



Dover Investments Pty Ltd
Bayview - The Boulevard
Notice of Intent

May 2015

Table of contents

Table of contents	i
1. Introduction.....	2
1.1 Overview	2
1.2 The Proponent	3
1.3 Limitations	3
2. Project Location and Description	4
2.1 Project Location Information	4
2.2 Project Description.....	5
3. Legislation	24
3.1 Commonwealth Legislation.....	24
3.2 Northern Territory Legislation	25
4. Site Description	29
4.1 Physical Environment	29
4.2 Terrestrial Environment.....	33
4.3 Cultural Environment	46
4.4 Estate Management.....	48
4.5 Economics	48
5. Potential Impacts and Mitigation Measures	49
6. References.....	57

Table index

Table 1-1 Proponent contact details	3
Table 1-2 Consultant contact details.....	3
Table 4-1 Rainfall and temperature statistics (Darwin Airport 1941-2012).....	29
Table 4-2 Land unit 9b	33
Table 4-3 Land unit 1c	33
Table 4-4 Land unit 4c	34
Table 4-5 Declared weeds recorded during 1991 EIS vegetation and flora survey	37
Table 4-6 Summary of the threatened fauna species known or predicted to occur within the study area	42
Table 4-7 Long-term management responsibility.....	48
Table 5-1 Environmental aspects / activity – potential impacts and mitigation measures.....	49

Figure index

Figure 1	Development Location	14
Figure 2	Project Area	15
Figure 3	Current Zoning	16
Figure 4	Future Zoning.....	17
Figure 5	Proposed Development Master Plan	18
Figure 6	Proposed Development Staging	19
Figure 7	Fill and Podium Structure Areas	20
Figure 8	Typical Bund Wall Sea Wall Cross Section	21
Figure 9	Typical Earthworks Cross Section	22
Figure 10	Location of Storm Water Head Works	23
Figure 11	Acid Sulfate Soil Probability	32
Figure 12	Land Units	35
Figure 13	Vegetation Communities.....	39

Appendices

Appendix A – EPBC Protected Matters Search Tool Results

1. Introduction

1.1 Overview

Dover Pty Ltd (Dover) proposes to develop an eastern expansion to the inner city Darwin suburb of Bayview. The Project is “Bayview – The Boulevarde”. This Notice of Intent (NOI) is submitted to the Northern Territory Environment Protection Authority (NT EPA) as formal notification of the project as part of the environmental permitting process.

Bayview is located approximately five kilometres north of Darwin central business district (CBD) and is bounded by Tiger Brennan Drive to the north, Sadgroves Creek to the east (directly opposite Charles Darwin National Park) and south, and Frances Bay to the west. It is in the City of Darwin Local Government Area.

Key project components include:

- Proposed temporary works:
 - — Temporary bund walls and outer haul roads for stages
 - — Sediment and erosion controls such as sediment basins and silt curtains.
- Proposed permanent works:
 - — A central boulevard leading to a new road entrance from Tiger Brennan Drive opposite Benison Road
 - — Internal roads
 - — Working platforms for residential development
 - — An external sea wall
 - — Multiple dwelling, medium and high density residential buildings
 - — Essential services
 - — Walking / bike paths
 - — Cultural and heritage park at O’Ferrals Rock
 - — Landscaped open spaces
 - — Convenience store/café.

At this stage, the following elements of the project design are concept only and their feasibility is being determined:

- Waterfront restaurant
- Jetty/pontoon, fishing platform
- Suspended walkway through mangroves.

The existing Bayview Haven Canal Estate was completed in 2006 by Dover. Dover is, now fully owned by Austcorp Property Group Pty Ltd. The development was subject to assessment under the Northern Territory *Environmental Assessment Act 1982* at the level of an Environmental Impact Statement (EIS). The Bayview Haven Canal Estate EIS (Dames and Moore *et al.* 1991) was completed in 1992.

The proposed action is a stand-alone development in its own right, however The Boulevarde Project is also an extension to the existing Bayview Haven Canal Estate, completing the overall plan for the suburb outlined in the Central Darwin Planning Concepts and Land Use Objectives (DLPE 1999) This broader land use plan has been adopted in the Bayview Master Plan

document prepared by Dover (2014) that includes a shared bicycle/pathway and recreational facilities such as exercise stations around the entire suburb (www.theboulevarde.com.au).

The objectives of this NOI are to provide:

- notification of the proposed project;
- an overview of key elements of the project;
- an understanding of the existing environment;
- an indication of potential impacts and management measures; and
- sufficient information for the NT EPA to formally determine the level of assessment required under the Northern Territory *Environmental Assessment Act 1982*.

1.2 The Proponent

The proponent for the project is Dover Pty Ltd. Contact details for the proponent, and the consultant company preparing the NOI, are contained in Table 1-1 and Table 1-2.

Table 1-1 Proponent contact details

Company	Dover Pty Ltd
Contact	Trevor Chappell
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Table 1-2 Consultant contact details

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1.3 Limitations

This Notice of Intent (“Report”):

- has been prepared by GHD Pty Ltd (“GHD”) for Dover Pty Ltd (“Dover”);
- must not be copied to, used by, or relied on by any person other than Dover, NT EPA and Department of the Environment without the prior written consent of GHD; and
- may only be used for the purpose of providing a preliminary understanding of potential environmental impacts and mitigation measures of proposed works (and must not be used for any other purpose).

GHD otherwise disclaims responsibility to any person other than Dover arising in connection with this report. GHD excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

GHD has prepared this report on the basis of information provided by Dover and others who provided information to GHD, which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

2. Project Location and Description

2.1 Project Location Information

2.1.1 Existing Land Use and Zoning

The proposed development area is located on Lots 5988, 7433 and; proposed Lots 7644 and 8690, Town of Darwin, five kilometres (km) north-east of the Darwin Central Business District (Figure 1).

Land use in the area to the west of the proposed development is single and medium density housing. Land use to the north is a combination of main road, general industry and residential housing.

Land to the east and south of the proposed development, extending to Sadgroves Creek is currently undeveloped mangrove vegetation and intertidal areas zoned as Future Development under the Northern Territory Planning Scheme

Under the Scheme, Future Development is an “interim zone” identifying an area that is intended for future rezoning and development, in accordance with an Area Plan (DLPE 2013b). An Area Plan does not apply to this project.

The proposed development footprint is approximately 25 ha. This is comprised of approximately 5 ha from undeveloped areas of the Bayview Haven Canal Estate (Lots 5988 and Lot 7433) and 20 ha of undeveloped land from proposed Lot 7644 and Lot 8690 (Figure 2).

The site itself consists of the following land use zones (Figure 3):

- Residential (lots undeveloped from Bayview Haven Canal Estate);
- Conservation and Public Space surrounding O’Ferrals Rock; and
- Future Development over the remainder of the site (DLPE 2013a).
- The site does not include the road reserve corridor

The area stretching east and south from the opposite bank of Sadgroves Creek is zoned for Conservation, and contained within Charles Darwin National Park.

2.1.2 Surrounding Marine Uses

Sadgroves Creek opens into Frances Bay, Darwin Harbour, approximately 2 km downstream from the development. The surrounding marine uses include a mixture of commercial shipping, military activity and recreational boating and fishing. Coastal recreational activities such as sailing and diving are also popular.

Ongoing construction of the Ichthys gas processing facility and associated infrastructure at Blaydin Point, and the Marine Supply Base adjacent to East Arm Wharf has resulted in additional dredging and shipping activity in the Harbour.

Beneficial uses for Darwin Harbour have been declared under the *Water Act 1992*. These are *Aquatic Ecosystem Protection* and *Recreational Water Quality & Aesthetics*.

2.1.3 Proposed Zoning / Land Use

The subdivision design for the proposed development consists of the following zones (Figure 4):

- Multiple Dwelling Residential to the west of the boulevard;
- Medium and High Density Residential to the east of the boulevard;
- Conservation reserve over O'Ferrals Rock;
- Public Open Space on the southern perimeter; and
- Organised Recreation corridors between Medium Density Residential blocks (DLPE 2013a).

Zoning along the northern perimeter of the development is to be confirmed. It represents the extension of the existing stormwater easement along the northern perimeter of the Bayview Haven Canal Estate.

As part of the development consent application to the Northern Territory Government, Dover will recommend a hand back of significant areas to the east and south of the proposed development that are currently zoned for Future Development but are not required as part of the proposed development. Dover has suggested these areas revert to Conservation zoning (Figure 4).

This would enable approximately 52 ha of Future Development zoning to revert to Conservation zoning, containing approximately 32.5 ha of mangrove and intertidal habitat. This would provide a buffer zone between both the existing and proposed development and the marine environment within Sadgroves Creek and downstream Frances Bay.

2.2 Project Description

2.2.1 Master Plan Design

When complete the proposed estate will house up to 1,100 dwellings equating to a population of 2,500. A proposed master plan is provided in Figure 5 and a broader concept plan for the entire Bayview area is available at www.theboulevarde.com.au

The development will be based around a single north-south aligned, central boulevard approximately 1 km long, consisting of:

Western side of the boulevard

- multiple dwelling townhouse developments, two storeys high, ranging in size from two to five units per site;

Eastern side of the boulevard

- medium density apartments ranging from two to four storeys high in the centre;

- high density apartments ranging from six to eight storeys high positioned at the northern and southern ends.

The buildings will be orientated to maintain vistas and view corridors between the buildings.

Dover intends to extend the existing Bayview area perimeter walkways and sea wall around the new development area.

O'Ferrals Rock will be conserved as a cultural and heritage park and link with open space corridors around the eastern and southern boundaries of the development.

The subdivision has been designed using principles of energy efficiency including the use of a street layout and associated lot orientation that supports passive climate control.

The Master Plan includes jetties and a restaurant and a mangrove experience boardwalk in the southern mangrove area. At this stage these elements of the design are concept only and their viability is under investigation.

Services will be provided to individual lots as described in this NOI.

Bayview - The Boulevard subdivision layout presented in Figure 5 should be considered to be pre-concept and has been developed for headworks sizing and pricing purposes only. Final road and allotment layouts for the development are subject to change depending on the outcomes of community consultation, and the development assessment and consent process.

2.2.2 Construction schedule

Construction will take place in seven stages, working from north to south, with initial site access from Tiger Brennan Drive at Benison Road (Figure 6). Two construction methods are being considered: 1) conventional earthworks and surcharge; and 2) deep lift compaction.

Based on a conventional earthworks method, the Project is expected to continue for six to eight years. Landscaping will occur progressively, with the completion of each stage of residential blocks.

An alternative construction method, Deep Lift Compaction (DLC), is being considered (Section 2.2.6 below). The timeframe for construction using the DLC method is anticipated to be approximately 18 months less than convention cut and fill work (pers. com. Austcorp 2014).

The estimated start date for construction is 2016/2017 Financial Year. The commencement is, to a large extent, dependent upon the outcome of the Northern Territory and Commonwealth Government's environmental assessment process and the Northern Territory's development consent process. Once commenced, the proposed development will take in the order of six to eight years to complete.

2.2.3 Cut and Fill Operations

The site is located below 4.0 m AHD which is the known high water mark for the area.

A large proportion of this tidal area is covered by marine mud and mangroves with surface levels around 2.5 m AHD dipping to about 0.0 m AHD at the Sadgroves Creek sub branches and at the toe of the perimeter embankment in some locations. The ground above the high water mark rises to as high as 6.5 m AHD (the existing Bayview Haven Canal Estate sea wall).

With the exception of O'Ferrals Rock, the entire development site will require significant site filling works or the development of podium structure areas in order to form the proposed residential lots and internal roads. The total amount of imported fill required is estimated to be less than 500,000 m³ over the entire site. This will be sourced from existing construction sites and quarries around Darwin.

In-situ mangrove mud is a saturated low strength soil and can achieve reasonable load bearing strength by being surcharged with fill material, and giving sufficient time for the resultant overburden pressure to consolidate the existing marine mud to a suitable strength for residential construction.

Significant experience in the consolidation of mangrove mud has been gained by industry over the past 20 years through the construction of major road embankments over tidal mud flats in Darwin and the development of the existing Bayview Haven Canal Estate. Based on this experience the proponent has limited the development footprint to areas where the mud depths are less than 3 - 4 metres. This will limit the initial consolidation period and minimise long-term differential settlements (Dames and Moore *et al.* 1991).

2.2.4 Staged Construction Program

At each stage, the key components of the cut and fill operations are:

Initial bund wall construction and clearing of mangroves;

- At low tides the mangroves along the route of the embankment will be flattened with a “swamp dozer”, and then woven geotextile fabric laid down, and fill material placed by end dumping and spreading with a dozer.
- The top of the bund wall will be 8 m wide to be used as a haul road during the seven stages of construction
- The outer portion of the embankment will contain more rock in order to prevent erosion by tidal movements, *waves and storm surges. This will minimise the turbidity of tidal waters in the mangroves outside the bund wall during the construction phase.*
- The area of mangroves encircled by the embankment will progressively die and the mud will dry out.
- The mangroves will be cleared and disposed of at an approved landfill site, or as otherwise agreed with the Northern Territory Government.
- Drainage will be incorporated into each step of the construction earthworks as per an erosion and sediment control plan (ESCP).
- Progressive landscaping will also occur as part of the completion of each stage.

Construction of working platforms - The boulevard road, land to the west of the road and open space corridors;

Construction of working platforms will occur on The Boulevard road, on land west of the road and in open space corridors (Figure 7). The process will not require any cutting or removal of mangrove mud, typified by the cut and fill method. Instead, earthworks will involve fill and compaction using either the conventional method or Deep Lift Compaction method (described in more detail in section 2.2.6 below).

