Water Management* (Western Australian Planning Commission, 2008). A copy of the LWMS Checklist for Developers is included as Appendix A to assist the City of Mandurah (CoM) and Department of Water (DoW) in their review of this document.

1.2 Planning Context

The relationship of this document to the planning process is shown in Table 1. A pre-development hydrological monitoring report was prepared for the site in December 2012 by Hyd2o.

Table 1: Integrated Planning and Urban Water Management Process

Planning Phase	Planning Document	Urban Water Management Documents
Rezoning	Scheme Amendment Application	Lot 100 Mandura Rd, Madora Bay District Water Management Strategy (JDA Consultant Hydrologists, 2011) APPROVED
Local	Madora Bay North Local Structure Plan	Lot 100 Mandurah Rd, Madora Bay North Local Water Management Strategy THIS DOCUMENT
Subdivision	Subdivision Application	Urban Water Management Plan (for individual stages of development) FUTURE PREPARATION

1.3 Key Documents and Previous Studies

This LWMS uses the following key documents to define its principles, criteria, objectives, and implementation responsibilities:

- *Lot 100 Mandurah Rd. Madora Bay North District Water Management Strategy (JDA Consultant Hydrologists, 2011)*
- *Stormwater Management Manual for WA (Department of Water, 2007)*
- *Better Urban Water Management (WAPC, 2008)*
- *Decision Process for Stormwater Management in WA (Department of Water, 2009)*

2. Proposed Development

The proposed local structure plan for the site is shown in Figure 2.

The development of this plan has been guided by consideration of the predevelopment environment of the site and existing constraints.

The development area will consist of a number of residential lots, Public Open Space (POS) areas and a school site. The school site is proposed to be managed by the Department of Education, with the adjoining POS to be council managed public open space with a shared oval. Stormwater management at the school site is the responsibility of the Department of Education and is separate to this LWMS, with all stormwater from the school site to be retained on the school site itself.

3. Pre-Development Environment

3.1 Site Conditions

The site is bound by Mandurah Road to the east, Madora Beach Road to the south, the Indian Ocean to the west and urban development to the north.

The site currently has some remnant native vegetation, planted vegetation and is partly cleared for grazing of stock (Figure 3).

The site is characterised by coastal dunes with topography ranging from approximately 6 mAHD to 10 mAHD in western and central lower areas, with the chaotic dunes rising to peaks of 20 mAHD to 25 mAHD along the eastern portion of the site (Figure 3).

A search of the Department of Indigenous Affairs online Aboriginal Heritage Inquiry System indicates that Heritage Site 20780 - Madora Bay Foreshore Reserve Bush Tucker Area is located within the site. This area has been fenced off from public access by the owners to protect it from off road vehicle and stock grazing damage (JDA, 2011).

3.2 Geotechnical

According to the *Rockingham Sheet 2033 II and 2033 III of the Environmental Geology Series* (Gozzard, 1983) the site is characterised predominantly by the following (Figure 4):

- S2 – Calcareous Sand: White fine medium grained sub-rounded quartz.
- LS1 – Limestone: Pale yellowish brown medium ground sub rounded quartz.
- S13 – Calcareous Sand: White medium grained rounded quartz.

Four groundwater monitoring bores were installed via drill rig across the site by Hyd2o on 9th August 2011 to maximum depths of between 8 m and 13 m. Lithological logs taken by Hyd2o at the time of bore installation are attached as Appendix B, with findings summarised below:

- TOPSOIL – Dark brown fine grained sand to approximately 0.5 m.
- SAND – Light brown medium grained sand from 0.5m to end of hole.

Field observations were consistent with the environmental geology mapping. Limestone across the site is highly friable and fragmented.

3.2.1 Acid Sulphate Soils and Contaminated Sites

The Western Australian Planning Commission identifies the site as having no known risk of Acid Sulphate Soils within 3m of natural soil surface (WAPC 2004).

A search of the Department of Environment and Conservation's Contaminated Sites database indicates no known contaminated sites occur in the site area.

3.2.2 On-site Permeability Testing

Permeability testing at the site was undertaken by Hyd2o on 12th August 2013.

Three permeability test locations were chosen based on the location of soil types shown in environmental geology mapping and POS locations (Figure 4). Three replicate tests were undertaken at each location to a depth of 0.5 m using a borehole permeameter. Field

recorded saturated hydraulic conductivities ranged from 1.57 m/day to 12.21 m/day, with calculations based on Elrick and Reynolds (1992). The field results are comparable to Davidson (1995), which indicates fine to medium sand to have a saturated hydraulic conductivity of 8.2 m/day. Results are shown in Table 2 below, with calculations contained as Appendix C.

Table 2: Estimated Saturated Hydraulic Conductivity

Permeability Test Site	Soil Type	K _s m/day
PM1	LS1	1.57
PM2	S2	3.17
PM3	S13	12.21

3.3 Surface Water

There are no open or ephemeral water bodies, Environmental Protection Policy Lakes, wetlands, defined surface watercourses or drains located on the site.

There are no known external surface water catchments that discharge to the site. The study is not located within the Peel Harvey Estuarine System Catchment.

3.4 Groundwater

According to Davidson (1995) the underlying hydrogeology of the site is characterised by the Superficial Aquifer extending to approximately -15mAHD.

Four groundwater monitoring bores were installed by Edrill at the site on 9th August 2011, with locations shown in Figure 5. All bores were installed into the top of the superficial aquifer and constructed suitably for groundwater quality monitoring. Based on the recommendations in the DWMS an initial one-off groundwater level was taken across all bores to determine the depth to groundwater. Groundwater levels at the bores ranged from approximately 3.92 m to 8.79 m below natural surface. Given the depth to groundwater, the monitoring programme consisted of collection of quarterly groundwater quality samples and groundwater levels. This was undertaken in agreement with the Department of Water (Jane Sturgess, pers. comm., 26/09/2011).

Groundwater monitoring was also carried out directly to the south of the site within the Madora Bay East landholding by JDA Consultant Hydrologists. This monitoring combined with DoW data from the Perth Groundwater Atlas has been used to inform predevelopment groundwater levels and quality at the site.

3.4.1 Groundwater Levels

Predevelopment groundwater level monitoring was undertaken by Hyd2o on five occasions between August 2011 and July 2012 (Table 3). An additional one-off recording was taken in August 2013 at the time of permeability testing. The four onsite bores were monitored, as well as two bores in the adjacent Madora Bay East landholding, and two nearby DoW bores (T530 and T580).

Groundwater has a low gradient across the site, with flow west towards the Indian Ocean. As shown in Table 4, groundwater levels across the site bores ranged from a minimum of 0.74 mAHD at MB1 to a maximum of 1.20 mAHD at MB2. Across all monitored bores, groundwater levels during the monitoring period ranged from 0.25 mAHD to 1.20 mAHD. Depth to groundwater across the site ranged from 3.8m at MB2 to 8.6m at MB3. DoW mapping of May 2003 levels indicates typical summer groundwater levels range from approximately 0.1 to 0.3 mAHD across the site (DoW, 2013).

DoW groundwater monitoring bores T530 and T580 are both located within approximately 2.5km of the site. These bores have been monitored since 1975 and provide historical groundwater data for the site and have been used to calculate the Average Annual Maximum Groundwater Level (AAMGL) for the site.

Table 4 summarises the period of record and AAMGL for each groundwater monitoring bore. The average correction factor across both DoW bores was established as +0.87m, with this value used to derive the AAMGL of the onsite bores. Long term historical DoW data is contained as Appendix D.

The AAMGL for the site ranges across the site from 1.70mAHD to 2.07 mAHD (Table 5). The AAMGL for each of the monitored bores on the site was used to establish AAMGL contours for the site, as shown in Figure 5.

Table 3: Pre Development Groundwater Levels

	Easting	Northing	Top of Casing (mAHD)	Natural Surface (mAHD)	Water Level (mAHD)					
					9	31	13	23	27	12
					Aug 2011	Oct 2011	Jan 2012	Apr 2012	Jul 2012	Aug 2013
Madora Bay North Bores										
MB1	382532	6407433	6.05	5.45	0.91	0.77	0.74	0.86	0.86	n/a ¹
MB2	382696	6408336	6.17	5.57	1.10	1.16	1.08	1.15	1.2	1.19
MB3	383569	6408378	10.31	9.71	0.92	1.11	1.01	0.91	1.11	1.02
MB4	383416	6407447	8.23	7.63	0.90	1.00	0.93	0.90	0.83	1.01
Madora Bay East Bores										
MW1	382342	6406684	6.28	-	0.72	0.75	0.77	0.80	0.83	-
MW2	383302	6406604	9.69	-	<0.25	0.93	0.86	0.91	1.04	-
DoW Bores										
T530	384378	6410840	11.31	10.87	1.05	1.18	1.00	0.77	1.16	1.23
T580	386090	6407231	9.79	9.41	0.48	0.62	0.45	-	0.56	-

¹Bore inaccessible

Table 4: DoW Bore AAMGL

DoW Bore	Period of Record	AAMGL (mAHD)	July 2012 Level (mAHD)	Difference (m)
T530	1975-2013	1.77	1.16	0.61
T580	1975-2007	1.69	0.56	1.13
Correction factor				+0.87

Table 5: Estimated Site AAMGLs

Bore	AAMGL (mAHD)	Depth to AAMGL (m)
MB1	1.73	3.72
MB2	2.07	3.50
MB3	1.98	7.73
MB4	1.70	5.93

3.4.2 Groundwater Quality

Groundwater quality across the site was monitored quarterly between October 2011 and July 2012, consistent with DoW advice. Low flow sampling pump techniques were used to extract the samples. Samples were sent to the NATA accredited MPL laboratory for analysis of total nitrogen, total Kjeldahl nitrogen, ammonia, nitrate, nitrite, total phosphorous, and filterable reactive phosphorous. Physical parameters (electrical conductivity and pH) were measured in situ.

Table 6 outlines the results of the groundwater quality sampling with full results in Appendix E, with a summary below:

- pH in groundwater was found to range between 6.93 and 7.59, with an average across all bores of 7.20. This is within the ANZECC (2000) guidelines of 6.5 – 8 pH, and indicates that the groundwater is neutral.
- EC across the site ranged from 818 $\mu\text{S}/\text{cm}$ to 1279 $\mu\text{S}/\text{cm}$. The average across all bores was 1044 $\mu\text{S}/\text{cm}$, approximately 5 times the upper ANZECC guideline of 300 $\mu\text{S}/\text{cm}$. The average of 1044 $\mu\text{S}/\text{cm}$ equates to a salinity of approximately 670 mg/L, indicating the water is marginal salinity (Waters and Rivers Commission 1998).
- Total nitrogen (TN) was found to range between 2.2 mg/L and 11 mg/L. The site average TN is 5.5 mg/L, above the ANZECC guideline value of 1.2 mg/L.
- Total phosphorous values ranged between 0.03 mg/L and 0.23 mg/L, with the site average of 0.11 mg/L exceeding the ANZECC guideline of 0.065 mg/L.

Though the results indicate that the nutrients in the groundwater across the site exceed ANZECC guideline values, it should be noted that such results are reflective of the previous land use of stock grazing, and are typical within the superficial aquifer on the Swan Coastal Plain.

3.5 Summary of Key Constraints and Opportunities

Based on the existing site conditions, key constraints and opportunities for the site which inform the proposed water management strategy are summarised as follows:

- Change of landuse is likely to improve groundwater quality within the site.
- The site is suitable for infiltration of stormwater based on depth to groundwater, soil types and permeability testing.

Table 6: Groundwater Quality

Parameter	Mean Parameter Values					ANZECC
	MB1	MB2	MB3	MB4	Site Average	
Ec (µS/cm)	1221	1132	889	934	1044	120-300
pH	7.10	7.12	7.30	7.29	7.20	6.5-8.0
TN (mg/L)	4.18	7.58	6.13	3.95	5.46	1.2
TKN (mg/L)	1.49	1.74	1.16	0.80	1.30	n/a
NOx (mg/L)	2.73	5.77	4.95	3.15	4.15	0.15
Nitrate (mg/L)	2.70	5.70	4.95	3.15	4.13	n/a
Nitrite (mg/L)	0.03	0.08	0.005	0.005	0.03	n/a
Ammonia (mg/L)	0.010	0.006	0.006	0.005	0.007	0.08
TP (mg/L)	0.08	0.11	0.14	0.09	0.11	0.065
Phosphate (mg/L)	0.030	0.020	0.006	0.006	0.016	0.04

4. Design Criteria

Key design criteria for the site are shown in Table 7 and have been established consistent with criteria specified in the key reference documents previously detailed in Section 1.2.

These design criteria are used in Sections 5, 6 and 7 together with the identified constraints and opportunities of the predevelopment environment (Section 3) to establish the water management strategy for the site.

Table 7: Design Criteria

Strategy Elements	Criteria
Water Use Sustainability	
Water Efficiency	<ul style="list-style-type: none"> Reduce consumptive use through adoption of waterwise practices.
Water Supply	<ul style="list-style-type: none"> Develop “fit for purpose” water supply strategy, and minimise potable water use where drinking quality water is not essential.
Wastewater	<ul style="list-style-type: none"> Provide a wastewater system which meets agency requirements.
Stormwater	
Flood Protection	<ul style="list-style-type: none"> Provide safe passage and storage for 1 in 100 year ARI storm event Establish minimum habitable floor levels at 0.5m above the 100 year ARI flood levels. Provide flow paths for overland flows within the development area which exceed the capacity of piped drainage.
Serviceability	<ul style="list-style-type: none"> Provision of 1 in 5 year ARI storage areas for local stormwater. Road drainage system to be designed so that roads will be passable in the 1 in 5 year ARI event.
Ecological Protection	<ul style="list-style-type: none"> 1 in 1 year ARI 1 hour storm event to be retained on site. Bioretention areas established at 2% of connected impervious areas. Establishment of storage invert levels no lower than seasonal maximum groundwater levels. Implement non-structural controls.
Groundwater	
Fill Requirement & Subsoil Drainage	<ul style="list-style-type: none"> Provide subsoil drainage if/where required to control any post development groundwater rise. Establish development levels with acceptable clearance above groundwater levels.

5. Water Use Sustainability Initiatives

5.1 Water Efficiency Measures

Residential development of the site will create an increased demand for water supply. Implementation of a number of water conservation measures will reduce scheme water consumption in the development. Recommended measures are consistent with the Water Corporation's 'Waterwise' land development guidelines and include:

- Use of R20 lots to reduce garden (ex-house) use.
- Promotion of use of waterwise practices including water efficient fixtures and fitting (taps, showerheads, toilets and appliances, rainwater tanks, waterwise landscaping).
- All houses to be built to 5 star building standards.
- Use of native plantings and water sensitive species where appropriate.
- Maximising on site retention of stormwater.

Waterwise principles will guide landscape design at the site.

Agreed water conservation measures and locations will be detailed at the UWMP stage.

5.2 Water Supply

The Water Corporation's Integrated Water Supply System (IWSS) will supply potable water to the future homes on the site.

A Licence to Take Groundwater (GWL 179182) for irrigation and construction purposes was issued for the site by the Department of Water on 3 March 2015, with an allocation of 107250 kL/annum granted. Upon completion of construction works, the licence provides 53025 kL/annum for long term irrigation of 16.6 ha of POS. The remainder of the 107250 kL/annum will be transferred to the Department of Education upon completion of site construction. Upon advice from the Department of Water, water for irrigation of the school portion of the oval is to be drawn from the portion of the licence to be transferred to the Department of Education. The half of the oval accounted for in the irrigation schedule (Appendix H) requires 5700 kL/annum, providing an indication that ample allocation will be available for irrigation of the adjoining half of the oval on the school site. It will be the responsibility of the Department of Education to determine the exact irrigation volume required to be drawn from the available licence volume (54225 kL/annum), consistent with the landscaping plans for the school portion of the oval. The groundwater licence and operating strategy are attached as Appendix H.

Landscape plans and an irrigation schedule, prepared by Epcad and consistent with the issued allocation, are contained in Appendix F. Detailed landscape design and cross sections will be presented at UWMP stage.

Reduction of stormwater generation and minimisation of scheme water importation can be assisted by the integration of rain water tanks into the domestic water supply scheme as a non-potable source. Recommendations on rainwater tank sizing will be provided at UWMP stage, consistent with requirements of building design and DoW (2007).

Rain water tanks can assist in the reduction of stormwater generation and the minimisation of the use of scheme water. Implementation of rainwater tanks will be promoted but will not be mandatory.

5.3 Wastewater Management

Wastewater will be deep sewerage (reticulated) with management by Water Corporation.

6. Stormwater Management Strategy

Stormwater management is proposed to be undertaken consistent with DoW water sensitive urban design practices. The system will consist of subsurface storage/infiltration cells within road reserves. Runoff greater than the 1 in 1 year ARI event will be conveyed via overland flow to basin areas.

Key elements of the system which are reflected in the structure plan include:

- Maintenance of existing surface water flow paths and catchments.
- Infiltration of stormwater in sandy soils.

Management of road runoff through the use of flush kerbing adjacent to areas of public open space is recommended, with details to be considered at UWMP stage. The use of flush kerbing will allow some close to source infiltration through the capture and treatment of frequent rainfall events in the interface areas between road and POS. Opportunities for infiltration in the road reserves throughout the rest of the estate will be further considered at UWMP stage.

6.1 Stormwater Modelling

Stormwater modelling for the site was performed using the PONDS infiltration model. PONDS is a numerical model specifically designed for modelling ground water/surface water interactions for the design of stormwater infiltration areas, based on the finite difference computer program MODFLOW, developed by the U.S. Geological Survey.

This modelling determines conceptual flood storage requirements and provides an assessment of the local structure plan area required for drainage purposes at a level of detail consistent with requirements for an LWMS.

Key stormwater modelling parameters including runoff coefficients are shown in Table 10.

Storage areas were designed to contain and infiltrate runoff for up to the 100 year ARI storm event. Twenty-four infiltration areas were designed within POS with respect to the contributing catchment areas.

The following key parameters were used in the model:

- The invert of the infiltration areas were established at 1m below existing natural surface assuming minimal earthworks required in public open space.
- Base of superficial aquifer at -15 mAHD from the Perth Groundwater Atlas (DoE, 2004).
- Side slope for the infiltration area of 1:6.
- A saturated horizontal hydraulic conductivity and vertical unsaturated hydraulic conductivity for modelling purposes of 5 m/day and 2 m/day dependent on the location of the basin. In areas where 2 m/day is used it is assumed that any limestone will be deep ripped prior to construction of the basin.
- A runoff coefficient of 90% from road reserve areas, and 10% from lot area has been assumed.

Refinement of runoff rates, particularly for lot area will be undertaken at UWMP stage once site geotechnical investigations are complete and on site disposal opportunities via soakwell use confirmed.

The design rainfall storms modelled by PONDS were based on methodology in Australian Rainfall & Runoff (AR&R) (Institution of Engineers, Australia 2000) and determined using the Bureau of Meteorology Computerised Design IFD Rainfall System (CDIRS). The rainfall temporal pattern was assumed to be spatially uniform across the catchment. Storm durations modelled ranged from 1 hour to 72 hours. The design rainfall storms modelled by PONDS were based on methodology in Australian Rainfall & Runoff.

6.2 Serviceability (5 year)

Table 8 and Figure 6 detail the modelled storage volumes, areas, flood rises and inverts for the 5 year ARI design event. This provides the extent of the area required for stormwater serviceability requirements.

The total storage volume across the site required for the 5 year ARI event is estimated as approximately 6388m³.

Assuming a maximum flood depth of approximately 0.5m, the total basin area required for the 5 year ARI event is approximately 1.6 ha or 1.6% of the total development area.

6.3 Flood Protection (100 year)

Modelled flood protection storage volumes, areas and flood rises are detailed in Table 8 and Figure 7 for the 100 year ARI flood event.

The total storage volume across the site required for the 100 year ARI event is estimated as approximately 16526m³.

Assuming a maximum flood depth of approximately 1m, the total basin area required for the 100 year ARI event is approximately 2.4 ha or 2.3% of the total development area.

The UWMP will document the final infiltration area configuration and associated landscape and engineering drawings. This will be dependent on final earthworks, drainage, and road design levels for the development area. Minor refinements to the storage details shown in this report are considered likely to occur as part of the detailed design process. Stormwater modelling will be updated accordingly during the UWMP process.

Additional permeability testing and a refinement of infiltration modelling may be required at the UWMP stage, depending on the location and final elevations of the basin inverts relative to groundwater levels. Any changes to the final design inverts presented in this report will be determined in consultation with the DoW at subdivision stage and reported in a UWMP.

Minimum habitable building floor levels will comply with DoW requirements for a 300mm clearance above estimated 100 year ARI flood levels.

Table 8: Infiltration Area Conceptual Design

Site Characteristics		A1	B1	B2	B3	C1	D1	E1	F1
Lots (ha)	(10% runoff)	2.74	14.47	2.81	0.04	2.78	1.79	1.23	4.71
POS (ha)	(0% runoff)	0.70	0.01	0.03	0.00	0.31	0.02	0.55	0.25
Road & Road Reserve (ha)	(90% runoff)	1.37	6.44	1.35	0.30	1.19	0.83	0.71	2.26
Total Area (ha)		4.80	20.92	4.19	0.33	4.28	2.65	2.49	7.23
Equivalent Impervious Area (EIA) (ha)		1.51	7.24	1.50	0.27	1.35	0.93	0.76	2.56
Storage Design Parameters									
AAMGL (m AHD)		2.07	1.73	1.73	1.73	2.07	1.98	1.98	1.98
Storage Invert (mAHD)		6	6	6	6	6	9	9	9
Base Area (ha)		320	1925	320	50	280	320	252	1000
Side Slopes (v:h)		1:6	1:6	1:6	1:6	1:6	1:6	1:6	1:6
Minimum Bioretention Area Required									
Area (m ²)		302	1448	300	54	270	186	152	512
1 Year ARI Event									
Top Water Level Surface Area (m ²)		463	2204	463	125	415	442	366	1179
Flood Rise above Invert (m)		0.3	0.25	0.3	0.33	0.3	0.26	0.27	0.22
Volume (m ³)		117	516	117	28	104	99	83	239
Critical Storm (hr)		12hr	1hr	24hr	12hr	1hr	12hr	12hr	12hr
5 Year ARI Event									
Top Water Level Surface Area (m ²)		589	2452	589	199	542	572	485	1380
Flood Rise above Invert (m)		0.53	0.46	0.53	0.57	0.54	0.5	0.51	0.45
Volume (m ³)		237	1004	237	67	218	220	185	533
Critical Storm (hr)		12hr	1hr	12hr	12hr	12hr	72hr	72hr	72hr
100 Year ARI Event									
Top Water Level Surface Area (m ²)		896	3149	911	383	825	903	780	1945
Flood Rise above Invert (m)		1.00	1.00	1.02	1.03	0.99	1.01	1.00	1.02
Volume (m ³)		584	2513	602	196	524	593	492	1477
Critical Storm (hr)		12hr	72hr	72hr	72hr	12hr	72hr	72hr	72hr

Site Characteristics		G1	H1	I1	I2	J1	K1	L1	Q1
Lots (ha)	(10% runoff)	4.44	6.31	3.83	2.41	5.82	0.59	0.38	3.01
POS (ha)	(0% runoff)	0.41	1.13	0.01	0.00	0.99	0.00	0.56	0.04
Road & Road Reserve (ha)	(90% runoff)	1.62	2.44	1.93	1.38	2.55	0.06	0.51	1.09
Total Area (ha)		6.46	9.89	5.77	3.79	9.36	0.65	1.45	4.15
Equivalent Impervious Area (EIA) (ha)		1.90	2.83	2.12	1.48	2.87	0.11	0.50	1.28
Storage Design Parameters									
AAMGL (m AHD)		1.73	1.73	1.70	1.70	1.70	1.70	1.98	1.98
Storage Invert (mAHD)		5	5	8	8	8	8	7	9
Base Area (ha)		375	680	875	546	1140	10	150	476
Side Slopes (v:h)		1:6	1:6	1:6	1:6	1:6	1:6	1:6	1:6
Minimum Bioretention Area Required									
Area (m ²)		380	566	424	296	574	22	100	256
1 Year ARI Event									
Top Water Level Surface Area (m ²)		543	866	1033	690	1327	93	249	614
Flood Rise above Invert (m)		0.32	0.27	0.21	0.24	0.22	0.52	0.29	0.24
Volume (m ³)		146	208	200	148	271	23	57	131
Critical Storm (hr)		12hr	1hr	12hr	12hr	24hr	72hr	12hr	12hr
5 Year ARI Event									
Top Water Level Surface Area (m ²)		689	1032	1203	857	1546	142	349	762
Flood Rise above Invert (m)		0.56	0.49	0.42	0.49	0.46	0.71	0.53	0.47
Volume (m ³)		294	417	435	341	615	46	129	288
Critical Storm (hr)		12hr	12hr	72hr	72hr	72hr	72hr	72hr	72hr
100 Year ARI Event									
Top Water Level Surface Area (m ²)		1007	1463	1699	1280	2114	238	582	1152
Flood Rise above Invert (m)		1.01	0.99	0.96	1.03	1.04	1.00	0.98	0.99
Volume (m ³)		673	1037	1214	914	1681	100	336	782
Critical Storm (hr)		12hr	12hr	72hr	72hr	72hr	72hr	72hr	72hr

Site Characteristics		R1	S1	U1	V1	W1	X1	Y1	Z1
Lots (ha)	(10% runoff)	1.60	0.49	1.09	0.69	2.50	1.66	3.38	0.25
POS (ha)	(0% runoff)	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00
Road & Road Reserve (ha)	(90% runoff)	0.54	0.19	0.36	0.43	1.28	1.08	1.30	0.11
Total Area (ha)		2.17	0.68	1.45	1.12	3.81	2.74	4.71	0.35
Equivalent Impervious Area (EIA) (ha)		0.64	0.22	0.43	0.46	1.40	1.14	1.51	0.12
Storage Design Parameters									
AAMGL (m AHD)		1.70	1.70	1.73	1.73	1.73	1.73	2.62	2.62
Storage Invert (mAHD)		8	8	6	6	6	6	5	6
Base Area (ha)		200	48	120	60	350	220	300	27
Side Slopes (v:h)		1:6	1:6	1:6	1:6	1:6	1:6	1:6	1:6
Minimum Bioretention Area Required									
Area (m ²)		128	44	86	92	280	228	302	24
1 Year ARI Event									
Top Water Level Surface Area (m ²)		312	127	216	163	481	220	454	60
Flood Rise above Invert (m)		0.28	0.36	0.31	0.41	0.26	0.32	0.33	0.19
Volume (m ³)		71	30	51	44	108	354	124	8
Critical Storm (hr)		12hr	72hr	12hr	12hr	1hr	24hr	12hr	1hr
5 Year ARI Event									
Top Water Level Surface Area (m ²)		431	194	313	246	602	474	592	85
Flood Rise above Invert (m)		0.53	0.58	0.56	0.65	0.47	0.56	0.58	0.31
Volume (m ³)		164	66	117	93	221	190	254	17
Critical Storm (hr)		72hr	72hr	72hr	12hr	12hr	12hr	12hr	3hr
100 Year ARI Event									
Top Water Level Surface Area (m ²)		704	346	523	410	947	763	864	150
Flood Rise above Invert (m)		1.00	0.97	0.99	1.03	0.98	1.04	1.00	0.55
Volume (m ³)		428	169	295	216	613	484	558	45
Critical Storm (hr)		72hr	72hr	72hr	72hr	72hr	72hr	12hr	12hr

6.4 Ecological Protection (1 year)

6.4.1 Structural Controls

Storm volumes for ecological protection based on the 1 year ARI event are provided in Table 8 to provide a guide for storage requirements and areas for water quality treatment consistent with DoW requirements (DoW, 2009).

This requirement is effectively exceeded in the proposed design as events up to 100 year ARI will be infiltrated.

With respect to biofiltration, based on DoW criteria, the total area required for bioretention across all infiltration areas on site will be approximately 0.7ha, sized as 2% of the connected equivalent impervious area, which is assumed to 35 ha. Water quality treatment locations will be detailed at the UWMP stage.

The UWMP will contain further specific details of biofiltration areas, as well as opportunities to reduce the storage size requirements through consideration of distributed storage and potential use of raingardens.

Figure 8 provides a schematic of the possible form for bioretention systems within the development area.

Expected pollutant removal efficiencies for various WSUD measures in relation to water quality design criteria are outlined in Table 9, consistent with DoW's Stormwater Management Manual for Western Australia.