- Geotextile fabric will be laid over the dried mangrove mud prior to importing the fill.
- Appropriate temporary drainage measures will be put in place to avoid Wet Season ponding, and mosquito breeding.
- Filled areas require primary mud consolidation before construction of roads, services and townhouses can commence.

Construction of podium structures - Land east of the boulevard road;

Podium structures will be constructed in fill areas adjacent to Sadgroves Creek. Podium structures are constructed over piles driven through marine mud to the underlying rock. The

podium structures will support medium and high density residential development on the eastern side of the proposed boulevard. In creating podium structures, a geotextile layer will be rolled out over the prepared surface of marine muds before fill is placed by end dumping and spreading. Approximately 700 mm of fill placed over the geotextile layer provides a suitable thickness for construction traffic such as a dozers and trucks to safely work on the layer. Piles will be driven through this working platform and through underlying mud and clay to rock. A concrete basement slab will be constructed on the piles.

There will be settlement of the working platform during the placement of fill and piling operations, as underlying marine sediments consolidate. This settlement will need to be accounted for when estimating fill volumes. Based on previous experience in the Darwin area, the final design thickness of the working platform beneath the podium structures could be in the range of 1500 to 3000 mm, and comprise two to three layers of compacted fill separated by a geogrid reinforcing layer to prevent slip failure (according to the conventional fill and compaction method).

Various pile types have been used in Darwin and the Top End for marine and land-based structures including either pre-cast concrete piles or cast-in-situ expanded base (Franki) piles. The latter were used to support the multi-storey commercial and residential units in the Darwin City Waterfront

Two typical cross-sections of the earthworks, including fill and podium construction, are provided in Figure 8 and Figure 9.

Construction of the sea wall

Rock armouring of the final sea wall profile within each stage (Figure 8) is one of the final steps in the earth works construction process. The rock armour and filter layer from existing sea wall will be removed and stored for later reuse in the final sea wall.

Construction of the bund wall and haul road and final sea wall will occur in accordance with the staging plan illustrated in Figure 6 and described below:

- create the temporary bund wall as described in Section 2.7 above, including construction of a single lane haul road
- surcharge will be placed over the top section of the sea wall to a depth of 2 m and allowed to consolidate over 6-12 months
- once construction of podium areas in each stage is complete, and surcharge of the sea wall is complete, the surcharge will be removed down to 6.5 m AHD maximum height
- excavation into compacted fill to create the basement car parks , then geotextile will be placed on the batter and secured against the basement car park retaining wall, then steep, stable armour rock will be placed on the outer batters to prevent erosion by tidal movements, waves and storm surges.

The final sea wall will consist of a 6.5 m AHD platform forming a public walkway, an inner batter containing armour rock, stepped down to a temporary haul road and then an outer embankment with more armour rock (Figure 8).

The temporary haul road will remain until the final stage construction is completed. It may then function as a maintenance access road.

Construction of the Mangrove Boardwalk and Jetty

The construction method as provided by Dover (2015) of the mangrove boardwalk and jetty is described below.

In order to preserve ecologically sensitive areas like mangroves, the top down construction method is normally adopted when building timber boardwalks, decks and fishing piers.

The top down construction method ensures that no heavy equipment comes in contact with the ground during construction and limits damage to existing vegetation. The top down construction uses lightweight hydraulic impact and material handling equipment that stays on top of the structure during construction, minimising damage to vegetation and wildlife habitats.

Along with preserving the environment, the top down construction method provides lower construction costs than that of conventional construction. Under this type of construction, vegetation is hand cleared to a minimum to allow installation of the support piers and decking system.

Piers are installed either manually or via crane from the shoreline and all decking elements are then lifted into place from the shoreline or from sections of decking already completed.

It is essentially a leap frog style of construction technique.

Piers to the jetty would be installed via a barge mounted pile driving rig as these piers will be far more structural than those for the mangrove walk or fishing piers.

Construction materials could be a combination of treated hardwood timbers, treated steels, aluminium and plastic treading etc. Exact material selection will be made at the detailed design phase in consultation with the Northern Territory Government and City of Darwin.

2.2.5 Import and placement of fill

Fill material will be required to raise significant areas of the existing reclaimed areas to a sufficient level to protect against storm surge. In addition, fill material may be required for the construction of the sea wall or other engineered foreshore structure.

Fill will be predominately silty sand and gravel with some cobbles and boulder particles. All suitably excavated soil will be reused onsite.

Only clean fill will be used at the site. Some fill will be obtained from current on-site stockpiles, and the rest will be imported from offsite. Fill will be sourced from existing construction sites and quarries around Darwin, primarily the Howard Springs gravel pits. Any source location will be an approved location meeting Northern Territory Government specifications for general fill.

Fill requirements for earthworks will be predominately silty sand and gravel with some cobbles and boulder particles. All suitably excavated soil will be reused onsite.

2.2.6 Alternative Construction methods

Two construction methods for reclaiming land and removing water from sediments to be used for fill have been considered:

- 1) Conventional fill and compaction method
- 2) Deep lift compaction method.

Considerations of each construction method are discussed below.

Conventional fill and compaction method

The conventional fill and compaction method generally involves placement of a woven geotextile layer over marine muds and then rock fill is placed over the geotextile layer to create a working platform for construction traffic such as a dozers and rollers.

The geotextile is used to further flatten any remaining mangrove branches and leaves as the filling is placed, and also to minimise the egress of fines from the underlying mud into the base

of the filling layer (Douglas Partners 2013). General fill is separated from the working platform by a geogrid reinforcing layer to prevent slip failure.

Fill is then laid down in 200 mm thick lifts, moisture conditioned to the optimal moisture content and then compacted using conventional compaction techniques such as sheep foot or vibratory rollers.

Once the design level is reached, conventional fill and compaction utilises surcharge (additional fill), placed over the engineered filling to heights determined by engineering calculations. The settlement of the filling platform under surcharge loads is monitored by periodic survey, and the surcharge is removed when approximately 90 percent of primary consolidation under filling load has been achieved.

Surcharging usually requires an additional 2,000 mm of fill placed for a period of 6-12 months before primary consolidation can be achieved and construction of roads, services and residential dwellings can commence.

Appropriate temporary drainage measures will be put in place to avoid Wet Season ponding and mosquito breeding.

Deep lift compaction method

DLC involves the use of a non-circular impact roller to deliver high impact energy dynamic compaction (HIEDYC) to the fill. The conventional method uses conventional compactors to compact 200-300 mm layers, whereas the HIEDYC can compact most types of soil in loose thicknesses of 1000 -1250 mm at natural moisture content. This process of compaction in thicker (than conventional) layers is known as DLC.

Like the conventional method, DLC generally involves placement of geotextile over the marine muds and then fill placed over the geotextile layer to create a working platform. The DLC method then installs perforated vertical drains at 1-1.5 m intervals, to depths of approximately 5-9 m, depending on the depth of the marine muds. A layer of sand/gravel is installed over the area, approximately 300 - 500 mm deep, to act as a drainage blanket. Over this base, fill is laid down in 1000 – 1250 mm lifts, and compacted using a prime mover with modular compaction attachments. The compaction modules are non-circular high impact rollers that may be 3, 4 or 5 sided, depending in the nature of the fill. The compaction process creates pressure pulses in the marine muds and water is released into the vertical drains. Once the fill height reaches design level, an additional 1.5 m surcharge is added and left to settle for 3-6 months.

The benefits of DLC may include the following:

- Reduce the time spent on earthworks by compacting thicker lifts and reducing surcharge time from 12-18 months to 3-6 months
- Reduce the water requirement for compaction
- Create a stronger filling platform compared to the conventional approach (Whellans et al. undated).

Currently, deep lift compaction is the preferred method, subject to further feasibility investigation. The conventional filling consolidation method is the fall-back position.

Other construction infrastructure includes roads, lay down areas and headworks (power, water, stormwater and sewerage).

2.2.7 Road Access

A permanent access road at Tiger Brennan Drive, directly opposite Benison Road (Figure 2) is proposed for the development. This access road would also serve as the construction access road during construction.

Tiger Brennan Drive is being expanded to a major dual carriageway. It is due to be completed in 2017, subject to government funding. The Benison Road intersection (and entrance to the development) is due to be completed as part of this duplication works in 2015-16.

This permanent access road will be the access point for vehicles and machinery entering the residential development for the transport and stockpiling of fill, and construction of the earliest stages. Fill will be imported to other stages via the Benison Road intersection, and then a perimeter haul road adjacent to the sea wall.

2.2.8 Stormwater Drainage

Existing stormwater drainage from the Benison Road area and Bayview is intercepted by the existing drain contained within the stormwater easement in the buffer strip along the northern perimeter of the Bayview Haven Canal Estate (Figure 10).

This intercepted water will be continued east along the northern perimeter of the development in a proposed extension of the stormwater easement and will discharge into the Sadgroves Creek sub-branch at the north-eastern corner of the site. The final form of the drain extension is yet to be resolved.

There are currently two existing stormwater drains entering the development site from the Bayview Haven Canal Estate. These will be picked up within the new underground drainage system and discharged to Sadgroves Creek.

All road drainage within the proposed development will be directed to a number of suitable locations along the perimeter of the development adjacent to Sadgroves Creek. These outfalls will have flood gates to prevent reverse flows during extreme sea level events such as storm surges, and will be areas exposed to regular tidal flushing.

2.2.9 Headworks

Water Supply

A reticulated water supply will be provided to all lots within the estate. The reticulation will be designed and constructed to normal urban water supply criteria and will be comprised of below ground mains sized to provide domestic, firefighting and irrigation requirements.

Water will be supplied to the subdivision by laying a 300NB main from the existing 450NB distribution main on Woolner Road. While the design is yet to be finalised, it is intended to lay the underground main within Woolner Road reserves and easements and along Tiger Brennan Drive to the permanent access road easement, before entering the subdivision. This main would have sufficient capacity to fully service the subdivision. There would be minimal impact on the general public as the main is within existing road reserves.

Sewerage

A wastewater collection system will be required for the subdivision. It is proposed that this will consist of a conventional gravity sewerage system connected to various pump stations (yet to be finalised) located within the central boulevard road reserve. The stations will discharge via rising mains which would be located within the permanent road access easement. This would be discharged to the nearby gravity sewerage system owned by Power and Water Corporation

(PWC). The existing Bayview Haven Estate uses a combined gravity and vacuum sewer system.

Electricity

Full electricity reticulation is available to the site from the PWC network and it is proposed to provide an underground reticulated supply throughout the subdivision. Supply will extend from the Benison Road overhead transmission lines.

An existing 66KV overhead transmission line exists adjacent to Tiger Brennan Drive within the road reserve along the site's northern boundary. The proposed development will allow a 6 m buffer from this easement and have no impact on this line or its operation.

2.2.10 Hours of Construction

Working hours have not been confirmed at this stage but will adhere to the *Noise Guidelines for Development Sites in the Northern Territory* (NT EPA 2013). All construction activities will occur between 7 am and 7 pm, six days a week (if work occurs on Sundays or public holidays, hours will be from 9 am to 6 pm). Construction hours of work will be stipulated as part of a Construction Environmental Management Plan. Construction activities will occur during both the Dry and Wet Seasons.

2.2.11 Equipment and Materials

Storage and Laydown Area

An existing hard stand area is located on the northern boundary of the site on proposed Lot 7644 and is likely to be utilised for storage and laydown facilities. This area is away from the lowest-lying areas and sensitive environments such as O'Ferrals Rock. Temporary fencing will be used to secure an area for the storage of fuels, materials and machinery in accordance with Australian Standards.

A fuel storage area will be required for diesel fuel. Fuel will be used for pumps, generators, compressors and earthmoving equipment. Diesel fuel will be stored on self-bunded pallets and accompanied by appropriate spill clean-up kits.

Portable toilets will be required on site for the duration of construction activities.

The construction workforce numbers have not been allocated at this stage but will be sourced locally where possible.

Earthwork Equipment

Equipment to be used in construction includes:

- excavators;
- graders and scrapers;
- dozers;
- moxy trucks;
- water suppression vehicles;
- cranes;
- large vibratory rollers;
- concrete mixing trucks;
- bitumen trucks;

- 'swamp dozers'; and
- loaders.

2.2.12 Security

Fencing is proposed to be placed along the boundary within the existing Bayview Haven Canal Estate in areas where private property is currently unfenced during the entire construction period. A double leaf vehicle entry gate will be locked after hours.

Signage will be provided at the Stoddard Drive/temporary access road intersection in order to minimise the entry of unauthorised vehicles onto the access road. Signage will also be used at the intersection of Tiger Brennan Drive and the permanent access road during its construction.

2.2.13 Construction Area Lighting

It is assumed that the majority of the development site will be unlit. Should night operations be required, temporary mobile lighting will be used. Security lighting may be required for machinery and sites offices.

2.2.14 Traffic

A new intersection is proposed to be constructed on Tiger Brennan Drive. The Department of Transport will be advised of predicted population numbers in the estate to enable traffic planning and the re-direction of nearby traffic.

A traffic impact assessment was conducted for Stage 11 Bayview (GHD 2011). This stage was for blocks which are now part of this project. The assessment was based on the impact of an additional 54 dwellings (comprising 54 vehicles) on the existing road network and concluded that the existing road network could sufficiently support the additional vehicles.

While numbers of dwellings and subsequent vehicle generation are yet to be finalised, the following strategies are proposed to ensure the flow of traffic within the proposed development and existing Bayview Haven Canal Estate is optimised:



- a new main intersection will be constructed for the entrance to the estate off Tiger Brennan Drive at Benison Road;
- two internal linkages and two external access points will link the two estates and provide access to Benison Road for entry and egress; and
- three roundabouts will be constructed including a turning circle in the south of the boulevard.

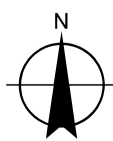
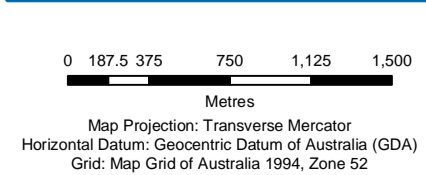
The Dover development Master Plan includes allowances for footpaths and bike paths. This will allow safe pedestrian access and opportunity for residents to interact with the neighbourhood.

A Traffic Management Plan will be developed to manage potential traffic impacts during construction.



LEGEND

-  National Park Boundary
-  Project area



Dover Investments Pty Ltd
Bayview - The Boulevard

Job Number | 43-2206300
Revision | A
Date | 08 Aug 2014

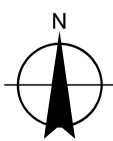
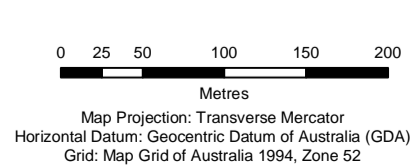
Project location

Figure 1



LEGEND

- Project area
- Road reserve
- National Park Boundary
- Lot 5988 boundary
- Lot 7433 boundary
- Lot 7525 boundary
- Lot 7644 boundary
- Minimum construction area (21.2 ha)
- Construction buffer zone (3.5 ha)
- O'Ferrals Rock Conservation Zone (0.6 ha)

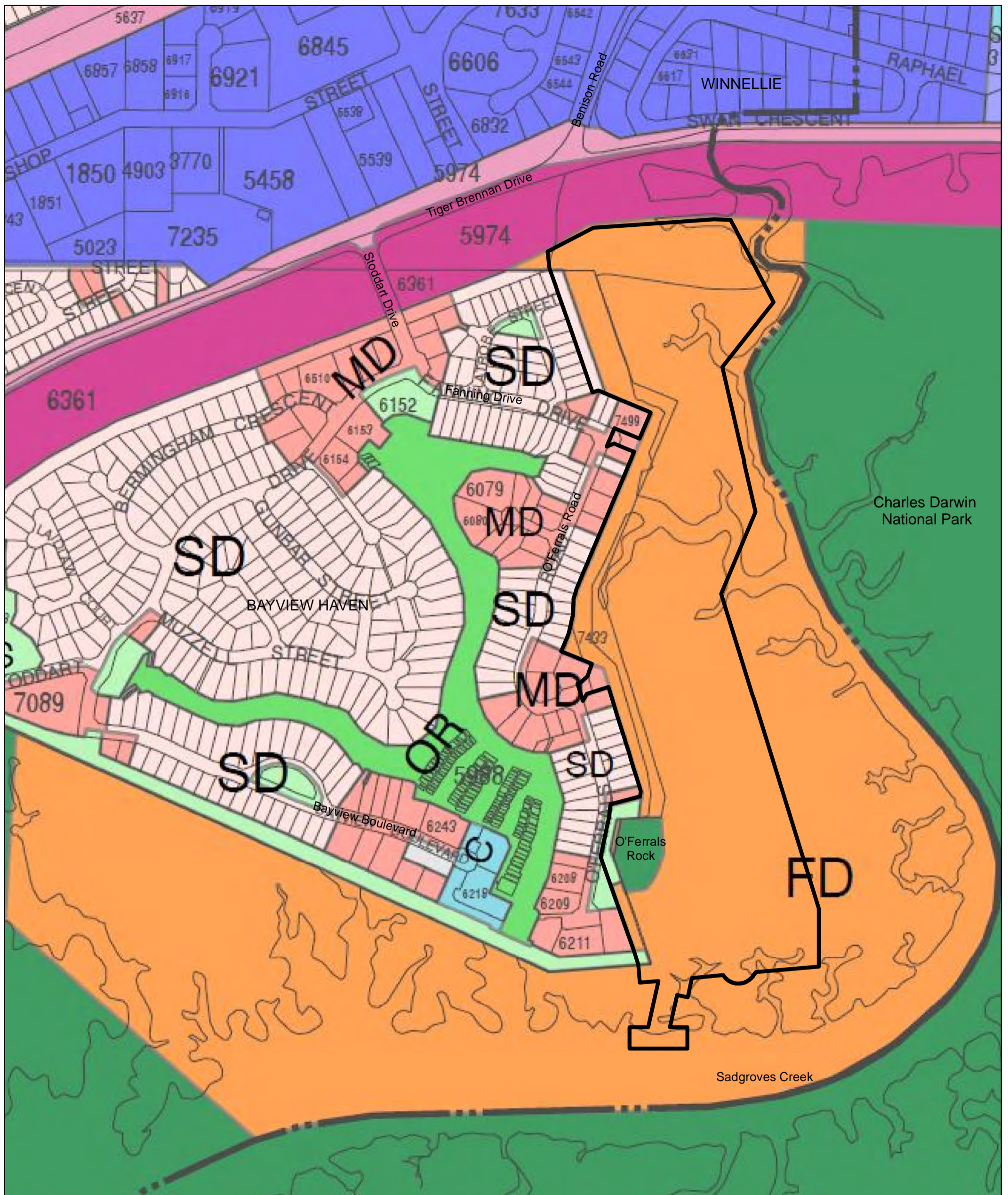


Dover Investments Pty Ltd
 Bayview - The Boulevard
 Environmental Impact Statement

Job Number | 43-2206300
 Revision | A
 Date | 22 May 2015

Project area

Figure 2



LEGEND

Project area

ZONING (NT PLANNING SCHEME)

Residential

- SD Single Dwelling
- MD Multiple Dwelling

Recreation

- PS Public Open Space
- OR Organised Recreation

Infrastructure

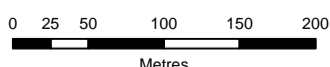
- M Main Road
- PM Proposed Main Road

Commercial

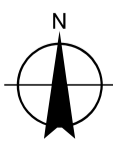
- C Commercial
- LI Light Industry
- GI General Industry

Other

- FD Future Development
- S_ Specific Use
- CN Conservation



Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 52

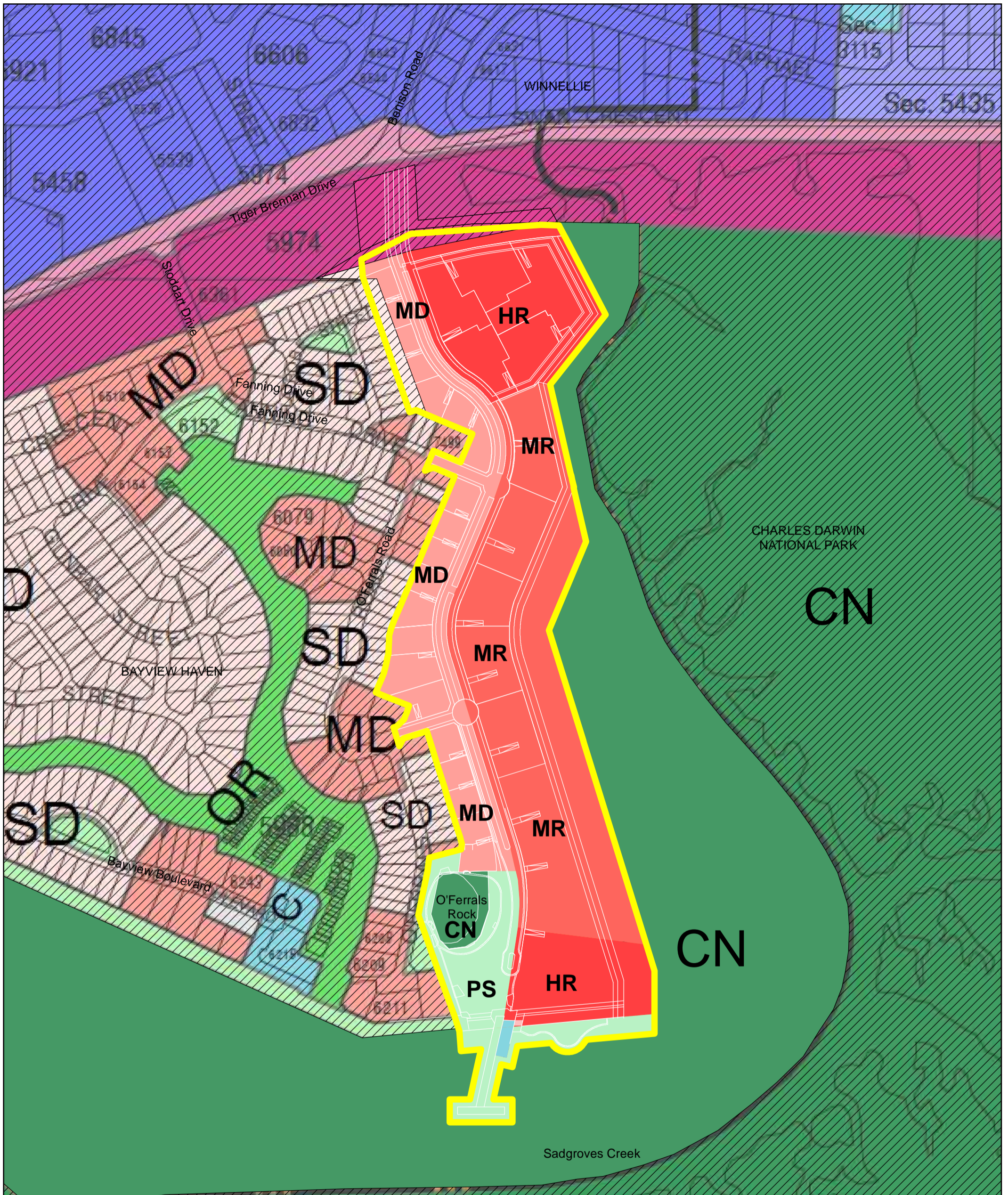


Dover Investments Pty Ltd
Bayview - The Boulevard
Environmental Impact Statement

Job Number | 43-2206300
Revision | A
Date | 22 May 2015

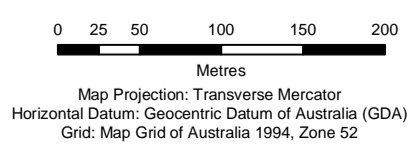
Current land use zoning

Figure 3



LEGEND

Specific Use Darwin	Residential	Recreation	Infrastructure	Commercial	Other
Existing zoning retained	SD Single Dwelling	PS Public Open Space	M Main Road	C Commercial	CN Conservation
	MD Multiple Dwelling	OR Organised Recreation	PM Proposed Main Road	Industry	
	MR Medium Density			LI Light Industry	
	HR High Density			GI General Industry	



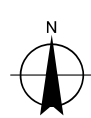
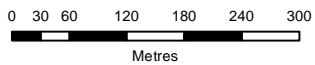
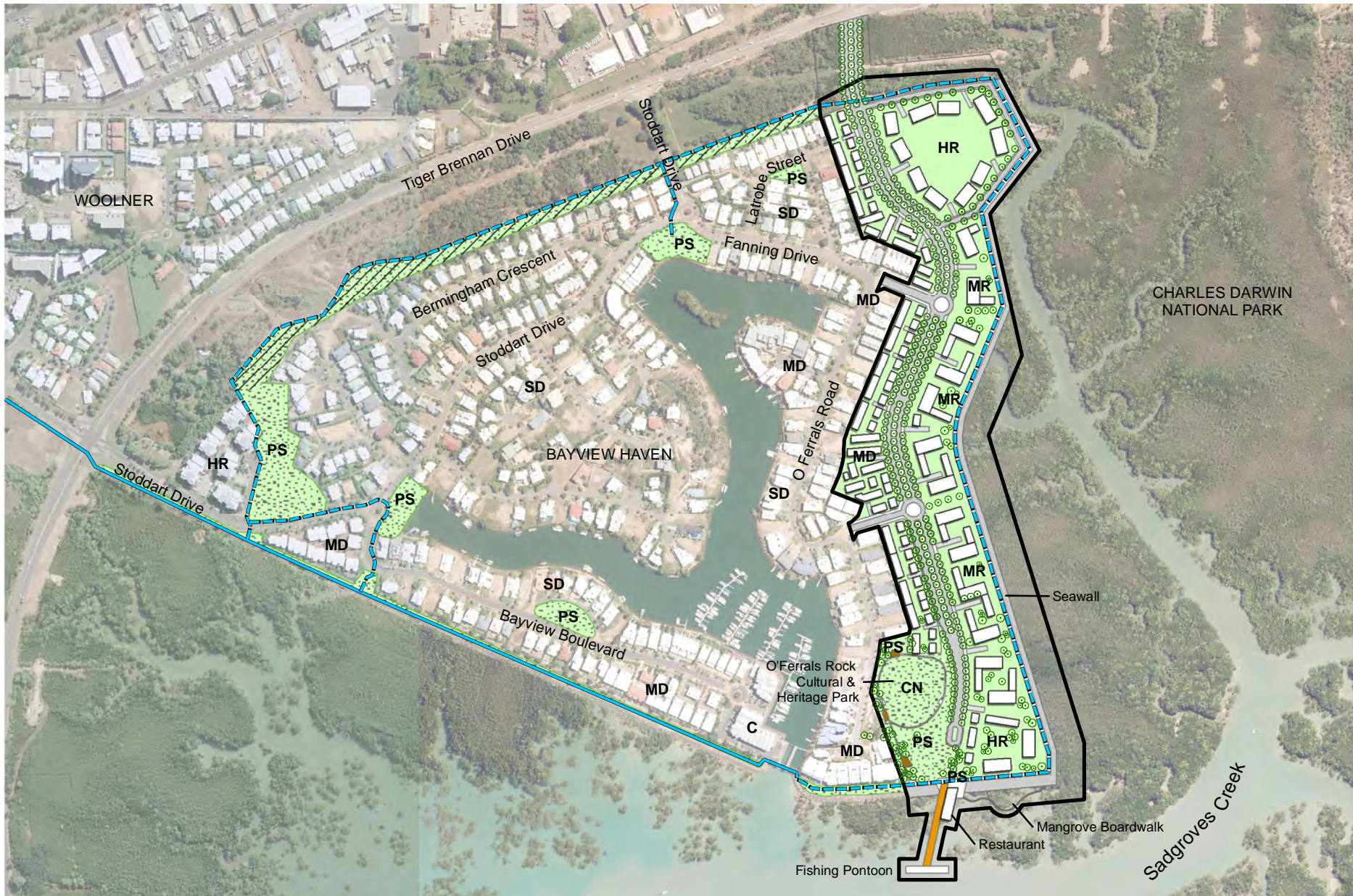
Dover Investments Pty Ltd
 Bayview - The Boulevard
 Environmental Impact Statement