Table 9: BMP Water Quality Performance In Relation to Design Criteria

Water Quality Parameter	Design Criteria via BUWM (WAPC,2008) (required removal as compared to a development with no WSUD)	Structural Controls Nutrient Output Reduction ¹	
		Bioretention Systems	Detention/ Retention Storages
Total Suspended Solids	80%	60-80%	65-99%
Total Phosphorus	60%	30-50%	40-80%
Total Nitrogen	45%	25-40%	50-70%
Gross Pollutants	70%	-	>90%

1. Typical Performance Efficiencies via DoW (2007)

6.4.2 Non-Structural Controls

Design objectives for water quality as presented in *Better Urban Water Management* (WAPC, 2008) have the potential to be achieved through application of a treatment train approach. This approach combines non-structural and structural measures previously outlined in Section 6.4.2.

This LWMS recommends a treatment train approach to water quality management which includes structural and non-structural controls:

- **Non Structural Controls**

Planning : Establishment of infiltration areas in POS

Landscape: Vegetation (native plantings) selection, WSUD integration

Education: Point of Sale WSUD education package

Maintenance: Street sweeping, Manhole education

Monitoring: Post development program and review

- **Structural Controls**

Bioretention : 2% of Connected Impervious Area

Ephemeral Infiltration Area : 1, 5 and 100 Year ARI Events

Measures adopted represent known best management practice as detailed in the DoW's Stormwater Management Manual for Western Australia (2007).

7. Groundwater Management Strategy

7.1 Fill and Subsoil Drainage

Depth to groundwater varies over the development area from approximately 3.7 m to 20 m below the existing natural surface.

Due to this clearance to groundwater and the sandy soil profile, it is unlikely that imported fill will be required for the site. As a result of the aforementioned factors, subsoil drainage will not be necessary at the site.

7.2 Acid Sulphate Soils

As previously discussed in Section 3.2.1, no known ASS risk is present at the site, therefore an ASS management plan is not required.

8. Urban Water Management Plans

Consistent with processes defined in WAPC (2008), UWMP's will be developed and submitted to support the subdivision application for the site. The UWMP's will address:

- Demonstrated compliance with LWMS criteria and objectives to the satisfaction of the City of Mandurah and DoW.
- Agreed/approved measures to achieve water conservation and efficiencies of water use.
- Detailed stormwater management design including refining stormwater modelling detailed in the LWMS.
- Management of groundwater levels including proposed fill levels.
- Specific structural and non-structural BMPs and treatment trains to be implemented including their function, location, maintenance requirements, expected performance and agreed on going management arrangements.
- Management of subdivisional works.
- Implementation plan including roles, responsibilities, funding and maintenance arrangements.
- Specific monitoring and reporting to be undertaken consistent with the monitoring program defined in the LWMS.
- Contingency plans (where necessary).

More detail of stormwater storage integration will be provided during the development of the UWMP's, including refinement of stormwater modelling, preparation of landscape plans (species selection and treatments), and detailed design drawings.

Preparation of the UWMP will be the developer's responsibility.

9. Monitoring

9.1 Pre-Development

No need is anticipated for additional predevelopment groundwater or surface water monitoring for the purpose of informing the UWMP and subdivision process.

If any further monitoring is required this will serve to inform engineering design rather than to satisfy government agency requirements.

9.2 Post Development

Post development groundwater monitoring locations and parameters are detailed in Figure 9 and Table 10.

DoW (2011) indicates a minimum of 3 years post development monitoring is required, and defines post development as *"from completion of first subdivision to five years after 80 per cent of the development (by land area) has been completed"*.

The program is therefore designed to operate over the minimum three year post development period, with the timing for commencement of the program to be negotiated at UWMP stage with DoW and CoM.

Water quality results should be monitored to ensure that they do not exceed the established trigger values. Trigger values have been based on pre development monitoring results. This is consistent with the following general objective of water sensitive urban design as included in Better Urban Water Management (Department of Water 2008) and the Stormwater Management Manual for WA (Department of Water 2007):

"To maintain and where possible, enhance water quality".

The trigger values will vary for each bore based on the predevelopment recorded values as outlined in Table 6 in Section 3.4.2.

Should average trigger values across the site be exceeded, targeted monitoring could be undertaken to find the cause of the exceedance of trigger values. The appropriate consultants should be engaged to take necessary action, such as:

- Soil amendment in infiltration areas,
- Increased nutrient stripping vegetation in infiltration area,
- Public awareness campaigning and distribution of community education tools related to water sensitive urban design.

The program may need to be modified as data is collected to increase or decrease the monitoring effort in a particular area, or to alter the scope of the program itself. Any modification to the program would be identified through review of the collected data and would require the agreement of all parties (DoW, CoM, and developer).

All water quality testing will be conducted by a NATA approved laboratory.

Table 10: Post Development Monitoring Program

Monitoring	Parameter	Location	Method	Frequency and Timing
Groundwater	Water Level (m AHD)	4 site bores, 2 Dow Bores	Electrical depth probe or similar	Quarterly
	pH			
	EC (µS/cm)	4 site bores	Pumped bore sample	Quarterly (Jan, Apr, Jul & Oct)
	Nitrogen(mg/L)			
	Phosphorus(mg/L)			

10. Implementation

Table 11 details the roles, responsibilities and funding to implement the LWMS for this site.

Monitoring outcomes will be used in a continual improvement capacity to review the implemented WSUD within the site and inform the planning and design approaches for subsequent stages of development.

Any modification required to the LWMS would be identified through the review process of monitoring data and would require the agreement of all parties (DoW, CoM, and developer).

Details of maintenance responsibilities will be detailed at the UWMP stage. It is envisaged that the schedule for maintenance works will be consistent with typical requirements of the City.

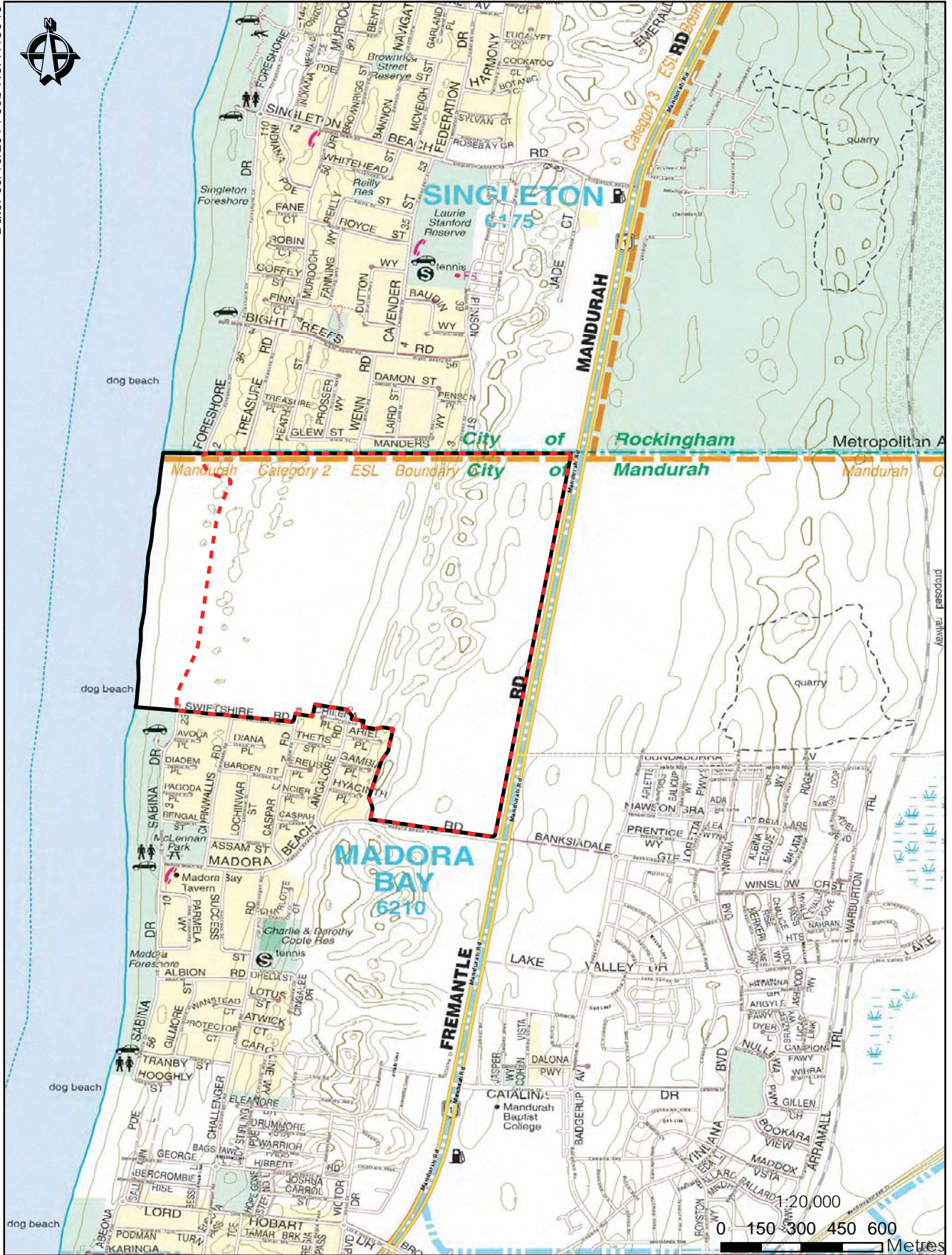
Table 11: Implementation Responsibility



LWMS Section	Implementation Action	Responsibility & Funding	
		The Developer	CoM
Urban Water Management Plan			
8	Preparation of a UWMP	<input checked="" type="checkbox"/>	
8	Review & Approval of UWMP		<input checked="" type="checkbox"/>
Monitoring Program			
9	Post Development Monitoring Program	<input checked="" type="checkbox"/>	
Stormwater System			
-	Construction of system	<input checked="" type="checkbox"/>	
Operation & Maintenance			
-	a) Prior to Handover	<input checked="" type="checkbox"/>	
-	b) Following Handover		<input checked="" type="checkbox"/>

11. References





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- Western Australian Planning Commission (2008). Better Urban Water Management, October 2008.

FIGURES





-  Site
-  ODP boundary



-  Site
-  ODP boundary
-  POS
-  School

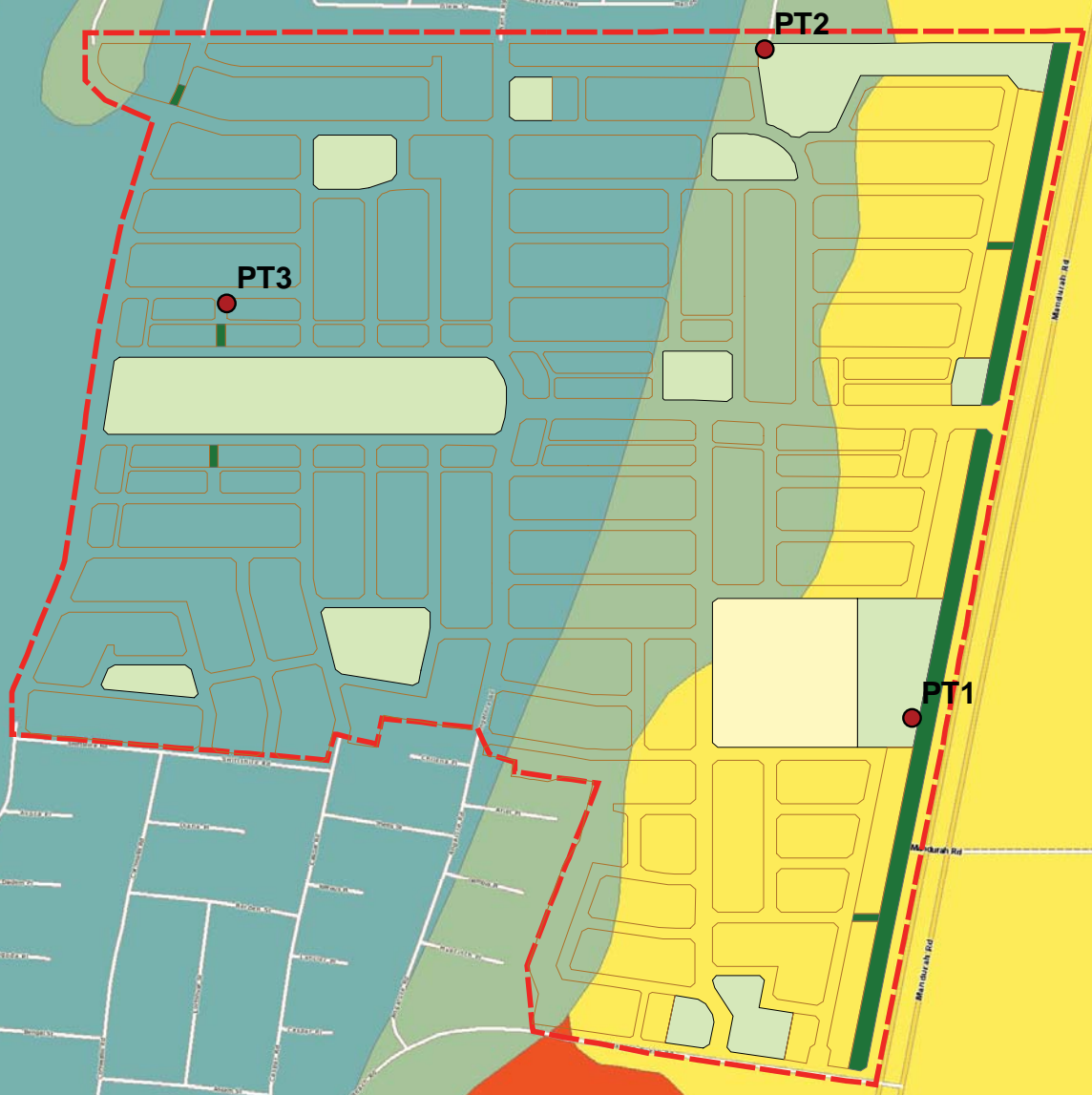
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 0 100 200 300 400
 Metres