Job Number | 43-2206300
 Revision | A
 Date | 22 May 2015

Proposed future land use

Figure 4

N:\AU\Darwin\Projects\43\22063\GIS\Maps\Deliverables\43_22063_051_EIS_A4P_ProposedSpecificUseDarwinZoningAndInternalZones.mxd Level 5 66 Smith Street Darwin NT 0800 Australia T 61 8 8982 0100 F 61 8 8981 1075 E drwmail@ghd.com W www.ghd.com
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 Data Source: DRLM: April 2013 Imagery; GHD: Project area and construction zones; HBO: Design layout. Created by: qjchung



LEGEND

- Project area
- Potential Shared Path
- Existing Shared Path
- Future development area
- Parks and public space
- Buffer zone walkway (By others)

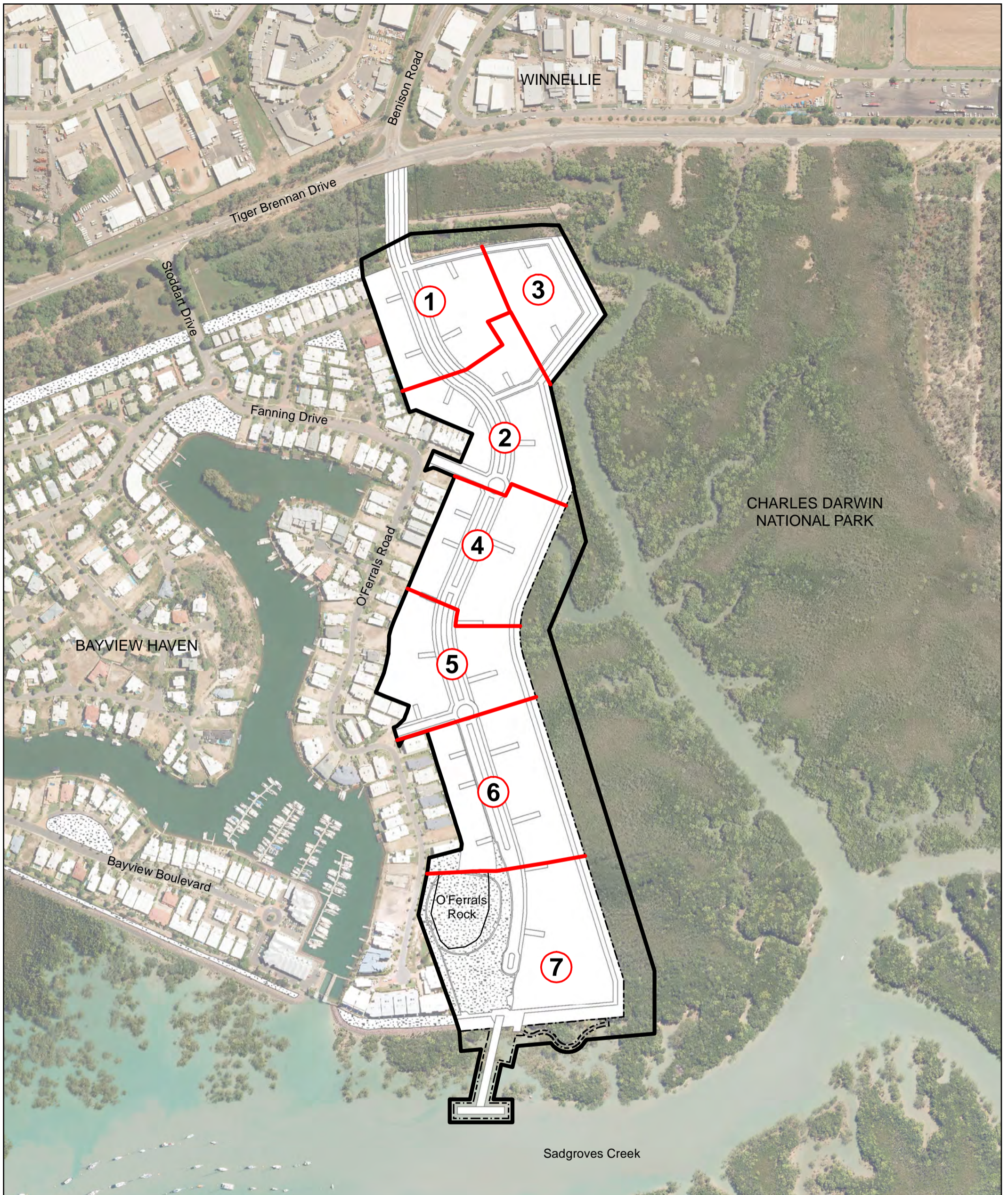


Dover Investments Pty Ltd
 Bayview - The Boulevard
 Environmental Impact Statement

Job Number	43-2206300
Revision	A
Date	22 May 2015

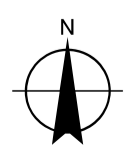
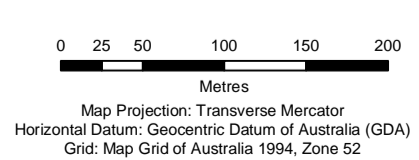
Proposed development master plan **Figure 5**

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 Data Source: Dover/HBO; Master plan design, NAVTEQ and PSMA Australia 2010; Street View; ; GHD: Site Boundary. Created by: qjchong



LEGEND

- Project area
- Construction buffer zone
- O'Ferrals Rock Conservation Zone
- Proposed staging divisions



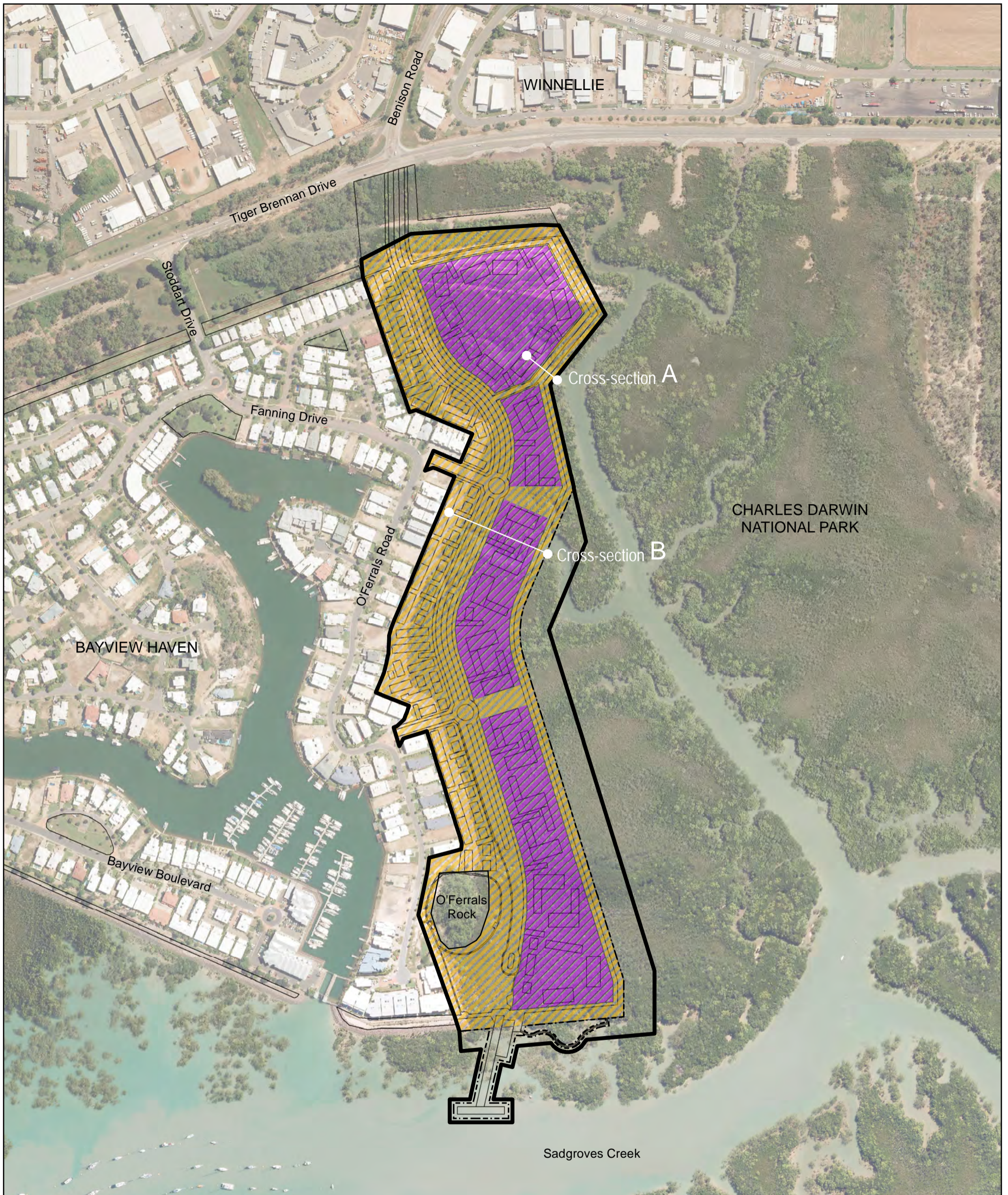
Dover Investments Pty Ltd
 Bayview - The Boulevard

Job Number	43-2206300
Revision	B
Date	22 May 2015

Construction staging plan

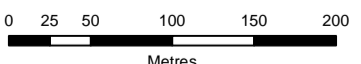
Figure 6

N:\AU\Darwin\Projects\43\22063\GIS\Maps\Deliverables\43_22063_054_EIS_A4P_ProposedDevelopmentStaging.mxd
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 Data Source: DRLM: April 2013 Imagery; GHD: Project area and construction zones; HBO: Design layout. Created by: qjchung

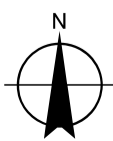


LEGEND

- XSections
- Project area
- Construction buffer zone
- O'Ferrals Rock Conservation Zone
- Fill areas
- Podium areas



Map Projection: Transverse Mercator
 Horizontal Datum: Geocentric Datum of Australia (GDA)
 Grid: Map Grid of Australia 1994, Zone 52

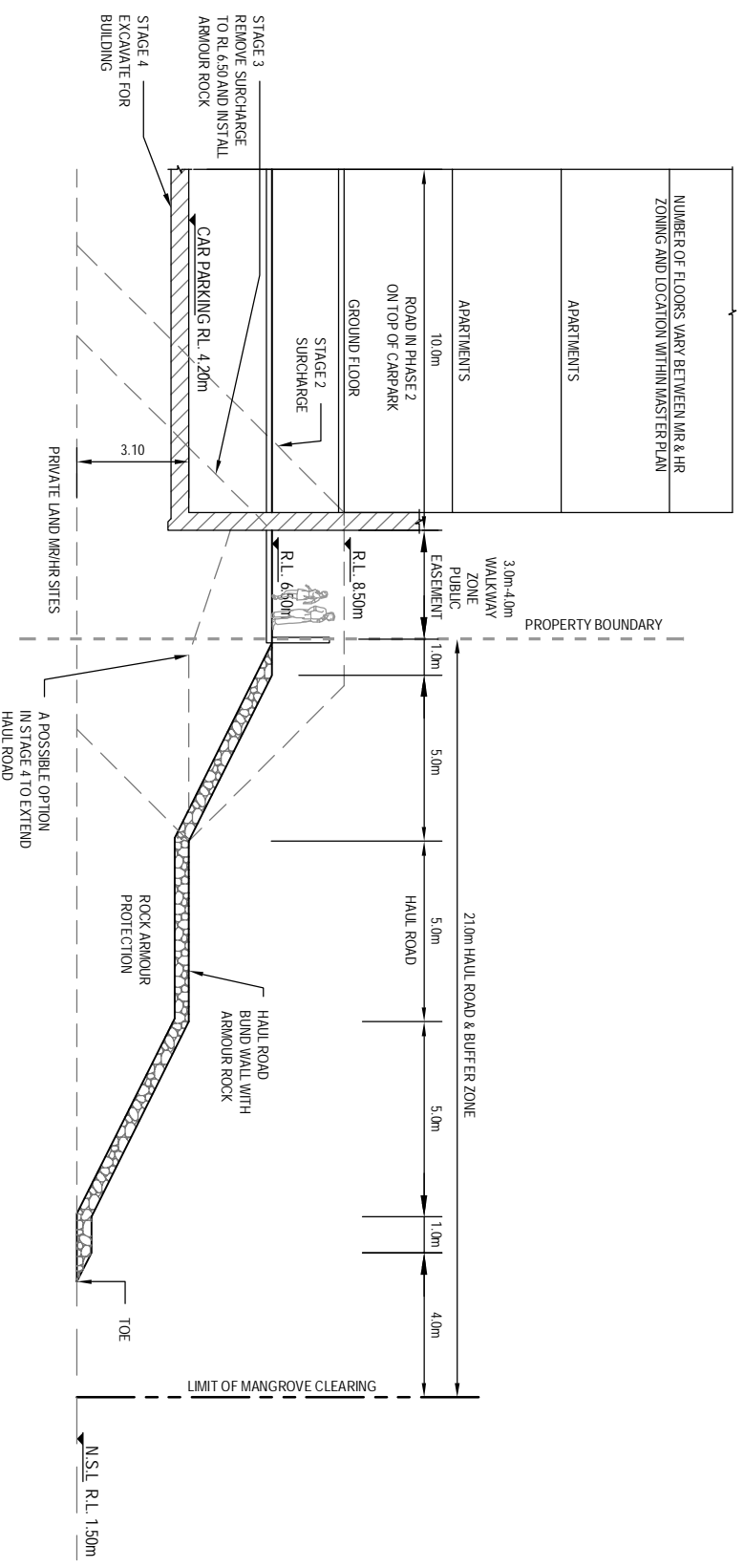


Dover Investments Pty Ltd
 Bayview - The Boulevard
 Environmental Impact Statement

Job Number | 43-2206300
 Revision | A
 Date | 22 May 2015

Fill and podium structure areas

Figure 7



A SECTION - TYPICAL BUND WALL/SEAWALL CROSS SECTION
 FIGURE 2-10
 SCALE 1 : 200



NUMBER OF FLOORS VARY BETWEEN MR & HR
 ZONING AND LOCATION WITHIN MASTER PLAN

APARTMENTS

APARTMENTS

ROAD IN PHASE 2
 ON TOP OF CARPARK

GROUND FLOOR

STAGE 2
 SURCHARGE

CAR PARKING RL 4.20m

STAGE 4
 EXCAVATE FOR
 BUILDING

STAGE 3
 REMOVE SURCHARGE
 TO RL 6.50 AND INSTALL
 ARMOUR ROCK

PROPERTY BOUNDARY

3.0m-4.0m
 WALKWAY
 ZONE
 PUBLIC
 EASEMENT

RL 8.50m

RL 6.50m

A POSSIBLE OPTION
 IN STAGE 4 TO EXTEND
 HAUL ROAD

HAUL ROAD
 BUND WALL WITH
 ARMOUR ROCK

ROCK ARMOUR
 PROTECTION

LIMIT OF MANGROVE CLEARING

NSL RL 1.50m

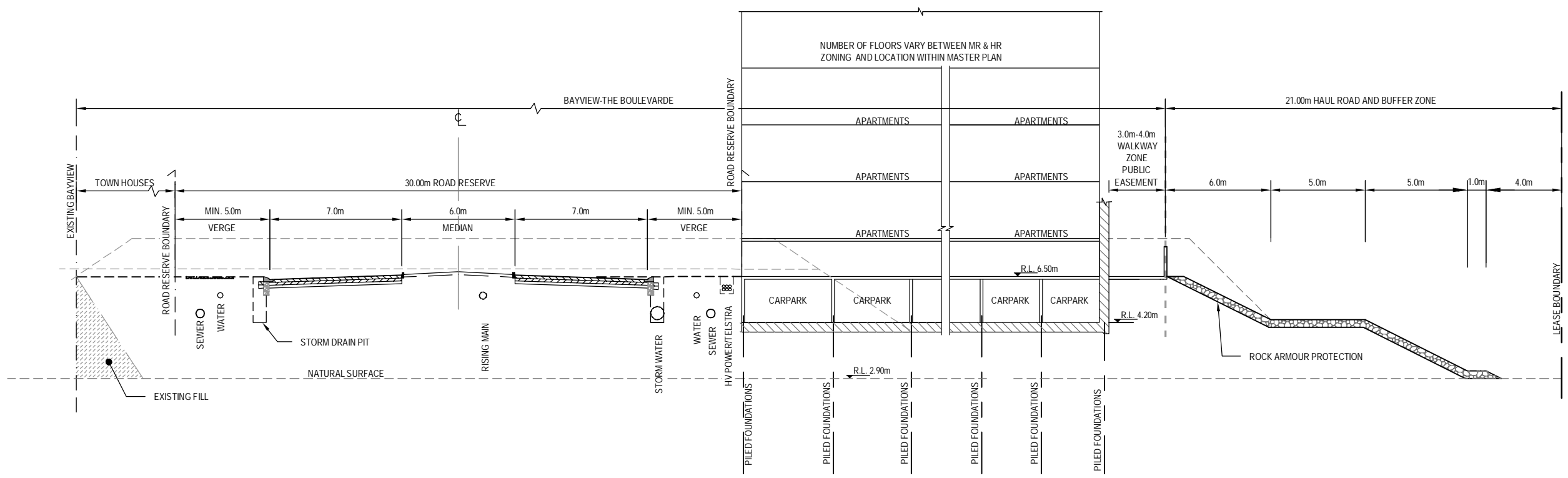
TOE

Client: DOVER INVESTMENT Pty Ltd
 Project: BAYVIEW - BOULEVARD
 TITLE: TYPICAL BUND WALL/SEAWALL
 CROSS SECTION (A)

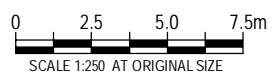
Job Number: 43-2187902
 Revision: A
 Date: SEPT 2014



Figure 8



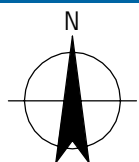
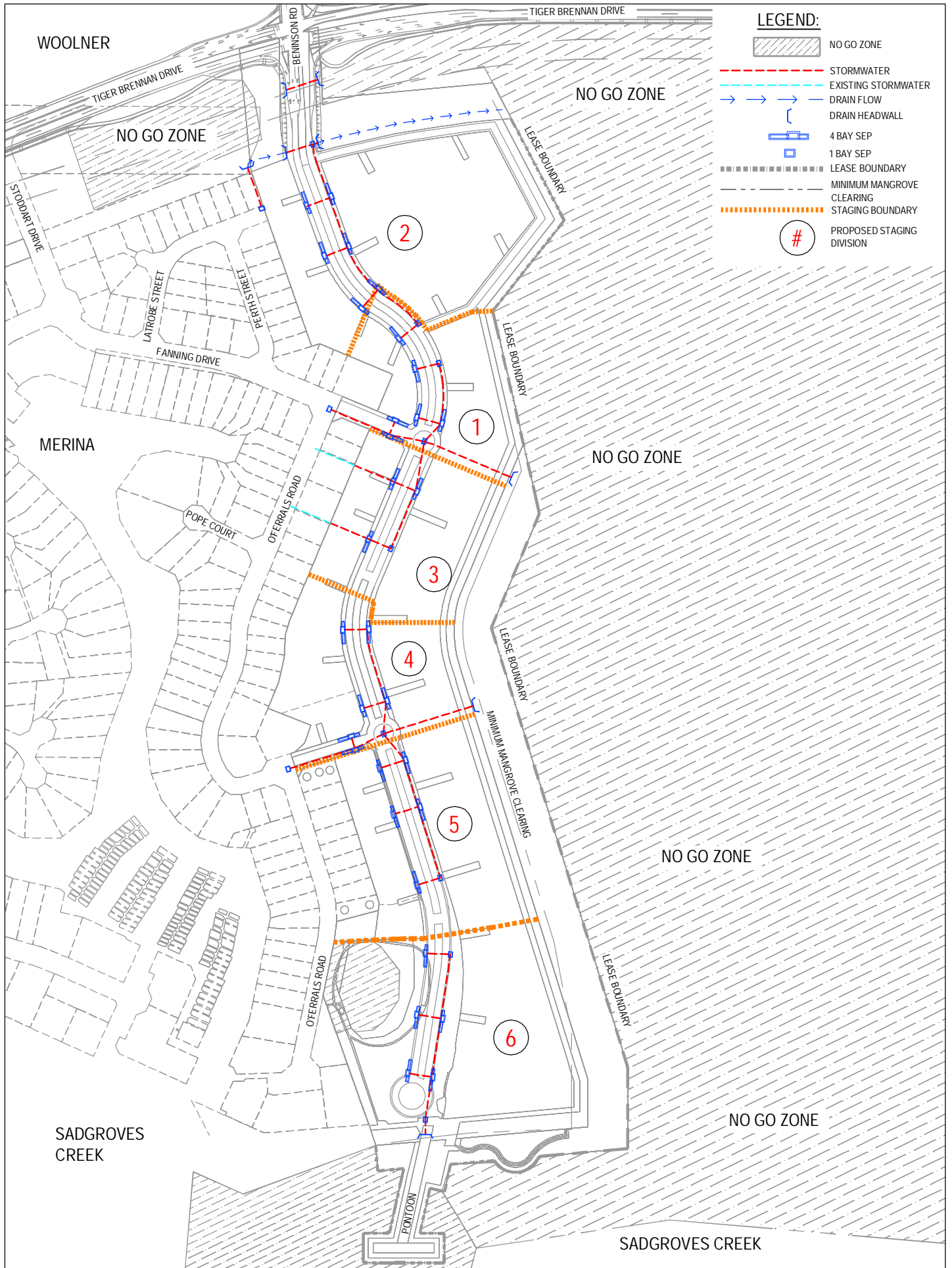
B SECTION - TYPICAL EARTHWORKS CROSS SECTION
 FIGURE 2-7 SCALE 1:250



Client: DOVER INVESTMENT Pty Ltd
 Project: BAYVIEW - BOULEVARDE
 TITLE: TYPICAL EARTH WORKS
 CROSS SECTION (B)

Job Number | 43-2187902
 Revision | A
 Date | SEPT 2014

Figure 8



Client: DOVER INVESTMENTS Pty Ltd
 Project: BAYVIEW - BOULEVARDE
 TITLE: LOCATION OF STORMWATER HEADWORKS

Job Number 43-2187902
 Revision A
 Date SEPT 2014

Figure 10

3. Legislation

An overview of legislation related to the proposed development is provided below.

3.1 Commonwealth Legislation

3.1.1 Environment Protection and Biodiversity Conservation Act 1999

Under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), any development requires assessment if it has the potential to significantly impact one or more of eight Matters of National Environmental Significance (MNES). The matters of MNES include:

- World Heritage properties;
- National Heritage places;
- Wetlands of international importance (listed under the Ramsar Convention);
- Listed threatened species and ecological communities;
- Migratory species protected under international agreements;
- Commonwealth marine areas;
- The Great Barrier Reef Marine Park; and
- Nuclear actions (including uranium mines).

The environment under the EPBC Act includes:

- ecosystems and their constituents;
- natural and physical resources;
- qualities and characteristics of locations, places and areas;
- heritage values of places; and
- social, economic and cultural aspects.

The EPBC Protected Matters Search Tool (PMST) indicates that there are 25 threatened fauna species and 51 migratory species within 1.5 km of the proposed development (DoE 2015). An EPBC Act referral (EPBC 2015/7466) has been submitted to DoE for assessment in April 2015. Determination of the assessment is expected in late May 2015.

3.1.2 Native Title Act 1993

The objectives of the *Native Title Act 1993* are to:

- provide for the recognition and protection of Native Title;
- establish ways in which future dealings affecting Native Title may proceed and to set standards for those dealings;
- establish a mechanism for determining claims to Native Title; and
- provide for, or permit, the validation of past acts, and intermediate period acts, invalidated because of the existence of native title.

The proposed development was previously subject to the Larrakia Native Title claim but this was dismissed on 17 May 2006 (Section 4.3.3).

3.1.3 National Environment Protection Measures (Implementation) Act 1998

Under the *National Environment Protection Measures (Implementation) Act 1998*, the National Environmental Protection Council (NEPC) was established to set national environmental goals and standards for Australia through the development of National Environment Protection Measures (NEPMs). The NEPC is part of the Environment Protection and Heritage Council (EPHC).

Section 14(1) of the NEPC Act prescribes that NEPMs may relate to any one or more of the following:

- ambient air quality;
- ambient marine, estuarine and fresh water quality;
- the protection of amenity in relation to noise;
- general guidelines for the assessment of site contamination;
- environmental impacts associated with hazardous wastes; and
- the re-use and recycling of used materials.

Mitigation and management measures were developed in accordance with Section 14(1) of the Act (Section 5).

3.1.4 National Strategy for Ecologically Sustainable Development

The goal of the National Strategy for Ecological Sustainable Development (ESD) is to develop in a way that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. This strategy is being implemented in the Northern Territory, under the *Northern Territory Environment Protection Authority Act 2012*. Under this Act the NT EPA is required to:

- promote ESD; and
- protect the environment, having regard for the need to enable ESD.

Under the NT EPA Act (2012), ESD means using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life now and in the future can be increased.

3.2 Northern Territory Legislation

3.2.1 Northern Territory Environmental Protection Authority Act 2012

The *Northern Territory Environment Protection Authority Act 2012* commenced on 1 January 2013. The Act establishes the new Northern Territory Environment Protection Authority (NT EPA) as an independent regulatory authority and makes consequential amendments to the *Waste Management and Pollution Control Act* and the *Environmental Assessment Act*.