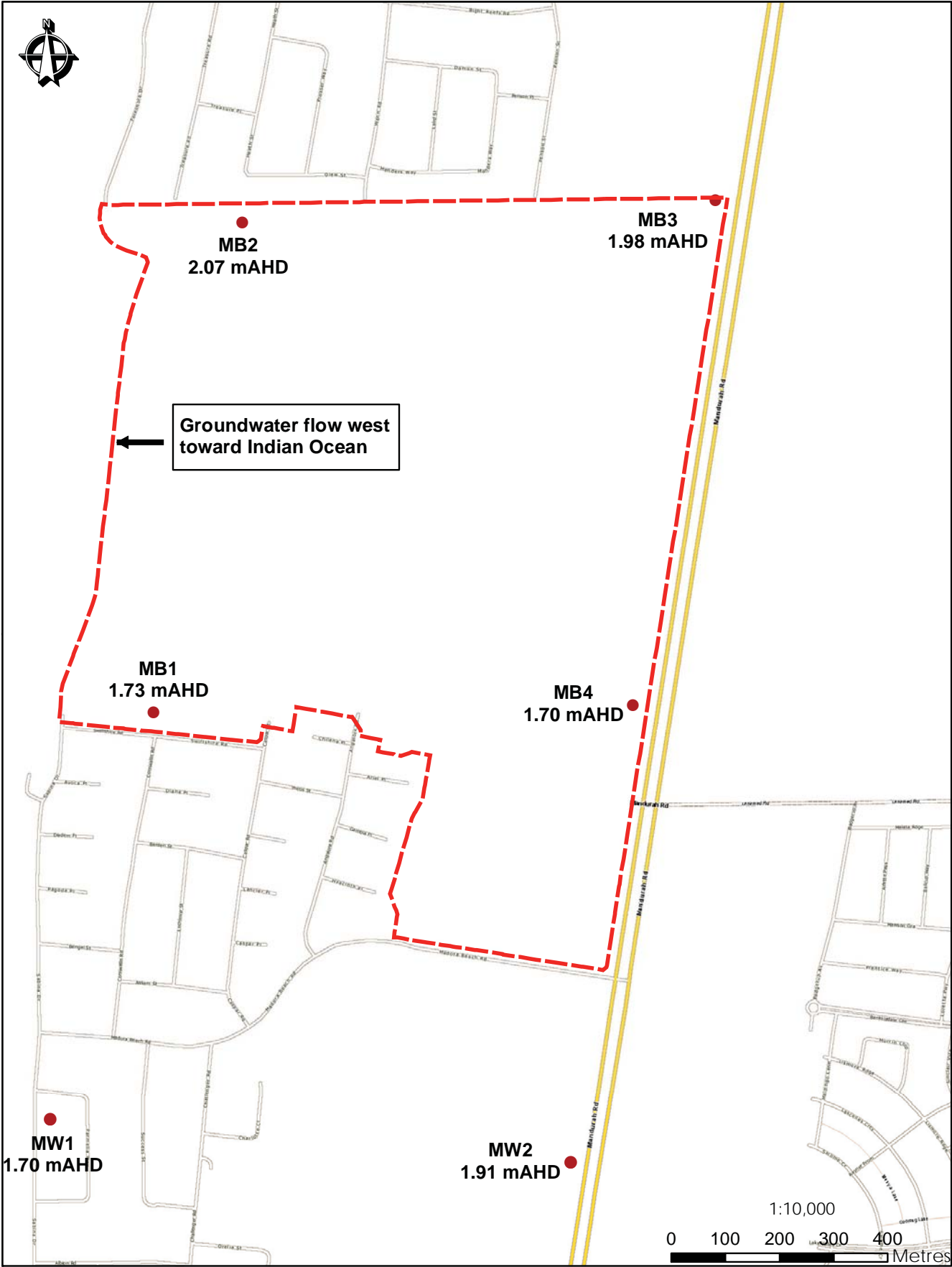
-  Site
-  Elevation contours (mAH)



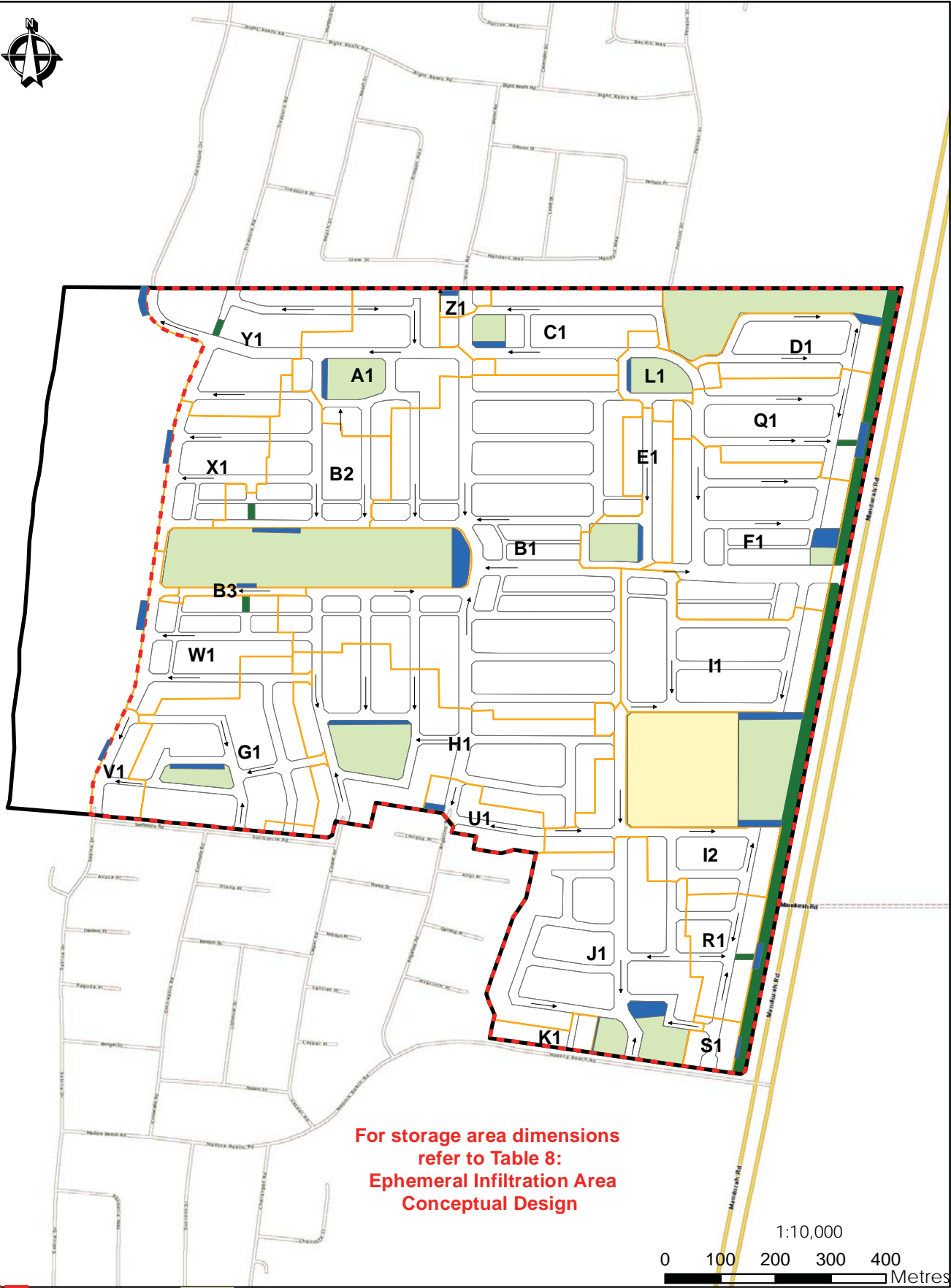
No ASS risk present on site



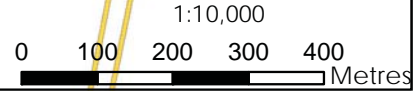
-  Site
-  Lots
-  POS
-  Permeability Test Site
-  Non creditable POS
-  LS1 - Limestone
-  S2 - Calcareous Sand
-  S13 - Calcareous Sand
-  LS4 - Limestone
-  School



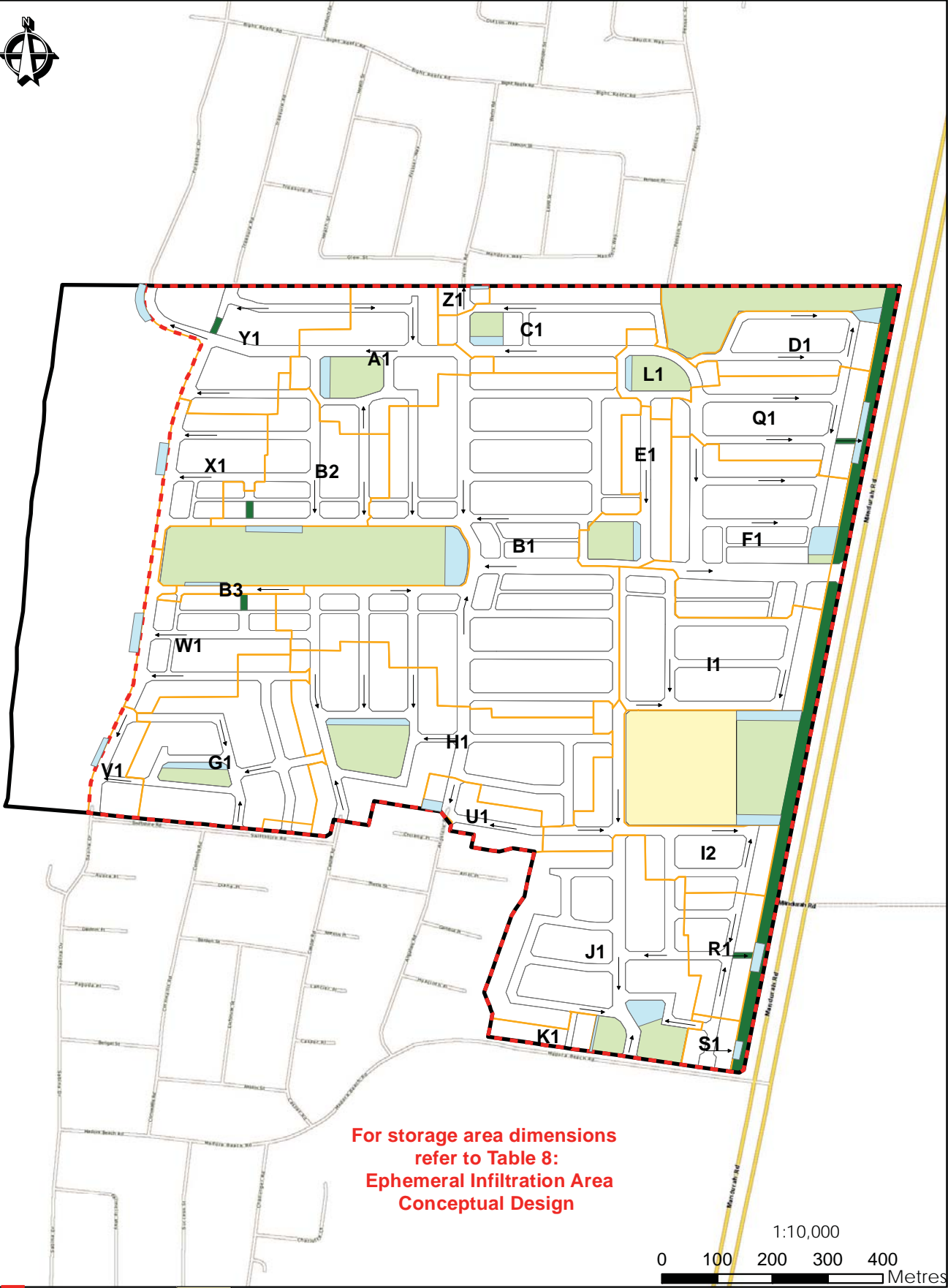
-  Site
-  Groundwater Bore
- MW1**
1.73 mAHD
- AAMGL**



For storage area dimensions refer to Table 8: Ephemeral Infiltration Area Conceptual Design



- Site
- Catchments
- POS
- 5 Year ARI Ephemeral Infiltration Storage
- ODP
- School
- Non creditable POS
- Flow Path



**For storage area dimensions
refer to Table 8:
Ephemeral Infiltration Area
Conceptual Design**

- Site
- School
- Catchments
- Non creditable POS
- POS
- Flow Path
- 100 Year ARI Ephemeral Infiltration Storage
- ODP boundary

1:10,000
0 100 200 300 400 Metres

Design Function

Note: Transition and drainage layers may not be required if direct infiltration of treated stormwater to surrounding soils is possible

Aid aesthetics and assist in pollutant removal

Sedimentation of primary sediments and metals

Suppress weeds and retain moisture in underlying filter media

Nutrient uptake by biofilms

Nutrient sorption and pollutant decomposition by soil/bacteria

Soil filters fine sediments and colloidal particles

Soil layer supports plant growth

Sorption of metals and nutrients by filter particles

Side liner required if in clay sites to prevent contamination of filter, and in coarse sandy sites if the native soil has a higher hydraulic conductivity than the filter media

Sawdust provides carbon source to enhance chemical processes in soil

Separates filter layer from drainage layer to avoid clogging

Free draining layer containing pipe (if required)
Subsoil pipe can aid in water table control and also required in impervious systems to collect and convey water

Infiltration from base if in sandy sites

Design Guidelines

Extended detention depth

200 - 300mm

Local, native, ephemeral plants e.g. *Ficinia nodosa* (formerly *isolepis nodosa*)
4 - 8 plants per m², dependent on species

PLANTS

50mm

Stone 100% within 4 - 13 mm. No fines. Note that wood mulch will float under flooded conditions

75mm

Ameliorate soil to enhance plant growth - test to confirm

Washed sand, sandy loam, or clean free draining sand.
Saturated hydraulic conductivity in range 100 - 300 mm/hr
Clay & Silt < 3%
Very Fine Sand 5 - 30% (0.05 - 0.15 mm)
Fine Sand 10 - 30% (0.15 - 0.25 mm)
Medium to Coarse Sand 40 - 60% (0.25 - 1.0 mm)
Coarse Sand 7 - 10% (1.0 - 2.0 mm)
Fine Gravel < 3% (2.0 - 3.4 mm)
pH 5.5 - 7.5
Total salts < 500ppm
Amend soil with 30% sawdust or woodchips

300 - 500mm

FILTER

100mm

Coarse sand 90% retained above 0.25 mm particle size
Alternatively - use Geotextile

200mm

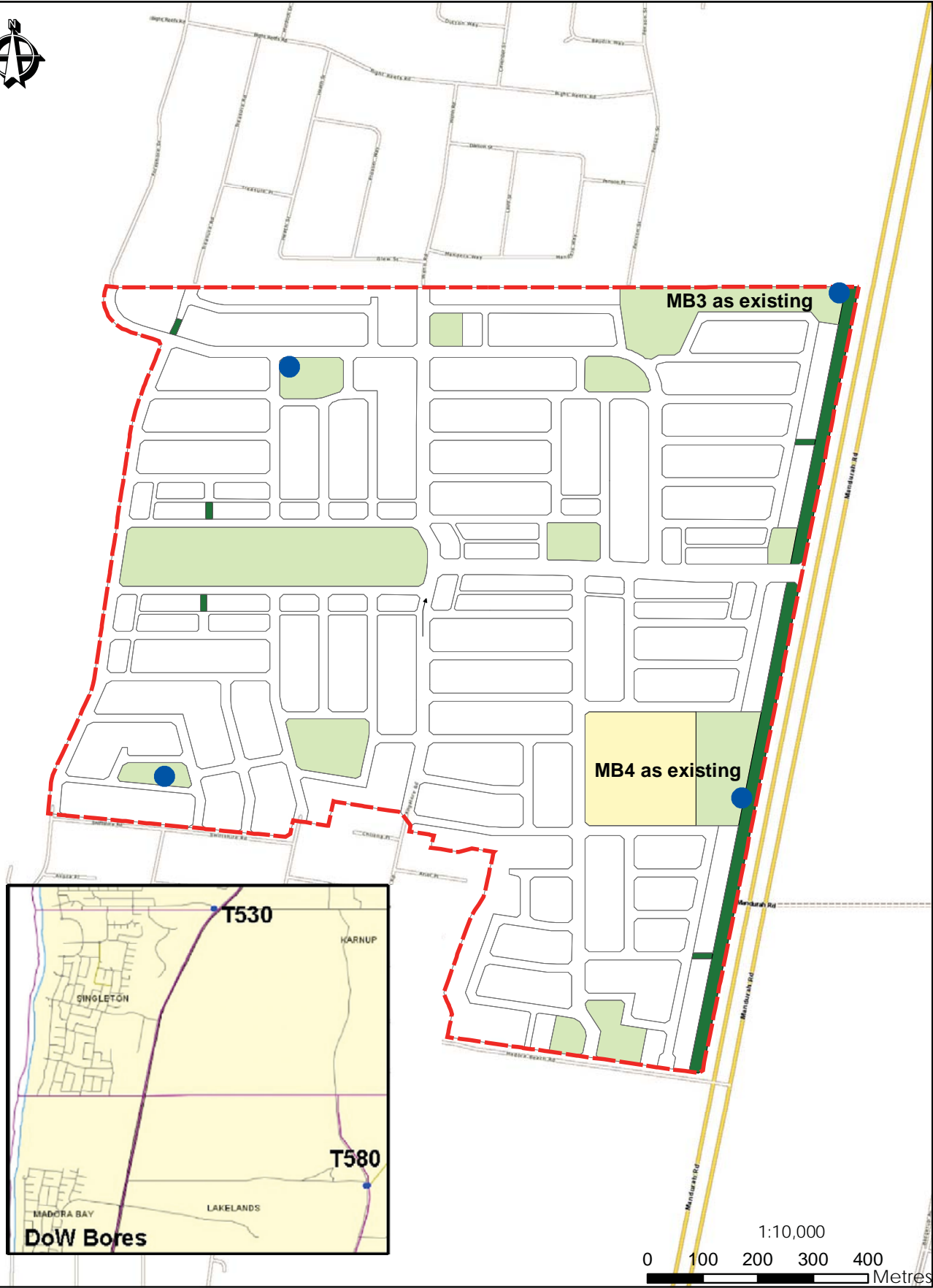
Fine gravel / crushed rock 4 mm - 7 mm
7 mm 100% passing, 4 mm 30% passing, 2 mm 0% passing
Slotted subsoil pipe in geotextile (if required)

TRANSITION

DRAINAGE

* Cross Section should be considered indicative only - 1 year areas to be designed at UWMP stage

Source : Lechanault Catchment Council Bioretention Facisheet



- Site
- POS
- Non creditable POS
- School
- Post Development Monitoring Bore

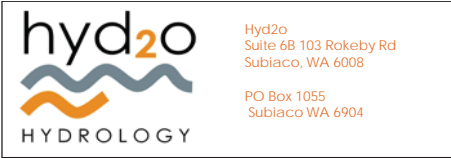
APPENDIX A
LWMS Checklist for Developers

Better Urban Water Management LWMS Checklist

Local Water Management Strategy Item	Deliverable	✓	Comments
Executive summary			
Summary of the development design strategy, outlining how the design objectives are proposed to be met	Table 1: design elements and requirements for BMP's and critical control points	<input checked="" type="checkbox"/>	Executive Summary and Strategy Table
Introduction			
Total water cycle management - principles and objectives Planning background Previous studies		<input checked="" type="checkbox"/>	Section 1.1, 1.2
Proposed development			
Structure plan, zoning and land use Key landscape features Previous land use	Location plan Local Site structure plan conditions plan	<input checked="" type="checkbox"/>	Section 1& 2, Figure 1, Figure 2, Figure 3
Landscape - proposed POS areas, POS credits, water source, bore(s), lake details (if applicable), irrigation areas	Landscape plan	<input checked="" type="checkbox"/>	Landscape Plans to be developed at UWMP Stage and informed by LWMS. Stormwater Areas and Volumes to inform POS credits identified (Table 8, Figure 8, Figure 9, Section 6). Water Availability identified (Section 5.2)
Design criteria			
Agreed design objective and source of objective		<input checked="" type="checkbox"/>	Section 4
Pre-development environment			
Existing information and more detailed assessments (monitoring). How do the site characteristics affect the design?		<input checked="" type="checkbox"/>	Section 3
Site conditions- existing topography/ contours, aerial photo underlay, major physical features	Site condition plan	<input checked="" type="checkbox"/>	Section 3.1, Figure 3
Geotechnical - topography, soils including acid sulfate soils and infiltration capacity, test pit locations	Geotechnical plan	<input checked="" type="checkbox"/>	Section 3.2, Figure 3, Figure 4
Environmental- areas of significant flora and fauna, wetlands and buffers, waterways and buffers, contaminated sites	Environmental plan plus supporting data where appropriate	<input checked="" type="checkbox"/>	Section 3
Surface water- topography, 100 year floodways and flood fringe areas, water quality of flows entering and leaving (if applicable)	Surface water plan	<input checked="" type="checkbox"/>	Section 3.3 Figure 6
Groundwater - topography, pre development groundwater levels and water quality, test bore locations	Groundwater plan plus details of groundwater monitoring and testing	<input checked="" type="checkbox"/>	Section 3.4, Figure 7
Water use sustainability initiatives			
Water efficiency measures- private and public open spaces including method of enforcement		<input checked="" type="checkbox"/>	Section 5.1
Water supply (fit- for-purpose strategy), agreed actions and implementation. If non-potable supply, support with water balance		<input checked="" type="checkbox"/>	Section 5.2
Wastewater management		<input checked="" type="checkbox"/>	Section 5.3
Stormwater management strategy			
Flood protection - peak flow rates, volumes and top water levels at control points, 100 year flow paths and 100 year detentions storage areas	100yr event plan	<input checked="" type="checkbox"/>	Section 6.1 and 6.3, Table 8, Figure 9,
Manage serviceability - storage and retention required for the critical 5 year ARI storm events Minor roads should be passable in the 5 year ARI event	5yr event plan	<input checked="" type="checkbox"/>	Section 6.2, Table 8, Figure 8
Protect ecology - detention areas for the 1 yr 1 hr ARI event, areas for water quality treatment and types of (including indicative locations for) agreed structural and non-structural best management practices and treatment trains. Protection of waterways, wetlands (and their buffers), remnant vegetation and ecological linkages	1 yr event plan Typical cross sections	<input checked="" type="checkbox"/>	Section 6.4, Table 8

Local Water Management Strategy Item	Deliverable	✓	Comments
Groundwater management strategy			
Post development groundwater levels, fill requirements (including existing and likely final surface levels), outlet controls, and subsoil areas/exclusion zones	Groundwater/subsoil Plan	<input checked="" type="checkbox"/>	Section 7.1
Actions to address acid sulphate soils or contamination		<input checked="" type="checkbox"/>	Section 7.2, Figure 5
The next stage - subdivision and urban water management plans			
Content and coverage of future urban water management plans to be completed at subdivision. Include areas where further investigations are required prior to detailed design		<input checked="" type="checkbox"/>	Section 8
Monitoring			
Recommended future monitoring plan including timing, frequency, locations and parameters, together with arrangements for ongoing actions		<input checked="" type="checkbox"/>	Section 9, Table 10
Implementation			
Developer commitments		<input checked="" type="checkbox"/>	Section 10, Table 11
Roles, responsibilities, funding for implementation		<input checked="" type="checkbox"/>	Section 10, Table 11
Review		<input checked="" type="checkbox"/>	Section 10, Table 11

APPENDIX B
Lithological Logs



LITHOLOGICAL LOG

Client: Madora Bay Partnership Job No: H11005
 Project: Lot 100 Madurah Rd, Madora Bay North Hole commenced: 8:15
 Bore location: MB1 Hole completed: 8:45
 Datum: MGA94/AHD Logged by: S. Smart

Bore Name: Total Depth: 7.94
 Drill type: Drill rig R.L. TOC: 6.05
 Hole diameter: 50 mm Natural Surface: 5.45

support	backfill	water	Slot / Screen Depth	Depth (metres)	SOIL CHARACTERISTICS					
					COLOUR	PARTICLE SIZE	TEXTURE	ORGANIC CONTENT	MOISTURE	COMMENTS
PVC (Class 9)				0.5m	Dark Brown	Fine			Dry	
				1.0-4.0 m					Moist	
				4.5 m						
				5.0 m						
				5.5 m			Sand	Low		
				6.0 m	Light Brown	Medium				
				6.5 m					Saturated	
				7.0 m						
				7.5 m						
				8.0 m						

NOTES ON BORELOG

COLOURS: Solid colours are BLACK, WHITE, BEIGE
 Dar Brown, Red, Orange, Yellow, Grey, Blue Tones : solid colour, blemish or mottle
 Me Brown, Red, Orange, Yellow, Grey, Blue
 Lig Brown, Red, Orange, Yellow, Grey, Blue

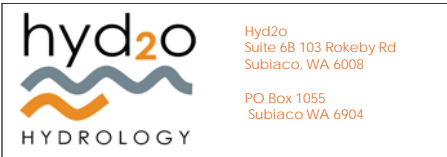
PARTICLE SIZE : Particles are either FINE, MEDIUM or COARSE

TEXTURE : Sand, Loamy Sand, Clayey Sand
 Silt, Loam, Sandy Loam, Clay Loam
 Clay, Sandy Clay

ORGANIC CONTENT: VOLUME: High, Medium, Low
 SIZE: Fine, Medium, Coarse

MOISTURE: Soil Moisture can be either: DRY, SLIGHTLY MOIST, MOIST or SATURATED

STATIC WATER LEVEL
 Date: ... 9/08/2011
 WL below TOC: 5.14 m
 Stickup above NS: 0.60 m
 WL: 4.54 m below NS



LITHOLOGICAL LOG

Client: Madora Bay Partnership Job No: H11005
 Project: Lot 100 Mandurah Rd, Madora Bay North Hole commenced: 10:00
 Bore location: MB2 Hole completed: 10:22
 Datum: MGA94/AHD Logged by: S. Smart

Bore Name: Total Depth: 7.57
 Drill type: Drill rig R.L. TOC: 6.17
 Hole diameter: 50 mm Natural Surface: 5.57

support	backfill	water	Slot / Screen Depth	Depth (metres)	SOIL CHARACTERISTICS					
					COLOUR	PARTICLE SIZE	TEXTURE	ORGANIC CONTENT	MOISTURE	COMMENTS
PVC (Class 9)				0.5m	Dark Brown	Fine	Sand	Low	Dry	
				1.0m	Medium Brown					
				3.0m						
				3.5m						
				4.0m						
				4.5m	Light Brown	Medium				
				5.0m						
				5.5m						
				6.0m						
				7.0m						
								Slightly Moist		
								Saturated		

NOTES ON BORELOG

COLOURS: Solid colours are BLACK, WHITE, BEIGE
 Dar Brown, Red, Orange, Yellow, Grey, Blue Tones : solid colour, blemish or mottle
 Me Brown, Red, Orange, Yellow, Grey, Blue
 Lig Brown, Red, Orange, Yellow, Grey, Blue

PARTICLE SIZE : Particles are either FINE, MEDIUM or COARSE

TEXTURE : Sand, Loamy Sand, Clayey Sand
 Silt, Loam, Sandy Loam, Clay Loam
 Clay, Sandy Clay

ORGANIC CONTENT: VOLUME: High, Medium, Low
 SIZE: Fine, Medium, Coarse

MOISTURE: Soil Moisture can be either: DRY, SLIGHTLY MOIST, MOIST or SATURATED

STATIC WATER LEVEL

Date: ... 9/08/2011

WL below TOC: 4.52 m

Stickup above NS: 0.60 m

WL: 3.92 m below NS



Hyd20
Suite 6B 103 Rokeby Rd
Subiaco, WA 6008
PO Box 1055
Subiaco WA 6904

LITHOLOGICAL LOG

Client: Madora Bay Partnership
Project: Lot 100 Mandurah Rd, Madora Bay North
Bore location: MB3
Datum: MGA94/AHD

Job No: H11005
Hole commenced: 11:30
Hole completed: 13:00
Logged by: S. Smart
Total Depth: 12.70
R.L. TOC: 10.31
Natural Surface: 9.71

Bore Name:
Drill type: Drill rig
Hole diameter: 50 mm

support	backfill	water	Slot / Screen Depth	Depth (metres)	SOIL CHARACTERISTICS							
					COLOUR	PARTICLE SIZE	TEXTURE	ORGANIC CONTENT	MOISTURE	COMMENTS		
PVC (Class 9)				0.5 m	Medium Brown-Orange	Medium	Sand	Low	Dry			
				1.0 m	Light Brown					Limestone chunks		
				1.5 m								
				2.0 m	Beige	Medium						
				2.5 m								
				3.0 m							Limestone layer	
				6.0 m							NO CUTTINGS returned	
				9.0 m								
				12.0 m								
												End of hole

NOTES ON BORELOG

COLOURS: Solid colours are BLACK, WHITE, BEIGE
Dar Brown, Red, Orange, Yellow, Grey, Blue
Med Brown, Red, Orange, Yellow, Grey, Blue
Lig Brown, Red, Orange, Yellow, Grey, Blue
Tones : solid colour, blemish or mottle

PARTICLE SIZE : Particles are either FINE, MEDIUM or COARSE

TEXTURE : Sand, Loamy Sand, Clayey Sand
Silt, Loam, Sandy Loam, Clay Loam
Clay, Sandy Clay