Amendments to the *Waste Management and Pollution Control Act* identify the NT EPA as the entity responsible for administration of the regulatory functions of that Act.

Amendments to the *Environmental Assessment Act* identify the NT EPA as the entity responsible for administration of the assessment functions and impose additional transparency and reporting responsibilities on the Environment Minister and the responsible Minister for specific projects.

3.2.2 The Environmental Assessment Act 1982 and Environmental Assessment Administrative Procedures Act 1984

The *Environmental Assessment Act 1982* and the *Environmental Assessment Administrative Procedures Act 1984* ensure each matter affecting the environment is fully examined and taken into account in, and in relation to:

- formulation of proposals;
- carrying out of works and other projects;
- negotiation, operation and enforcement of agreements and arrangements (including agreements and arrangements with authorities of the commonwealth, the states and other territories);
- making of, or the participation in the making of, decisions and recommendations; and
- incurring of expenditure.

This NOI was prepared in accordance with the Information Guidelines for a Notice of Intent (NRETAS, now used for assessment by the NT EPA).

The NT EPA will determine whether the proposal is likely to have a significant impact on the environment following submission of the NOI. If the impact is likely to be significant, a Public Environment Report or Environmental Impact Statement will be required under the Act. If the impact is not likely to be significant, the proponent will be advised of any conditions for the proposal to proceed such as the implementation of an Environmental Management Plan.

3.2.3 Northern Territory Aboriginal Sacred Sites Act 1989

The *Northern Territory Aboriginal Sacred Sites Act 1989* is administered by the Aboriginal Areas Protection Authority (AAPA). The Act provides for the location, recognition, description and protection of sites sacred under Aboriginal tradition. All sacred sites (even if not registered) are protected under the Act and it is an offence to enter or carry out work on a sacred site without permission or a certificate issued by the AAPA. The certificate sets out conditions under which the work may be carried out.

An AAPA Authority Certificate (C2013/229) was issued to Dover in December 2013. It covers all works associated with the extension of the existing Bayview residential development, and is valid provided works commence within 24 months of the issue of the certificate (i.e. December 2015) Heritage Act 2011

The *Heritage Act 2011* commenced on 1 October 2012. It replaced the *Heritage Conservation Act*, which had been in operation since 1991.

This Act applies to the Project. Chapter two of the Act allows for the establishment of the Northern Territory Heritage Register. Members of the community can nominate areas, places, sites, buildings, shipwrecks and heritage objects to the register. If the Minister agrees that these features are of special significance to the heritage of the Northern Territory, the place is added to the register. The place will then be protected from accidental and deliberate damage or harm. The Act allows for processes to approve works and maintenance for a heritage place.

Sections 17 and 18 of the new Act declare all Aboriginal and Macassan archaeological places and objects heritage places, providing the same level of protection as places on the Heritage Register. Part 3.2 of the Heritage Act allows for applications to work on heritage places, including work on, or salvage of, Aboriginal archaeological sites. In practice, permits to salvage Aboriginal Archaeological places will be issued under conditions which include the approval of the appropriate Traditional Owner or Site Custodian for a site. Permits under the new Act will also require reasonable study of each site disturbed, and appropriate curation of any artefacts

salvaged. This will normally mean repatriation of artefacts to the appropriate Traditional Owners of an area.

The Heritage Act includes a provision for the declaration of classes of places or objects that are known to be of significance in the Northern Territory but where not all locations are currently mapped and recorded.

O'Ferrals Rock was nominated for listing on the Northern Territory Heritage Register but was not supported as it is currently zoned as Conservation under the Northern Territory Planning Scheme. The proposed development will include this site as a cultural and heritage park. There are no other nominated or declared heritage places in the project area (Section 4.3).

3.2.4 Planning Act 2009

Northern Territory Planning Scheme

The *Planning Act 2009* regulates the subdivision and development of land in the Northern Territory. It defines "development" as an activity that involves carrying out works on land, including clearing of native vegetation. "Works" is defined as any activity on land other than mining or agriculture, resulting in a physical change to the land or a part of the land.

The Act provides for a single integrated Northern Territory Planning Scheme. The proposed residential uses of this development (Medium Density, High Density) are identified as a discretionary use under the zoning table for Future Development in the Northern Territory Planning Scheme. A discretionary use requires consent from the Development Consent Authority. The Planning Scheme also establishes certain standards for subdivision including minimum lot sizes, general layout, and the provision of open space and parking.

Services will be provided to individual lots as described in this NOI (Section 2.2). The provision of new water supply pipes, sewerage pipes and telecommunications to the proposed lots are exempt under Clause 1.3 (2 (b) i, ii, iii) of the Northern Territory Planning Scheme.

Native Vegetation Clearing

The planning scheme requires native vegetation to be cleared in accordance with the *Land Clearing Guidelines 2010* (NRETAS 2010a).

This document contains guidelines for clearing, and sets out the need to provide additional information for developments within coastal and marine areas, including the provision of a plan for acid sulfate management where the area is considered a moderate to high acid sulfate risk. Acid sulfate soils are known to occur in the project area and an acid sulfate soil management plan will be prepared for construction works.

3.2.5 Water Act 1992

The *Water Act 1992* covers allocation, use, control, protection and management of Northern Territory water resources.

Pollution under the Act includes directly or indirectly altering the physical, thermal, chemical, biological or radioactive properties of the water so as to render it less fit for a prescribed beneficial use for which it is or may reasonably be used, or to cause a condition which is hazardous or potentially hazardous to:

- public health, safety or welfare;
- animals, birds, fish or aquatic life or other organisms; and
- plants.

Mitigation and management measures were developed in accordance with this Act (Section 5).

3.2.6 Waste Management and Pollution Control Act 1998

The purpose of the *Waste Management and Pollution Control Act 1998* is to protect the environment through objectives and approvals, encouraging effective and responsible waste management and reduction and response to pollution. This Act facilitates the implementation of national environment protection measures made under the *National Environment Protection Council (Northern Territory) Act 1999*, and incorporates environmental compliance plans and audits.

Section 14 of the Act establishes a process for notifying the NT EPA (the administering agency for the Act) about incidents causing, or threatening to cause pollution. Schedule 2 of the Act requires environment protection / licensing for certain activities.

Waste Management and Pollution Control (Administration) Regulations 2012

These regulations deal with administrative issues such as fees for licensing and approvals and payment of "on the spot fines".

Construction activities will generate waste, noise and air pollution. Specifications of the Act will be applicable to the project (Section 5).

3.2.7 Traffic Act 1987

This Act regulates traffic and applies to or in relation to a driver, vehicle or pedestrian, on a public street or in a public place.

Vehicles will be entering the site during construction. This Act will be applicable to the project.

3.2.8 Other Legislation

Other legislation that may be applicable to the project includes:

- *Territory Parks and Wildlife Conservation Act 2006*;
- *Soil Conservation and Land Utilisation Act 2001*;
- *Weeds Management Act 2001*; and
- *Work Health and Safety (National Uniform Legislation) Act 2011*.

3.2.9 Guidelines

The following Northern Territory Guidelines are relevant to this project:

- Guidelines for Preventing Biting Insect Problems for Urban Residential Developments or Subdivisions in the Top End of the Northern Territory (Northern Territory Department of Health and Families 2009);
- Guidelines for Preventing Mosquito Breeding Associated with Construction Practice near Tidal Areas in the Northern Territory (Northern Territory Department of Health and Community Services 2011);
- Erosion and Sediment Control Plan Content – Factsheet (NRETAS 2006);
- Darwin City Council Subdivision and Development Guidelines (Darwin City Council 2005);
- NP020 - Guidelines for Developers of Subdivisions and Electricity Infrastructure (PWC 2008);
- Land Clearing Guidelines – Northern Territory Planning Scheme (NRETAS 2010a); and
- Queensland Acid Sulfate Soil Technical Manual (Queensland Government 2004).

4. Site Description

4.1 Physical Environment

4.1.1 Climate

The development area is located in the wet-dry tropics and is subject to annual periods of flood and drought. The closest meteorological station with comprehensive climatic data is located at Darwin Airport, approximately 4 km to the north.

The Dry Season extends from approximately March to September, and displays moderate temperatures, low humidity and winds predominantly from the east.

The Wet Season officially begins in early October and continues with some variation through to late March / April. It is characterised by high humidity, high temperatures and heavy rainfall events with a monsoonal influence.

The hottest months are October and November with daily temperatures of approximately 33 degrees Celsius. The mean annual rainfall is approximately 1,729 mm. Average monthly rainfalls range from 424 mm in January to 1 mm in July (Bureau of Meteorology 2013).

Table 4-1 Rainfall and temperature statistics (Darwin Airport 1941-2012)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)												
Highest	940	1,110	1,014	396	299	51	27	84	130	339	371	665
95 th %ile	764	671	612	273	85	5	6	36	65	170	242	559
Mean	424	375	321	101	21	2	1	5	16	70	139	251
5 th %ile	188	136	119	7	0	0	0	0	0	2	41	83
Lowest	136	103	88	0	0	0	0	0	0	0	17	19
Temp (°C)												
Highest ¹	31.8	31.4	31.9	32.7	32.0	30.6	30.5	31.4	32.6	33.2	33.3	32.6
Lowest ²	24.8	24.7	24.5	24.0	22.1	19.9	19.3	20.4	23.0	24.9	25.3	25.3

Notes: ¹ Monthly mean maximum temperature is the average of the available daily maxima for a month.

² Monthly mean minimum temperature is the average of the available minima for a month.

4.1.2 Topography, Soils and Geology

The Bayview area comprises the hinterland system, low lying foot slopes and tidal flats (Dames and Moore *et al.* 1991). The proposed development area lies almost entirely within the tidal flats.

The hinterland system rises to 25 m above sea level, and forms the northerly section of the current Bayview Haven Canal Estate. The surface of this plateau is flat with numerous stones and boulders strewn on the surface (Dames and Moore *et al.* 1991). The soils in this system are shallow lithosols with a high gravel and stone content. In low lying parts of this land system are seepage areas which show signs of imperfect drainage and waterlogging in the Wet Season. The soils in these hinterland areas are moderately deep yellow massive earths ranging in texture from sandy clay loam to light clay.

The tidal flats are distinguished by mangrove forest vegetation and estuarine muds which are strongly alkaline, and in areas of tidal influence are classified as saline grey cracking clays. They form a grey brown surface horizon and mottled deep subsoil (CCNT 1985).

Sediment is constantly being eroded and redeposited in Sadgroves Creek as a result of the high tidal range, tidal prism, and tidal streams. The tidal flats include coastal mangroves and open intertidal sections that become exposed mudflats at low tide.

4.1.3 Groundwater

Groundwater in the hinterland is contained within the Cretaceous Bathurst Island Formation and is subject to distinct seasonal water table fluctuations of up to 6 m (Semeniuk 1985).

Groundwater recharge occurs in these adjacent hinterland areas. This adjacent plateau area is effectively dissected by Tiger Brennan Drive which would intercept any groundwater recharge that may have moved southeast to the access road (Dames and Moore *et al.* 1991).

Groundwater mapping indicates that the groundwater salinity in the proposed development area is high (>1000 mg/L TDS) with typical yields of <0.5 L/s (NRETA 2008). The salinity of the groundwater and soil water systems on tidal flats and adjoining hinterland is an important mechanism which regulates health of mangrove populations. Salinity ranges from being high in tidal flats to moderate on hinterland margins to low in the hinterlands.

On the tidal flats groundwater occurs at about 10 cm below the surface during low tide (Dames and Moore *et al.* 1991). Groundwater salinity ranges in these areas from 38-40 parts per thousand to hypersaline levels (Semeniuk 1985).

4.1.4 Surface Water

The most significant surface water adjacent to the proposed development site is Sadgroves Creek. Sadgroves Creek flows into Frances Bay and comprises only a small percentage of the total area of Darwin Harbour. Sadgroves Creek is a tidal creek and its hydrology and water quality is determined by a number of factors including catchment characteristics, tidal influence, rainfall, runoff, evaporation and groundwater.

The creek forms a shallow channel less than 1 m deep at Lowest Astronomical Tide (LAT). Tidal influence is important due to the large tidal excursion (up to 20 km), rapid tidal streams (3 to 4 knots), and high tidal range (up to 8 m) (Dames and Moore *et al.* 1991). This results in Sadgroves Creek being well flushed and the channels maintained in a stable condition. During exceptional climatic conditions very high tide levels can be experienced, with tide levels possibly reaching 6.2 m AHD for a 1 in 1000 year storm surge (NRETAS 2011). Sadgroves Creek experiences high turbidity during the Wet Season when rainfall and runoff are at a maximum. Evaporation is highest during the Dry Season from July to October.

4.1.5 Stormwater

Rainfall in the Wet Dry tropics is characterised by intense monsoon rains between November and April.

There are currently two existing stormwater drains entering the proposed development area from the Bayview Haven Canal Estate. These will be picked up within a new underground drainage system.

The development area receives stormwater runoff from the Benison Road industrial area north of the development, and Bayview Haven Canal Estate to the west. The reaches of Sadgroves Creek below the development also receive stormwater from Woolner and Winnellie.

Stormwater runoff from the Bishop Street industrial area, Darwin City and Stuart Park enters Sadgroves Creek further downstream from the development (Dames and Moore *et al.* 1991).

4.1.6 Marine Water Quality

Darwin Harbour is classified as a slightly disturbed marine ecosystem (ANZECC/ARMCANZ 2000). Hydrodynamic modelling, supported by water quality studies, indicate that significant tidal movement in the Harbour does not transport diffuse and point source nutrients out of the Harbour, but rather assists in their dispersal within the Harbour precinct (NRETAS 2010b).