ORGANIC CONTENT: VOLUME: High, Medium, Low
SIZE: Fine, Medium, Coarse

MOISTURE: Soil Moisture can be either: DRY, SLIGHTLY MOIST, MOIST or SATURATED

STATIC WATER LEVEL

Date: .. 9/08/2011

WL below TOC: 9.39 m

Stickup above NS: 0.60 m

WL: 8.79 m below NS



Hyd20
Suite 6B 103 Rokeby Rd
Subiaco, WA 6008
PO Box 1055
Subiaco WA 6904

LITHOLOGICAL LOG

Client: Madora Bay Partnership	Job No: H11005
Project: Lot 100 Mandurah Rd, Madora Bay North	Hole commenced: 14:00
Bore location: MB4	Hole completed: 14:20
Datum: MGA94/AHD	Logged by: S. Smart
Bore Name:	Total Depth: 7.73
Drill type: Drill rig	R.L. TOC: 8.23
Hole diameter: 50 mm	Natural Surface: 7.63

support	backfill	water	Slot / Screen Depth	Depth (metres)	SOIL CHARACTERISTICS					
					COLOUR	PARTICLE SIZE	TEXTURE	ORGANIC CONTENT	MOISTURE	COMMENTS
PVC (Class 9)				0.5m	Dark Brown	Fine				
				1.0m						Limestone chunks
				3.0m		Medium				
				3.5m			Sand	Low	Dry	
				4.0m	Light Brown					
				4.5m		Fine				
				6.0m						
			▽	8.0m					MOIST	
										End of hole

NOTES ON BORELOG

COLOURS: Solid colours are BLACK, WHITE, BEIGE
 Dar Brown, Red, Orange, Yellow, Grey, Blue
 Tones : solid colour, blemish or mottle
 Me Brown, Red, Orange, Yellow, Grey, Blue
 Lig Brown, Red, Orange, Yellow, Grey, Blue

PARTICLE SIZE : Particles are either FINE, MEDIUM or COARSE

TEXTURE : Sand, Loamy Sand, Clayey Sand
 Silt, Loam, Sandy Loam, Clay Loam
 Clay, Sandy Clay

ORGANIC CONTENT: VOLUME: High, Medium, Low
 SIZE: Fine, Medium, Coarse

MOISTURE: Soil Moisture can be either: DRY, SLIGHTLY MOIST, MOIST or SATURATED

STATIC WATER LEVEL

Date: .. 9/08/2011

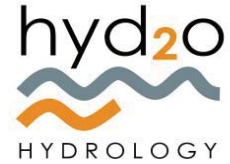
WL below TOC: 7.33 m

Stickup above NS: 0.60 m

WL: 6.73 m below NS

APPENDIX C
Saturated Hydraulic Conductivity Calculations

Borehole Permeameter : Field Result Analysis



Project/Site	PT3- Madora Bay North LWMS	
Location	382606	mE
	6408011	mN

TEST 1

r	6.5	cm
H	10.0	cm
time step	10	secs
H/r	1.54	
C	0.75	
Time (sec)	Level (cm)	Diff (cm)
0	4.0	0.0
10	21.5	17.5
20	36.2	14.7
30	50.9	14.7
40	65.7	14.8
		15.4
		13.6

TEST 2

r	6.5	cm
H	10.0	cm
time step	10	secs
H/r	1.54	
C	0.75	
Time (sec)	Level (cm)	Diff (cm)
0	2.6	0.0
10	24.2	21.6
20	40.4	16.2
30	61.2	20.8
	Avg Diff (cm)	19.5
	q (cm ³ /s)	17.2

TEST 3

r	6.5	cm
H	10.0	cm
time step	10	secs
H/r	1.54	
C	0.75	
Time (sec)	Level (cm)	Diff (cm)
0	21.0	0.0
10	27.1	6.1
20	49.0	21.9
30	69.0	20.0
	Avg Diff (cm)	12.0
	q (cm ³ /s)	10.6

METHOD 1 : Elrick and Reynolds (1992)

Ks (cm/s)	0.0139	Ks (cm/s)	0.0176	Ks (cm/s)	0.0108
Ks (m/day)	12.03	Ks (m/day)	15.24	Ks (m/day)	9.36
Average (m/day)	12.21				

METHOD 2 : Talsma and Hallam Method (recommended for low Ks only <2.9)

q (cm ³ /min)	814.4	1031.4	cm ³ /min	633.6	cm ³ /min
r (cm)	6.5	6.5	cm	6.5	cm
H (cm)	10.0	10.0	cm	10.0	cm
0.5sinh ⁻¹ (H/2r)	0.35	0.35		0.35	
-sqrt((r/H) ² +0.25)	-0.82	-0.82		-0.82	
r/H	0.65	0.65		0.65	
Sum	0.18	0.18		0.18	
Sum*4.4*q	659.98	835.76		513.43	
2*pi*H ²	628.32	628.32		628.32	
Ksat (cm/min)	1.1	1.3		0.8	
Ksat (m/day)	15.13	19.15		11.77	
Average (m/day)	15.35				

APPENDIX D
DoW Historical Water Level Data

Department of Water

HYPLOT V133 Output 08/11/2013

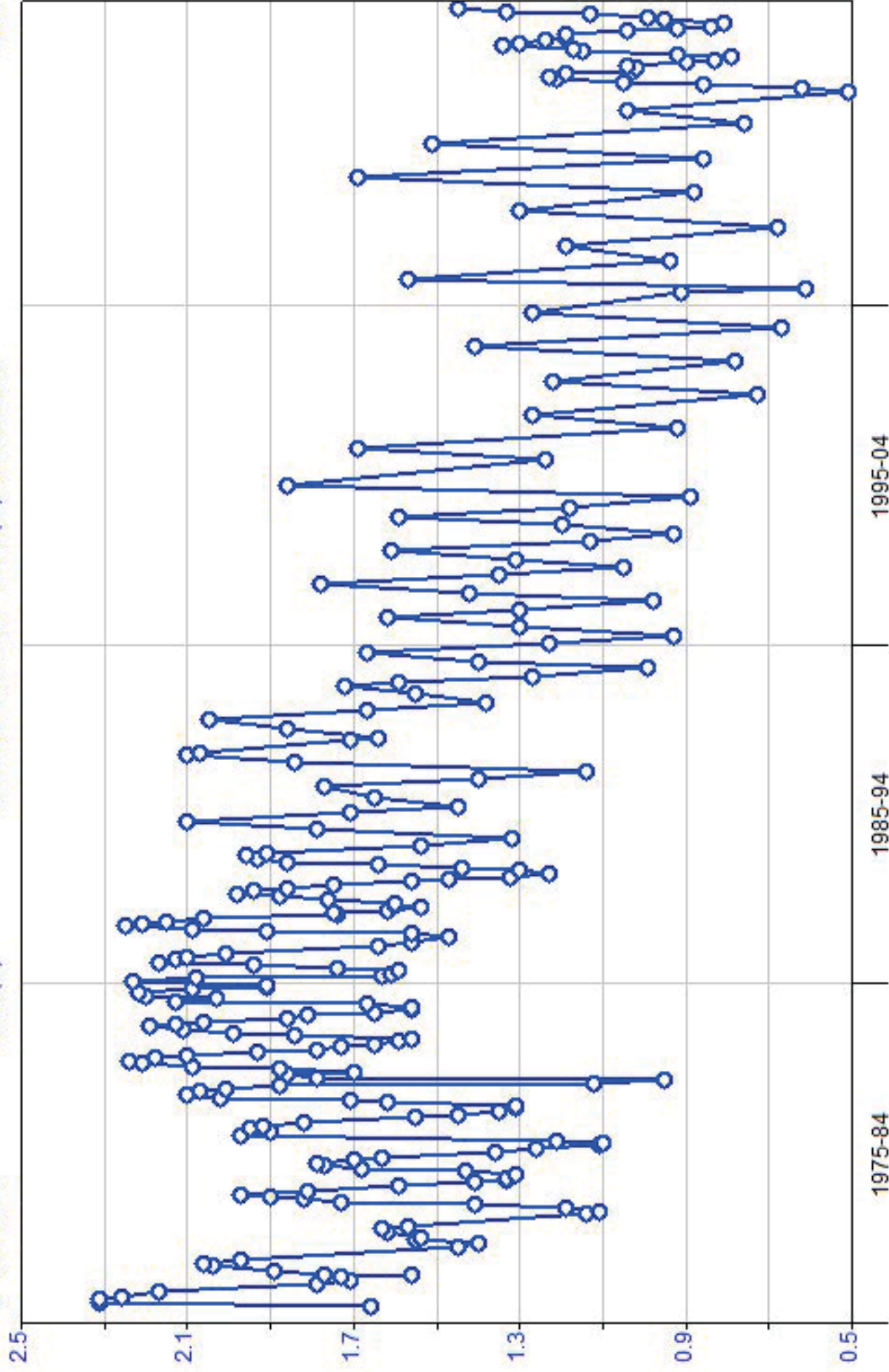
Period 39 Year Plot Start 00:00_01/01/1975
Interval 1 Month Plot End 00:00_01/01/2014

1975-14

GWL

6268.00 Line/Point Level(m)AHD Discrete

61410027 T530 (O)



Department of Water

HYPLOT V133 Output 08/11/2013

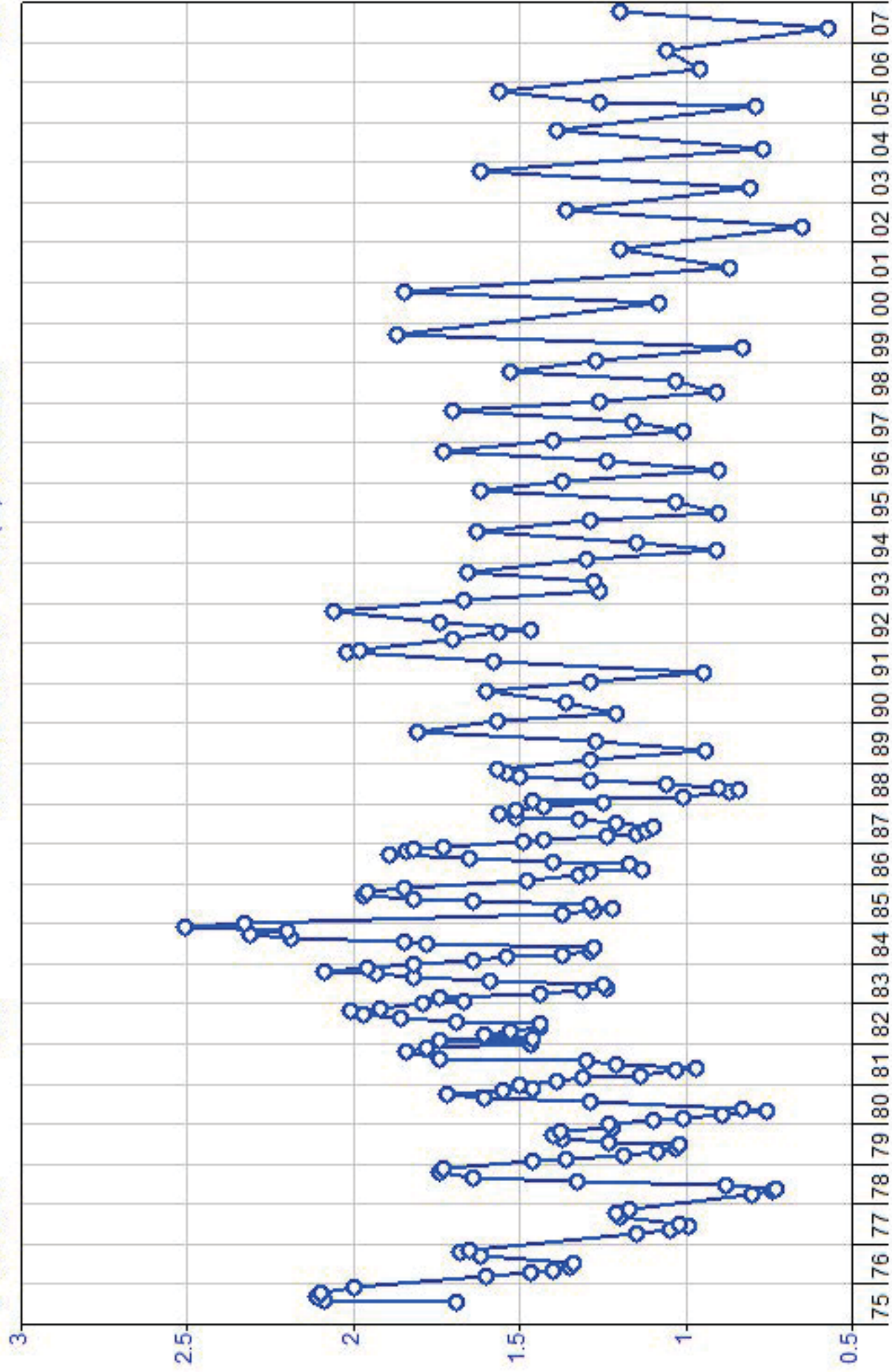
Period 33 Year Plot Start 00:00_01/01/1975
Interval 1 Month Plot End 00:00_01/01/2008

1975-08

6268.00 Line/Point Level(m)AHD Discrete

61410047 T580

GWL



APPENDIX E
Groundwater Quality Data and Laboratory Results



Monitoring Data

Job number: H11005
Job name: Madora Bay North
Sample Type: Groundwater Quality

EC ($\mu\text{S}/\text{cm}$)	31/10/2011	13/01/2012	24/04/2012	27/07/2012	Mean
MB1	1240	1149	1216	1279	1221
MB2	1126	1139	1173	1089	1132
MB3	975	818	835	929	889
MB4	973	977	898	887	934
Mean : All Samples					1044

pH	31/10/2011	13/01/2012	24/04/2012	27/07/2012	Mean
MB1	7.06	7.29	7.09	6.96	7.10
MB2	7.18	7.31	7.06	6.93	7.12
MB3	7.21	7.58	7.26	7.15	7.30
MB4	7.19	7.59	7.16	7.23	7.29
Mean : All Samples					7.20

TN (mg/L)	31/10/2011	13/01/2012	24/04/2012	27/07/2012	Mean
MB1	3.3	5.2	2.3	5.9	4.2
MB2	7.9	11.0	2.9	8.5	7.6
MB3	6.2	6.6	4.5	7.2	6.1
MB4	3.3	5.7	2.2	4.6	4.0
Mean : All Samples					5.5

TKN (mg/L)	31/10/2011	13/01/2012	24/04/2012	27/07/2012	Mean
MB1	0.36	2.20	0.20	3.20	1.49
MB2	0.57	2.50	0.60	3.30	1.74
MB3	0.73	1.10	0.30	2.50	1.16
MB4	0.48	1.50	0.10	1.10	0.80
Mean : All Samples					1.30