The waters of Darwin Harbour are moderately turbid with distinct fluctuation in suspended sediment concentration values from tidal frequency and seasonal influences. Freshwater runoff along channel banks and mangrove zones is the main contributor to fine sediments dispersed into the upper arms of the harbour during the wet season (INPEX 2011).

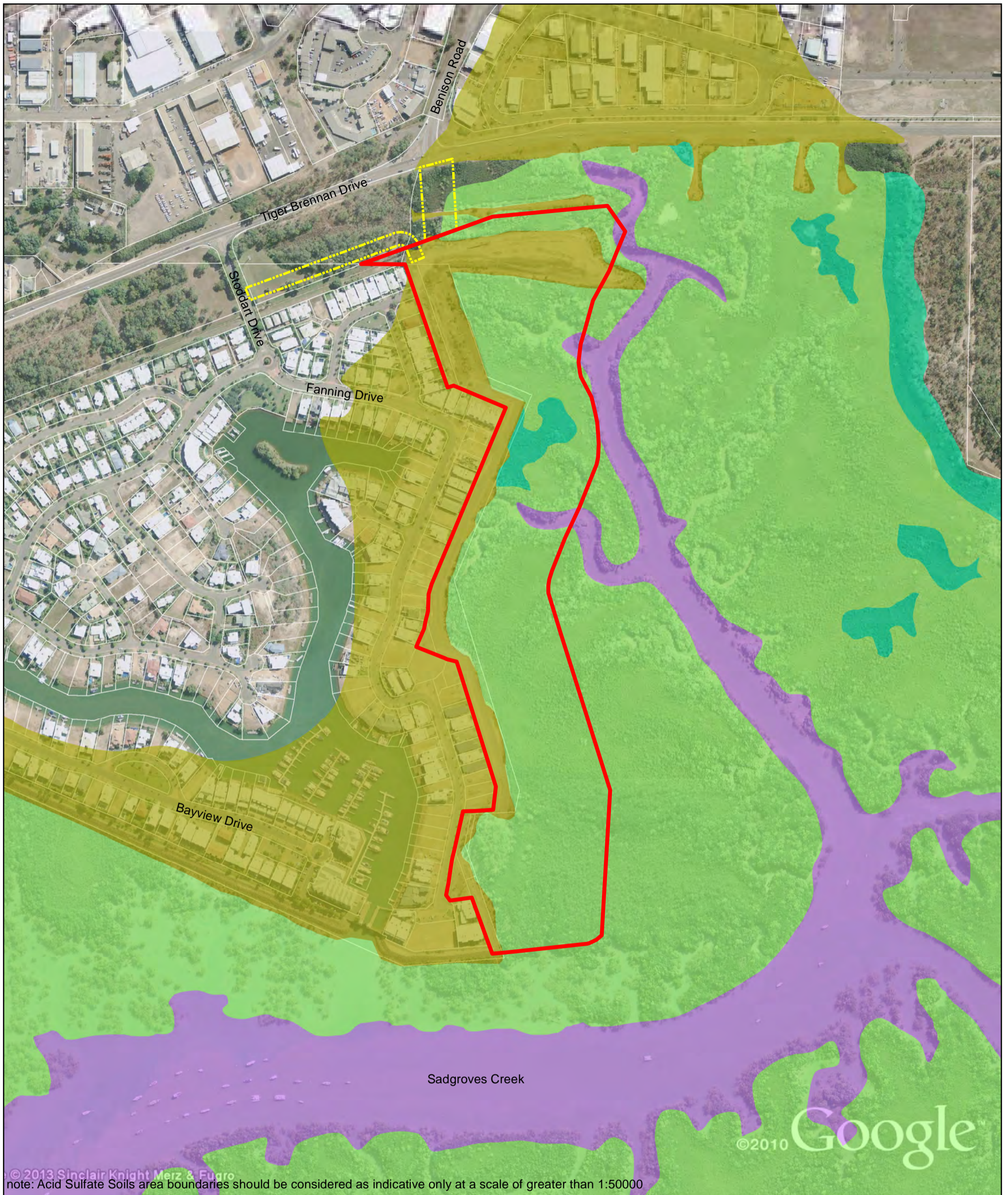
Salinity varies according to season and location within Darwin Harbour (Padovan 2003). Highest salinity has been measured during September-October when values were typically 35 parts per thousand. The lowest salinity has been measured in the period January-March, coinciding with rainfall and fresh water runoff into the harbour. Padovan (2003) concluded that the degree to which salinity was reduced is a function of location within the harbour and amount of rainfall during the monsoon period.

The Darwin Harbour Report Card 2012 indicated that water quality in Darwin Harbour and its catchment was generally good to excellent (DLRM 2012). Water quality in the harbour can vary between locations according to weather, benthic habitat type and tidal state; and be influenced by activities such as the dredging currently being undertaken as part of the Ichthys Project development.







4.1.7 Acid Sulfate Soils

Acid Sulfate Soils (ASS) are naturally occurring soils, sediments or peats that contain iron sulfides which on exposure to air oxidise to form sulfuric acid. Production of sulfuric acid leads to the breakdown of soil structure, causing a release of acidity, metals and nutrients into soil and water environments. ASS are most commonly found in low-lying land areas less than five metres Australian Height Datum (AHD) including riverine, estuarine and mangrove areas, brackish lakes, tidal flats, salt marshes, salt pans, swamps and seasonally inundated plains (NRETAS 2008).

The proposed development area is in an area with a high probability of occurrence of ASS (NRETAS 2008). The majority of the site is classed as intertidal with a high probability of occurrence of ASS, with Probable Acid Sulfate Soils (PASS) material present within the upper metre of the soil (Figure 11). The Sadgroves Creek area has a high probability of occurrence of ASS, with PASS material and / or monosulfidic black ooze.



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 note: Acid Sulfate Soils area boundaries should be considered as indicative only at a scale of greater than 1:50000

LEGEND		Acid Sulfate Soil	
	Study Area		1a, High probability of occurrence of acid sulfate soils, probable acid sulfate soil material and/or monosulfidic black ooze, Bottom sediments, often with seagrasses
	Access Roads (separate NOI)		1b, High probability of occurrence of acid sulfate soils, probable acid sulfate soil present within upper 1 metre, Intertidal flats, often with mangroves
			1c, High probability of occurrence of acid sulfate soils, probable acid sulfate soil present within upper 1 metre, Supratidal flats with halophytes (samphire), salt marsh, salt pans
			1x, High probability of occurrence of acid sulfate soils, acid sulfate soil material present in former tidal zones inside bund walls and/or anthropic acid sulfate soil material > 0.3m thick, Floodplains, profoundly disturbed (dredge spoil, fill, ponds, excavations, urban development)

1:5,000 (at A3)
 0 25 50 100 150 200
 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: Geocentric Datum of Australia (GDA)
 Grid: Map Grid of Australia 1994, Zone 52



Dover Investments Pty Ltd
 Bayview II - The Groves
 Notice of Intent - Residential Development

Job Number | 43-22063
 Revision | B
 Date | 13 Sep 2013

Acid Sulfate Soil Probability **Figure 11**

G:\43\22063\GIS\Mapes\MXD\43_22063_003_ASS.mxd
 © 2010. While GHD has taken care to ensure the accuracy of this product, GHD and NRETAS, Geoscience Australia and Google Earth/SKM make no representations or warranties about its accuracy, completeness or suitability for any particular purpose.
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 Data Source: NRETAS: Acid Sulfate Soils of the Darwin Region; Geoscience Australia: 250K Topo; Google Earth/SKM: Imagery; GHD: Site Boundary. Created by: cwilson

4.2 Terrestrial Environment

4.2.1 Land Units

Land unit mapping for the Darwin area provides an overview of the expected landform, soil and vegetation in the project area. The land units that occur within or near the development area are described in Tables 4-2 to 4-4 below, and illustrated in Figure 12 . The proposed development area lies entirely within land unit 9b. A small proportion of the potential shared path and stormwater easement in the northeast corner lie within land units 1c and 4c.

Table 4-2 Land unit 9b

Element	Details
Land Form	Estuarine fringe. Gradient negligible, <0.5%. Muddy and soft surfaced.
Parent Material	Quaternary sediments.
Soils	Intertidal Hydrosol. Saline muds and clays. Silty clays, unconsolidated marine muds. Very poorly drained.
Vegetation	Low Closed Forest of mangrove species; <i>Avicennia marina</i> on seaward fringe with dense <i>Ceriops tagal</i> dominating much of community to landwards.
Drainage	Very poorly drained, subject to peak tidal inundation.
Limitations	Site drainage, Flooding (intertidal inundation), Potential for acid sulphate soils.
Map Unit	Estuarine fringes; gradient negligible, <0.5%; intertidal inundation; saline muds and clays: Low Closed Forest of Mangrove spp.

Table 4-3 Land unit 1c

Element	Details
Land Form	Low scarps and short steep slopes, mostly on lateritic material. Gradient 5-20%, relief 5-20 m. Extensive outcrop and surface stone (30-60% cover).
Parent Material	Lateritised siltstones and sandstones.
Soils	Leptic Rudosol. Shallow gravelly lithosols. Coarse textured. 50-70% stone and gravel throughout. Rapidly drained.
Vegetation	Woodland; dominant species are generally thin <i>Eucalyptus miniata</i> , <i>E. bleeseri</i> with <i>E. tetradonta</i> , <i>E. tectifera</i> , <i>E. foelscheana</i> as associated species; open shrub understory of <i>Xanthostemon paradoxus</i> , <i>Terminalia ferdinandiana</i> , <i>Buchanania obovata</i> , <i>Cycas armstrongii</i> , <i>Livistona humilis</i> ; open grass cover with <i>Sorghum plumosum</i> , <i>Eriachne avenacea</i> , <i>Chrysopogon latifolius</i> , <i>Heteropogon contortus</i> as major species.
Drainage	Very rapid.
Limitations	Steep slopes, shallow gravelly soils, common surface stone and








Element	Details
	Outcrop.
Map Unit	Short steep slopes and rises; gradient 5-15%; shallow gravelly lithosols: Eucalypt Woodland.

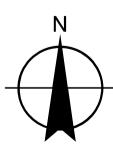
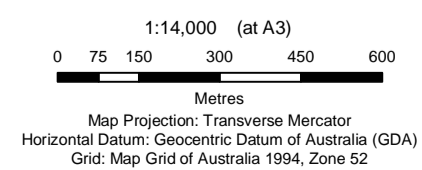
Table 4-4 Land unit 4c

Element	Details
Land Form	Gentle lower slopes. Gradient 0.5-1.5%.
Parent Material	Colluvium.
Soils	Kandosolic Redoxic Hydrosol. Hardsetting deep mottled yellow massive earths. Sandy loam or light sandy clay loam surface grading to light clay subsoil. Minor ferruginous gravel in subsoil. Imperfectly drained; high water table in wet-season.
Vegetation	Open Forest, minor Woodland; with large mixed species including <i>Eucalyptus tetrodonta</i> , <i>E. papuana</i> , <i>Erythrophleum chlorostachys</i> , <i>Eucalyptus polycarpa</i> , <i>E. miniata</i> , <i>Lophostemon lactifluus</i> ; dense shrub layer, including <i>Pandanus spirilus</i> , <i>Verticordia cunninghamii</i> ; medium to dense grasses including <i>Coelorachis rottboellioides</i> , <i>Sorghum plumosum</i> , <i>Chrysopogon latifolius</i> , <i>Heteropogon triticeus</i> , <i>Eriachne trisetata</i> .
Drainage	Slow, wet-season waterlogging, often Dry Season seepage.
Limitations	Soil drainage, site drainage, hardsetting surface, high seasonal water table.
Map Unit	Gentle lower slopes; gradient 0.5-1.5%; wet-season water table; hardsetting deep mottled yellow massive earths: Mixed species Open Forest, minor Woodland.



LEGEND

 Study	Land units	 Rises: 1c; 2b1; 2b2	 Alluvial Plains: 6b; 6c	 Marine: 9a; 9b; 9c
 Access Roads (separate NOI)	 Plains: 3a; 3b; 3c; 3d; 3e; 4c	 Swamps: 8b; 8c		



Dover Investments Pty Ltd
Bayview II - The Groves
Notice of Intent - Residential Development

Job Number | 43-22063
Revision | B
Date | 12 Sep 2013

Land Units

Figure 12

4.2.2 Vegetation and Flora

There are five vegetation communities present in/around the Bayview area (Figure 13), including:

- Low Closed Forest of mangrove spp.;
- Open Forest of Eucalyptus spp. over mixed grasses;
- Open Woodland of *Eucalyptus miniata* over *Sorghum* spp.;
- Woodland of *Eucalyptus miniata*, *Corymbia bleeseri* over *Sorghum* spp.; and
- Coastal monsoon vine-thicket.

The Project area is approximately 25 ha, comprising (Figure 13):

- Undeveloped lots and area already cleared (approximately 5 ha)
- Maximum extent proposed to be cleared of vegetation (including construction buffer zone) (approximately 20 ha)
- Water bodies to be reclaimed and developed (no clearing required) (approximately 1 ha)

The development area consists almost entirely of low closed forest of mangrove spp. (approximately 20 ha) with a small area (approximately 1 ha) of coastal monsoon vine-thicket within the site of O'Ferrals Rock. This steeply inclined rocky hill is clothed in a rich vine-thicket assemblage (Dames and Moore *et al.* 1991). The Monsoon vine thicket will not be cleared.