Nox as N	31/10/2011	13/01/2012	24/04/2012	27/07/2012	Mean
MB1	3.00	3.01	2.21	2.71	2.73
MB2	7.40	8.33	2.21	5.16	5.77
MB3	5.50	5.51	4.21	4.61	4.95
MB4	2.80	4.21	2.11	3.51	3.15
Mean : All Samples					4.15

Nitrate as N	31/10/2011	13/01/2012	24/04/2012	27/07/2012	Mean
MB1	3.00	2.90	2.20	2.70	2.70
MB2	7.40	8.20	2.20	5.00	5.70
MB3	5.50	5.50	4.20	4.60	4.95
MB4	2.80	4.20	2.10	3.50	3.15
Mean : All Samples					4.13

Nitrite as N	31/10/2011	13/01/2012	24/04/2012	27/07/2012	Mean
MB1	0.005	0.110	0.005	0.006	0.032
MB2	0.005	0.130	0.005	0.160	0.075
MB3	0.006	0.005	0.005	0.005	0.005
MB4	0.005	0.005	0.005	0.005	0.005
Mean : All Samples					0.029

Ammonia as N	31/10/2011	13/01/2012	24/04/2012	27/07/2012	Mean
MB1	0.010	0.005	0.005	0.020	0.010
MB2	0.005	0.005	0.005	0.010	0.006
MB3	0.005	0.005	0.005	0.010	0.006
MB4	0.005	0.005	0.005	0.005	0.005
Mean : All Samples					0.007

TP	31/10/2011	13/01/2012	24/04/2012	27/07/2012	Mean
MB1	0.16	0.04	0.07	0.04	0.08
MB2	0.14	0.13	0.15	0.03	0.11
MB3	0.13	0.14	0.23	0.07	0.14
MB4	0.12	0.03	0.03	0.17	0.09
Mean : All Samples					0.11

Phosphate as P	31/10/2011	13/01/2012	24/04/2012	27/07/2012	Mean
MB1	0.030	0.030	0.045	0.031	0.034
MB2	0.020	0.020	0.022	0.022	0.021
MB3	0.005	0.005	0.008	0.007	0.006
MB4	0.005	0.005	0.008	0.005	0.006
Mean : All Samples					0.017

Shaded box denotes value below detectable limit

CERTIFICATE OF ANALYSIS 121611

Client:

Hyd2O

Suite 6B, 103 Rokeby Rd
Subiaco
WA 6008

Attention: Sasha Martens

Sample log in details:

Your Reference:

Madora Bay North

No. of samples:

4 x Waters

Date samples received:

23/4/12

Date completed instructions received:

23/4/12

Location:

Analysis Details:

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by:

1/05/12

Date of Preliminary Report:

Not issued

Issue Date:

1/05/12

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Tests not covered by NATA are denoted with *.

Results Approved By:



Todd Lee
Laboratory Manager

Nutrients in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ----- -----	121611-1 H11005-MB1 23/04/2012 Water	121611-2 H11005-MB2 23/04/2012 Water	121611-3 H11005-MB3 23/04/2012 Water	121611-4 H11005-MB4 23/04/2012 Water
Total Nitrogen (Total N)	mg/L	2.3	2.9	4.5	2.2
Total Kjeldahl Nitrogen	mg/L	0.2	0.6	0.3	<0.1
Nitrate as N	mg/L	2.2	2.2	4.2	2.1
Nitrite as N	mg/L	<0.005	<0.005	<0.005	<0.005
Ammonia as N	mg/L	<0.005	<0.005	<0.005	<0.005
Total Phosphorus (Total P)	mg/L	0.07	0.15	0.23	0.03
Phosphate as P	mg/L	0.045	0.022	0.008	0.008

Method ID	Methodology Summary
INORG-055	Total Nitrogen by colourimetric analysis in accordance with APHA 4500-P J, 4500-NO3 F.
INORG-062	TKN by calculation from Total Nitrogen and NOx using APHA methodology.
INORG-055	Nitrate by colourimetric analysis and calculation in accordance with APHA 21st ED 4500-NO3 F.
INORG-055	Nitrite by colourimetric analysis in accordance with APHA 21st ED 4500-NO2 B.
INORG-057	Ammonia by colourimetric analysis in accordance with APHA 21st ED 4500-NH3 F.
INORG-060	Total Phosphorus by colourimetric analysis in accordance with APHA 21st ED 4500-P J.
INORG-060	Phosphate by colourimetric analysis in accordance with APHA 21st ED 4500-P E.

Client Reference: Madora Bay North

QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Nutrients in Water						Base II Duplicate II %RPD		
Total Nitrogen (Total N)	mg/L	0.1	INORG-055	<0.1	[NT]	[NT]	LCS	87%
Total Kjeldahl Nitrogen	mg/L	0.1	INORG-062	[NT]	[NT]	[NT]	[NR]	[NR]
Ammonia as N	mg/L	0.005	INORG-057	<0.005	[NT]	[NT]	LCS	88%
Total Phosphorus (Total P)	mg/L	0.01	INORG-060	<0.01	[NT]	[NT]	LCS	98%
Phosphate as P	mg/L	0.005	INORG-060	<0.005	[NT]	[NT]	LCS	102%

MPL Reference: 121611
Revision No: R 00



Report Comments:

INS: Insufficient sample for this test; NT: Not tested; PQL: Practical Quantitation Limit; <: Less than; >: Greater than
RPD: Relative Percent Difference; NA: Test not required; LCS: Laboratory Control Sample; NR: Not requested
NS: Not specified; NEPM: National Environmental Protection Measure

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD a matrix spike recoveries for the sample batch were within laboratory acceptance criteria.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.

Matrix Spike and LCS: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and Speciated Phenols is acceptable.

Surrogates: 60-140% is acceptable for general organics and 10-140% for SVOC and Speciated Phenols.

CERTIFICATE OF ANALYSIS 124735

Client:

Hyd2O

Suite 6B, 103 Rokeby Rd
Subiaco
WA 6008

Attention: Suzanne Smart

Sample log in details:

Your Reference:	<u>H11005 Madora Bay North</u>
No. of samples:	4 Water
Date samples received:	26/7/12
Date completed instructions received:	26/7/12
Location:	

Analysis Details:

Please refer to the following pages for results, methodology summary and quality control data. Samples were analysed as received from the client. Results relate specifically to the samples as received. Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by:	2/08/12
Date of Preliminary Report:	Not issued
Issue Date:	31/07/12

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Tests not covered by NATA are denoted with *.

Results Approved By:



Joshua Lim
Operations Supervisor

MPL Reference: 124735
Revision No: R 00

Nutrients in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ----- -----	124735-1 H11005-MB1 26/07/2012 Water	124735-2 H11005-MB2 26/07/2012 Water	124735-3 H11005-MB3 26/07/2012 Water	124735-4 H11005-MB4 26/07/2012 Water
Total Nitrogen (Total N)	mg/L	5.9	8.5	7.2	4.6
Total Kjeldahl Nitrogen	mg/L	3.2	3.3	2.5	1.1
Nitrate as N	mg/L	2.7	5.0	4.6	3.5
Nitrite as N	mg/L	0.006	0.16	<0.005	<0.005
Ammonia as N	mg/L	0.020	0.010	0.010	<0.005
Total Phosphorus (Total P)	mg/L	0.04	0.03	0.07	0.17
Phosphate as P	mg/L	0.031	0.022	0.007	<0.005

Method ID	Methodology Summary
INORG-055	Total Nitrogen by colourimetric analysis in accordance with APHA 4500-P J, 4500-NO3 F.
INORG-062	TKN by calculation from Total Nitrogen and NOx using APHA methodology.
INORG-055	Nitrate by colourimetric analysis and calculation in accordance with APHA 21st ED 4500-NO3 F.
INORG-055	Nitrite by colourimetric analysis in accordance with APHA 21st ED 4500-NO2 B.
INORG-057	Ammonia by colourimetric analysis in accordance with APHA 21st ED 4500-NH3 F.
INORG-060	Total Phosphorus by colourimetric analysis in accordance with APHA 21st ED 4500-P J.
INORG-060	Phosphate by colourimetric analysis in accordance with APHA 21st ED 4500-P E.

Client Reference: H11005 Madora Bay North

QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Nutrients in Water						Base II Duplicate II %RPD		
Total Nitrogen (Total N)	mg/L	0.1	INORG-055	<0.1	[NT]	[NT]	LCS	120%
Total Kjeldahl Nitrogen	mg/L	0.1	INORG-062	0.1	[NT]	[NT]	[NR]	[NR]
Ammonia as N	mg/L	0.005	INORG-057	<0.005	[NT]	[NT]	LCS	86%
Total Phosphorus (Total P)	mg/L	0.01	INORG-060	<0.01	[NT]	[NT]	LCS	100%
Phosphate as P	mg/L	0.005	INORG-060	<0.005	[NT]	[NT]	LCS	99%

MPL Reference: 124735
Revision No: R 00



Report Comments:

INS: Insufficient sample for this test; NT: Not tested; PQL: Practical Quantitation Limit; <: Less than; >: Greater than
RPD: Relative Percent Difference; NA: Test not required; LCS: Laboratory Control Sample; NR: Not requested
NS: Not specified; NEPM: National Environmental Protection Measure

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD a matrix spike recoveries for the sample batch were within laboratory acceptance criteria.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.

Matrix Spike and LCS: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and Speciated Phenols is acceptable.

Surrogates: 60-140% is acceptable for general organics and 10-140% for SVOC and Speciated Phenols.

CERTIFICATE OF ANALYSIS 116168

Client:

Hyd2O

Suite 6B, 103 Rokeby Rd
Subiaco
WA 6008

Attention: Suzanne Smart

Sample log in details:

Your Reference:	H11005
No. of samples:	4 waters
Date samples received:	1/11/11
Date completed instructions received:	1/11/11
Location:	Madora Bay North

Analysis Details:

Please refer to the following pages for results, methodology summary and quality control data. Samples were analysed as received from the client. Results relate specifically to the samples as received. Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by:	8/11/11
Date of Preliminary Report:	Not issued
Issue Date:	8/11/11

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Results Approved By:



Joshua Lim
Operations Supervisor

MPL Reference: 116168
Revision No: R 00

Nutrients in Water Our Reference: Your Reference Date Sampled Type of sample Time Sampled	UNITS ----- -----	116168-1 H11005-MB1 31/10/2011 water	116168-2 H11005-MB2 31/10/2011 water	116168-3 H11005-MB3 31/10/2011 water	116168-4 H11005-MB4 31/10/2011 water
Total Nitrogen (Total N)	mg/L	3.3	7.9	6.2	3.3
Total Kjeldahl Nitrogen	mg/L	0.36	0.57	0.73	0.48
NOx as N	mg/L	3.0	7.4	5.5	2.8
Nitrate as N	mg/L	3.0	7.4	5.5	2.8
Nitrite as N	mg/L	0.005	<0.005	0.006	<0.005
Ammonia as N	mg/L	0.010	<0.005	<0.005	<0.005
Total Phosphorus (Total P)	mg/L	0.16	0.14	0.13	0.12
Phosphate as P	mg/L	0.03	0.02	<0.005	<0.005

MethodID	Methodology Summary
INORG-055	Total Nitrogen by colourimetric analysis in accordance with APHA 4500-P J, 4500-NO3 F.
INORG-062	TKN by calculation from Total Nitrogen and NOx using APHA methodology.
INORG-055	NOx by colourimetric analysis and calculation in accordance with APHA 21st ED 4500-NO3 F.
INORG-055	Nitrate by colourimetric analysis and calculation in accordance with APHA 21st ED 4500-NO3 F.
INORG-055	Nitrite by colourimetric analysis in accordance with APHA 21st ED 4500-NO2 B.
INORG-057	Ammonia by colourimetric analysis in accordance with APHA 21st ED 4500-NH3 F.
INORG-060	Total Phosphorus by colourimetric analysis in accordance with APHA 21st ED 4500-P J.
INORG-060	Phosphate by colourimetric analysis in accordance with APHA 21st ED 4500-P E.

Client Reference: H11005

QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Nutrients in Water						Base II Duplicate II %RPD		
Total Nitrogen (Total N)	mg/L	0.05	INORG-055	<0.05	[NT]	[NT]	LCS	103%
Total Kjeldahl Nitrogen	mg/L	0.005	INORG-062	0.005	[NT]	[NT]	[NR]	[NR]
NOx as N	mg/L	0.005	INORG-055	<0.005	[NT]	[NT]	LCS	112%
Ammonia as N	mg/L	0.005	INORG-057	<0.005	[NT]	[NT]	LCS	113%
Total Phosphorus (Total P)	mg/L	0.01	INORG-060	<0.01	[NT]	[NT]	LCS	108%
Phosphate as P	mg/L	0.005	INORG-060	<0.005	[NT]	[NT]	LCS	110%

MPL Reference: 116168
Revision No: R 00



Report Comments:

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform & E.coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC& ARMC 2011.

INS: Insufficient sample for this test; NT: Not tested; PQL: Practical Quantitation Limit; <: Less than; >: Greater than
 RPD: Relative Percent Difference; NA: Test not required; LCS: Laboratory Control Sample; NR: Not requested
 NS: Not specified; NEPM: National Environmental Protection Measure

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

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LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the sample batch were within laboratory acceptance criteria.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.

Matrix Spike and LCS: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and Speciated Phenols is acceptable.

Surrogates: 60-140% is acceptable for general organics and 10-140% for SVOC and Speciated Phenols.

CERTIFICATE OF ANALYSIS 118323

Client:

Hyd2O

Suite 6B, 103 Rokeby Rd
Subiaco
WA 6008

Attention: Sasha Martens

Sample log in details:

Your Reference:	<u>Madora Bay North</u>
No. of samples:	4 x Waters
Date samples received:	13/1/12
Date completed instructions received:	13/1/12
Location:	

Analysis Details:

Please refer to the following pages for results, methodology summary and quality control data. Samples were analysed as received from the client. Results relate specifically to the samples as received. Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by:	20/01/12
Date of Preliminary Report:	Not issued
Issue Date:	1/02/12

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Tests not covered by NATA are denoted with *.

Results Approved By:



Joshua Lim
Operations Supervisor

MPL Reference: 118323
Revision No: R 01

Nutrients in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ----- -----	118323-1 H11005-MB1 13/01/2012 Water	118323-2 H11005-MB2 13/01/2012 Water	118323-3 H11005-MB3 13/01/2012 Water	118323-4 H11005-MB4 13/01/2012 Water
Total Nitrogen (Total N)	mg/L	5.2	11	6.6	5.7
Total Kjeldahl Nitrogen	mg/L	2.2	2.5	1.1	1.5
Nitrate as N	mg/L	2.9	8.2	5.5	4.2
Nitrite as N	mg/L	0.11	0.13	<0.005	<0.005
Ammonia as N	mg/L	<0.005	<0.005	<0.005	<0.005
Total Phosphorus (Total P)	mg/L	0.04	0.13	0.14	0.03
Phosphate as P	mg/L	0.03	0.02	<0.005	<0.005

Method ID	Methodology Summary
INORG-055	Total Nitrogen by colourimetric analysis in accordance with APHA 4500-P J, 4500-NO3 F.
INORG-062	TKN by calculation from Total Nitrogen and NOx using APHA methodology.
INORG-055	Nitrate by colourimetric analysis and calculation in accordance with APHA 21st ED 4500-NO3 F.
INORG-055	Nitrite by colourimetric analysis in accordance with APHA 21st ED 4500-NO2 B.
INORG-057	Ammonia by colourimetric analysis in accordance with APHA 21st ED 4500-NH3 F.
INORG-060	Total Phosphorus by colourimetric analysis in accordance with APHA 21st ED 4500-P J.
INORG-060	Phosphate by colourimetric analysis in accordance with APHA 21st ED 4500-P E.

Client Reference: Madora Bay North

QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Nutrients in Water						Base II Duplicate II %RPD		
Total Nitrogen (Total N)	mg/L	0.05	INORG-055	<0.05	[NT]	[NT]	LCS	84%
Total Kjeldahl Nitrogen	mg/L	0.005	INORG-062	[NT]	[NT]	[NT]	[NR]	[NR]
Ammonia as N	mg/L	0.005	INORG-057	<0.005	[NT]	[NT]	LCS	95%
Total Phosphorus (Total P)	mg/L	0.01	INORG-060	<0.01	[NT]	[NT]	LCS	97%
Phosphate as P	mg/L	0.005	INORG-060	<0.005	[NT]	[NT]	LCS	95%

MPL Reference: 118323
Revision No: R 01



Report Comments:

This report R01 replaces the original R00 due to correction in dilution factor.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform & E.coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC& ARMC 2011.

INS: Insufficient sample for this test; NT: Not tested; PQL: Practical Quantitation Limit; <: Less than; >: Greater than
RPD: Relative Percent Difference; NA: Test not required; LCS: Laboratory Control Sample; NR: Not requested
NS: Not specified; NEPM: National Environmental Protection Measure

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the sample batch were within laboratory acceptance criteria.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.

Matrix Spike and LCS: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and Speciated Phenols is acceptable.

Surrogates: 60-140% is acceptable for general organics and 10-140% for SVOC and Speciated Phenols.

APPENDIX F
Landscape Irrigation Design (EPCAD 2014)

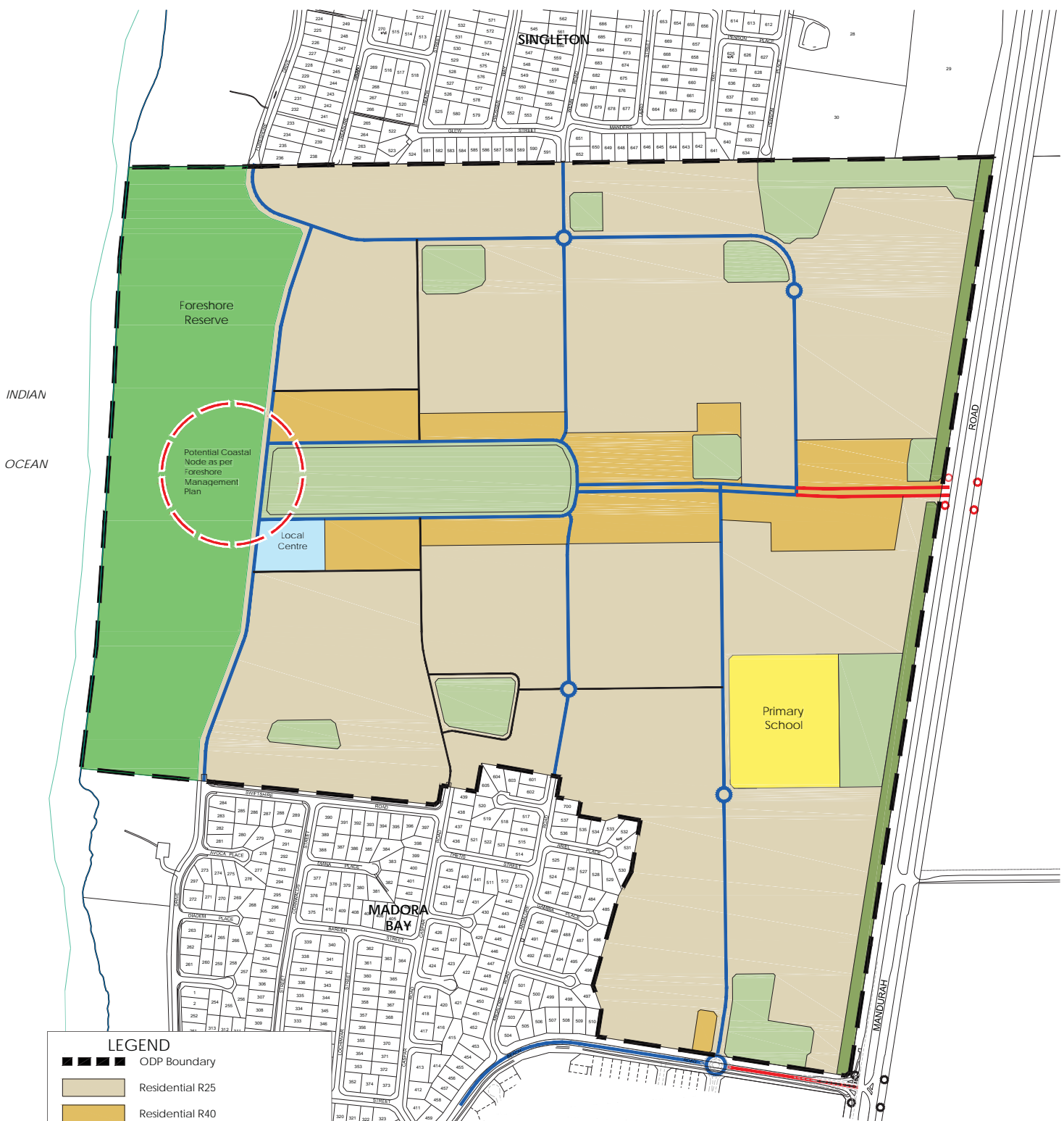
6.0 Irrigation Guidance Plan

Longterm Irrigation

1 The Beach Node	2, 550 kl/yr
2 Central Parklands	18, 000 kl/yr
3 Backshore Park (South)	1, 500 kl/yr
4 Backshore Park (North)	2, 775 kl/yr
5 Foredune Park (South)	4, 200 kl/yr
6 Foredune Park (North)	825 kl/yr
7 Mid Ridge Park	2, 550 kl/yr
8 South Ridgeway Park	4, 725 kl/yr
9 North Ridgeway Park	5, 925 kl/yr
10 Madora North Entry	-
11 Madora North Oval	5, 700 kl/yr
* Streetscapes	4, 275 kl/yr



APPENDIX G
Madora Bay North Outline Development Plan (CLE 2014)



LEGEND

	ODP Boundary
	Residential R25
	Residential R40
	Primary School
	Commercial (R60) <small>'Short Stay Accommodation' is an additional 'AA' use within this zone</small>
	Public Open Space
	Foreshore Reserve <small>Subject to approved Foreshore Management Plan</small>
	Vegetated Buffer <small>to Mandurah Road</small>
	Integrator B
	Neighbourhood Connector
	Local Roads
	Traffic Lights - Proposed
	Traffic Lights - Existing

This Plan has been prepared for illustrative purposes only and represents an indicative land use concept of what may occur, once and if appropriate approvals are in place. The proposals depicted on this Plan generally have no formal approval status and can be varied by CLE or the landowner without notice. This Plan remains the property of CLE.

ODP REQUIREMENTS

1. Development of the Local Centre shall be in accordance with an approved Detailed Area Plan;
2. The preparation and implementation of the following management plans may be a requirement of subdivision approval, if granted:
 - A foreshore management plan;
 - An urban water management plan;
 - A transport noise management plan.



APPENDIX H
Groundwater Licence



LICENCE TO TAKE WATER

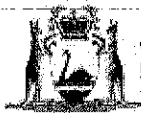
Granted by the Minister under section 5C of the Rights in Water and Irrigation Act 1914

Licensee(s)	B.H PERRY & J.D.PERRY & P.R PERRY & The trustee for the Nancy Grace PERRY TESTAMENTARY TRUST		
Description of Water Resource	South West Coastal Perth - Superficial Swan	Annual Water Entitlement	107250 kL
Location of Water Source	Lot 101 On Plan 73957 - Volume/Folio 2792/290 - Lot 101 Lot 9006 On Plan 402594 - Volume/Folio 2849/649 - Lot 9006		
Authorised Activities	Taking of water for	Location of Activity	
	Dust suppression for earthworks and construction purposes Irrigation of up to 16.6 ha of public open space	Lot 101 On Plan 73957 - Volume/Folio 2792/290 - Lot 101	
	Dust suppression for earthworks and construction purposes	Lot 9006 On Plan 402594 - Volume/Folio 2849/649 - Lot 9006	
Duration of Licence	From 3 March 2015 to 3 March 2025		

This Licence is subject to the following terms, conditions and restrictions:

- 1 The licensee shall not use water for public open space between 9 am and 6 pm except for the establishment of newly planted areas. For newly planted areas water may be used within these hours for a period of up to 28 consecutive days, commencing from the date of planting.
- 2 Between 1 June and 31 August in any year, the licence-holder must not water a lawn, garden, or grass-covered area ("turf") by reticulation, provided always that this restriction shall not apply to watering with a hand held hose; or watering, by way of reticulation: newly planted areas for a period of up to 28 days from the date of planting; for renovating turf; or for maintenance of reticulation systems.
- 3 The licensee shall comply with the commitments of the operating strategy for GWL179182, as prepared by the Department of Water and approved by the Department of Water on 27 March 2015 including any modifications to the commitments as approved during the term of the licence.
- 4 The licensee must install an approved meter to each water draw-point through which water is taken under this licence.
- 5 The annual water year for water taken under this licence is defined as 1 July to 30 June.
- 6 The licensee must not, in any water year, take more water than the annual water entitlement specified in this licence.
- 7 The licensee must take and record the reading from each meter required under this licence at the beginning and another at the end of the water year defined on this licence.
- 8 The licensee must submit to the Department of Water the recorded meter readings and the volume of water taken within the water year, every 12 month(s) commencing 14/07/2015.

This Licence is granted subject to the Rights in Water and Irrigation Regulations 2000



LICENCE TO TAKE WATER

Granted by the Minister under section 5C of the Rights in Water and Irrigation Act 1914

This Licence is subject to the following terms, conditions and restrictions:

- 9 The licensee must ensure the installed meter(s) accuracy is maintained to within plus or minus 5% of the volume metered, in field conditions.
- 10 The licensee must notify the Department of Water in writing of any water meter malfunction within seven days of the malfunction being noticed.
- 11 The licensee must obtain authorisation from the Department of Water before removing, replacing or interfering with any meter required under this licence.

End of terms, conditions and restrictions

This Licence is granted subject to the Rights in Water and Irrigation Regulations 2000



Operating Strategy - GWL179182

Licensee: B.H PERRY & J.D PERRY & P.R PERRY & The trustee for the Nancy Grace PERRY TESTAMENTARY TRUST

Legal Description of land where water is taken:

Lot 101 on plan 73957 and Lot 9006 on plan 402594

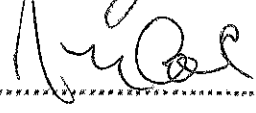
Declaration:

"I understand that the commitments given in the attached operating strategy will be a condition of an associated water licence if approved and that a breach of a commitment or any licence condition may be an infringement of the Rights in Water and Irrigation Act 1914":

Signatures

Person legally responsible for water licence:  Date 20/2/15

printed name: John Perry

Approved by delegated authority Department of Water:  Date 27/2/15

printed name:

Introduction

Madora Bay Partnership are expanding their housing development and require water for the irrigation of 16.6 ha of long term public open space and short term dust suppression. The site is situated within the South West Coastal Mandurah sub area. Due to the close proximity to the coast, salinity management is required to minimise risk of saline intrusion to users and the environment. A comprehensive operating strategy or hydrogeological assessment is not required at this stage as the risks are believed to manageable through the following commitments.

Commitments

1. The licensee shall not abstract more than 25000kL/a from each production bore.
2. The licence shall only drill bores in the predetermined locations agreed with by the Department of Water.
3. The licensee will transfer part of the annual allocation to the Department of Education for the proposed primary school site on completion of the dust suppression works.
4. On completion of the dust suppression works the licensee will require an ongoing annual allocation of 53025kL/ a for long term public open space, any remaining water allocation will be relinquished to the Department of Water.

End of terms, conditions and restrictions



LICENCE TO CONSTRUCT OR ALTER WELL

Granted by the Minister under section 26D of the Rights in Water and Irrigation Act 1914

Licensee(s)	B.H PERRY & J.D PERRY & P.R PERRY & The trustee for the Nancy Grace PERRY TESTAMENTARY TRUST	
Description of Water Resource	South West Coastal Perth - Superficial Swan	
Location of Well(s)	Lot 101 On Plan 73957 - Volume/Folio 2792/290 - Lot 101 Lot 9006 On Plan 402594 - Volume/Folio 2849/649 - Lot 9006	
Authorised Activities	Activity	Location of Activity
	Construct 1 non-artesian well(s).	Lot 101 On Plan 73957 - Volume/Folio 2792/290 - Lot 101
	Construct 3 non-artesian well(s).	Lot 9006 On Plan 402594 - Volume/Folio 2849/649 - Lot 9006
Duration of Licence	From 3 March 2015 to 3 March 2016	

This Licence is subject to the following terms, limitations and conditions:

- 1 The well must be constructed by a driller having a current class 1 water well drillers certificate issued by the Western Australian branch of the Australian Drilling Industry Association or equivalent certification recognised nationally by the Australian Drilling Industry Association.
- 2 The licensee must install an approved meter to each well, and provide evidence of the installation to the Department of Water within 30 days of completion of the well.

End of terms, limitations and conditions