Regional impacts on vegetation and flora from the proposed clearing are likely to be minimal. None of the vegetation communities known from the proposed development area are listed or known to be threatened with extinction.

Cycads

There is one record of *Cycas armstrongii* within 1.5 km of the proposed development. This species is unlikely to be present in the development area since it occurs mainly in open grassy woodland on yellow and red earths (Liddle 2004).

Mangrove Communities

Intertidal areas within and surrounding the development area contain mangrove communities. The Sadgroves Creek area of mangroves contains less than 0.2% of Darwin's total mangrove area (Dames and Moore 1985).

Darwin Harbour contains one of the largest discreet blocks of mangrove forest in the Northern Territory. It is approximately 27,350 ha which constitutes 44% of the mangrove community in the bioregion and about 5% of the Northern Territory's entire mangrove area (INPEX 2011). These forests contain 36 species of mangrove and are recognised for their high diversity (Brocklehurst and Edmeades 1996).

Mangroves are an important ecological component of the marine and coastal environment. They are a food resource for a range of species and their root system acts as a breeding ground and nursery for crustacean, mollusc and fish species. Their extensive root system reduces water velocity and energy causing entrapment and deposition of suspended sediments, thereby providing stability and protection of coastlines. Mangroves form as a buffer zone attenuating wave energy and current flow, and reduce erosion and storm surge damage in coastal areas (Brocklehurst and Edmeades 1996).

Weeds

Much of the existing terrestrial flora in the Bayview area has been modified by human activity, particularly through clearing, construction dumping etc., and the number of introduced plant species reflects this disturbance.

Declared noxious weeds in the Northern Territory are plants proclaimed under the Weed Management Act 2001. The legislation requires that reasonable attempts be made to control or eradicate these species. Categories of noxious weeds include the following:

- Schedule Class A/C Weeds: These plants do not occur in the Northern Territory but pose a significant threat if they invade or if present, pose a serious threat. Reasonable effort must be made to eradicate these weeds.
- Schedule Class B/C Weeds: These weeds often occur widely in the Northern Territory. They are capable of spreading further and should be prevented from doing so. Continuing control measures are required to prevent their spread. Reasonable attempts must be made to contain the growth and prevent the movement of these plants.
- Schedule Class C Weeds: This category includes plants that pose an unacceptable risk of spreading in the Territory or to other parts of Australia if they were to be sold or traded in the NT and are a serious threat to another State or Territory of Australia. All schedule Class A and B weeds are considered to be Class C weeds.

Table 4-5 lists the declared weeds found during the 1991 Bayview Haven Canal Estate EIS vegetation and flora survey (Dames and Moore *et al.* 1991).

Table 4-5 Declared weeds recorded during 1991 EIS vegetation and flora survey

Scientific name	Common name	Class*
<i>Hyptis suaveolens</i>	Horehound	B/C
<i>Sida cordifolia</i>	Flannel weed	B/C
<i>Lantana camara</i>	Lantana	B/C
<i>Mimosa pudica</i>	Common sensitive plant	B/C
<i>Stachytarpheta sp.</i>	Snake weed	B/C

The following species were also recorded during the 1991 survey but are not declared weeds:








- golden shower tree (*Cassia fistula*);
- *Leucaena leucocephala*;
- date palm (*Phoenix dactylifera*);
- bush passion fruit (*Passiflora foetida*);
- cork passionflower (*Passiflora suberosa*);
- purple bush-bean (*Macroptilium atropurpureum*);
- snakevine (*Merremia dissecta*);
- hairy woodrose (*Merremia aegyptia*);
- *Aeschynomene sp.*;

- gambia pea (*Crotalaria goreensis*);
- cassava (*Manihot esculenta*);
- ivy-palm (*Schefflera actinophylla*); and
- fountain tree (*Spathodea campanulata*).

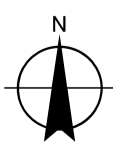
Some of these weed species are likely to be present in the proposed development area.



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 note: Vegetation communities area boundaries should be considered as indicative only at a scale of greater than 1:25000

LEGEND		Vegetation Communities	
 Study Area	 Coastal vine-thicket	 Open Forest of Eucalyptus spp. over mixed grasses; wet season watertable	 Woodland of E. miniata, C. bleeseri over Sorghum spp.
 Access Roads (separate NOI)	 Low Closed Forest of Mangrove spp.; intertidal inundation	 Open Woodland of E. miniata over Sorghum spp.	

1:5,000 (at A3)
 0 25 50 100 150 200
 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: Geocentric Datum of Australia (GDA)
 Grid: Map Grid of Australia 1994, Zone 52



Dover Investments Pty Ltd
 Bayview II - The Groves
 Notice of Intent - Residential Development

Job Number | 43-22063
 Revision | B
 Date | 12 Sep 2013

Vegetation Communities

Figure 13

4.2.3 Fauna

The Protected Matters Search Tool (PMST) identified 25 threatened species and 51 migratory species listed under the EPBC Act within a 1.5 km buffer of the site (DoE 2015). The search results can be found in Appendix A.

The PMST identified 25 listed threatened fauna species occurring within, or in the vicinity of, the proposed development (10 km buffer) (DoE 2015).

The distribution and habitat requirements for each of these threatened species were assessed against the extent and quality of vegetation types identified within the site, and existing records were reviewed in order to arrive at a likelihood of occurrence assessment based on desktop information only. Likelihood of occurrence is assessed in Table 1 below.

- Three species identified by the PMST are also included in the DLRM database; the Northern Quoll (*Dasyurus hallucatus*) (most recent record 1990), Black-footed Tree-rat (*Mesembriomys gouldii*) (most recent record 2008) and Gouldian Finch (*Erythrura gouldiae*) (most recent record 1948).
- Five species listed as threatened under TPWC Act (but not under EPBC Act) are included in DLRM database, including Black-footed Tree-rat (*Mesembriomys gouldii*), Floodplain Monitor (*Varanus panoptes*), Greater Sand Plover (*Charadrius leschenaultii*), Bar-tailed Godwit (*Limosa lapponica*) and Eastern Curlew (*Numenius madagascariensis*).
- Six of the listed threatened reptiles are marine turtles (which come on land to lay eggs) and are considered highly unlikely to occur in the mangroves within the Project area.
- The terrestrial vertebrate fauna survey undertaken as part of the 1991 Bayview Haven Canal Estate EIS identified two species in the field which have since been listed as threatened: the Northern Quoll (*Dasyurus hallucatus*) and Floodplain Monitor (*Varanus panoptes*).
- Six species of shark are identified in the PMST results, and one of these species is assessed as possible to occur in the adjacent waters of the Project area, Green Sawfish (*Pristis zijsron*). This species distribution includes Darwin Harbour however they have not been recorded in the near vicinity of the Project area (1.5 km) and the area is not a known breeding location for the species.

Of the vertebrate species identified by desktop review as possibly occurring in the Project area and/or listed as threatened under the EPBC Act and/or the TPWC Act, seven marine species may potentially occur within the Project area:

- Australian Snubfin Dolphin
- Indo-pacific Bottlenose Dolphin
- Indo-pacific Humpback Dolphin
- Green Turtle
- Beady Pipefish
- Dwarf Sawfish
- Green Sawfish

The Australian Snubfin Dolphin (*Orcaella heinsohni*) which is listed as data deficient, has been recorded from Sadgroves Creek during routine surveys of dolphins in Darwin Harbour (K. Metcalfe pers comm). Sadgroves Creek represents one of the many creek systems in Darwin Harbour which this species may visit intermittently while foraging.

The Green Turtle (*Chelonia mydas*) which is listed as vulnerable is a regular visitor to mangrove habitats within Darwin Harbour, where it feeds on juvenile leaves of the mangrove *Rhizophora stylosa* as well as algae which it gleans from the trunks and roots of mangrove trees (Metcalf 2007). Green turtles have been observed in cyclone damaged *Rhizophora* forests in the adjacent Charles Darwin National Park (K Metcalfe pers. comm.), and it is likely that they utilise similar habitat in the Bayview Project area.

The Beady Pipefish (*Hippichthys parvicarinatus*) which is listed as data deficient, is recorded as occurring in the seaward mangrove assemblage in nearby Charles Darwin National Park in 2001 (Metcalf 2007). There is a possibility that clearing within the Seaward mangroves will have an impact on the distribution or populations of this poorly known species; however a number of surveys of invertebrate fauna conducted in the Bayview area (Cardno and EcoScience 2012, 2013; Metcalfe 2007) have not recorded *Hippichthys parvicarinatus* from study sites in Sadgroves Creek.

A detailed assessment of the likelihood of occurrence in the Project area of species listed as threatened under the EPBC Act and/or TPWC Act is provided below.

Species listed as threatened under the EPBC Act and/or TPWC Act that were identified as likely to occur in the Project area include:

- Black-footed Tree-rat, *Mesembriomys gouldii*
- Floodplain Monitor, *Varanus panoptes*
- Greater Sand Plover, *Charadrius leschenaultii*
- Bar-tailed Godwit, *Limosa lapponica*
- Eastern Curlew, *Numenius madagascariensis*

These species tended to (a) use habitats that are not well represented or not represented at all in the Project area; or (b) use a range of habitats, and were not restricted to habitat types represented in the Project area. It was therefore deemed unnecessary to conduct field surveys targeting listed species.

Three of the terrestrial species identified in the desktop review as likely to occur in the Project area - the Greater Sand Plover, Bar-tailed Godwit and Eastern Curlew - are typically restricted to intertidal coastal habitats such as those that occur within the site. These species are recorded along most of the Northern Territory coastline and are unlikely to be measurably impacted by the Project.

An EPBC referral has been submitted to Department of the Environment for consideration.

Table 4-6 Summary of the threatened fauna species known or predicted to occur within the study area

Key to Table:

- EPBC Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
- TPWC *Territory Parks and Wildlife Conservation Act 2000*
- DLRM The Department of Land Resource Management (DLRM) fauna records (not predictions) database
- PMST Information sourced from the EPBC Protected Matters Search Tool
- CR Critically Endangered
- EN Endangered
- VU Vulnerable
- NT Near Threatened

Likelihood of occurrence of rare/threatened flora is assessed on a 4-tier scale:

Possible - suitable habitat occurs within the study area

Unlikely - suitable habitat unlikely to occur within the study area, or suitable habitat substantially modified, or suitable habitat present but species not recorded for over 50 years

Highly unlikely – no suitable habitat present within the study area and individuals not recorded within study area

Species	Source	Conservation Status		Likelihood of occurrence (in terrestrial habitats)
		TPWC	EPBC	
Mammals				
Northern Quoll (<i>Dasyurus hallucatus</i>)	PMST / DLRM	CR	EN	Highly unlikely – There are three records within 1.5 km of the study area from 1990 (DLRM 2013). Rocky habitats and open eucalypt forests are the preferred habitats although a wide range of habitats are used. There is little suitable habitat present within the proposed development area. In addition the Cane Toad has since become well established, occurring in most habitats within the development area. It is possible that the Northern Quoll previously occurred at Bayview and has experienced localised decline following the arrival of the Cane Toad.
Northern Brush-tailed Phascogale (<i>Phascogale pirata</i>)	PMST	EN	VU	Highly unlikely – This species is restricted to eucalypt forests in the top end of the Northern Territory (Woinarski et al. 2007). Suitable habitat is not present within the proposed development area.
Brush-tailed Rabbit-rat (<i>Conilurus penicillatus</i>)	PMST	EN	VU	Highly unlikely – There are no recent (post 1950) records from the Darwin area despite considerable survey effort (J.C.Z. Woinarski 2008, pers. comm., cited in TSSC 2008).

Species	Source	Conservation Status		Likelihood of occurrence (in terrestrial habitats)
		TPWC	EPBC	
Bare-rumped Sheath-tail Bat (<i>Saccolaimus saccolaimus nudicluniatus</i>)	PMST	NT	CR	Highly unlikely – There is insufficient recent data to reliably calculate current extent of occurrence or area of occupancy as there are only two records in the last two decades, both from north-eastern Queensland (Coles et al. 1999). There are no recent records from the Top End of the Northern Territory to even indicate whether the species still occurs in this region.
Water Mouse (<i>Xeromys myoides</i>)	PMST	DD	VU	Unlikely – This species has not been previously recorded in Darwin. Suitable habitat may exist in the proposed development area in the form of mangroves. The Water Mouse appears to utilise both intertidal and freshwater habitats. Most records have been from mangrove forests, saltmarsh, sedgeland, clay pans and freshwater melaleuca wetlands (Magnusson et al. 1976; Redhead and McKean 1975; Woinarski 2000). The biggest threat to this species is habitat removal (DERM 2009).
Black-footed Tree-rat (<i>Mesembriomys gouldii</i>)	DLRM	VU	-	Possible – This species has been recorded within 1.5 km of the proposed development area (DLRM 2013). Its habitat consists of tropical woodlands and open forests in coastal areas. The Black-footed Tree-rat is one of a suite of Top End mammals showing evidence of sharp decline within the past ten years (Woinarski et al. 2010).
Reptiles				
Floodplain Monitor (<i>Varanus panoptes</i>)	DLRM	VU	-	Possible – This species has been recorded within 1.5 km of the proposed development area (DLRM 2013). The Floodplain Monitor occupies a variety of habitats, including coastal beaches, floodplains, grasslands and woodlands. Suitable habitat exists within the proposed development area.
Plains Death Adder (<i>Acanthopis hawkei</i>)	PMST	VU	VU	Highly unlikely – The exact distribution of the species is unclear. Suitable habitat for the Plains Death Adder consists of flat, treeless, cracking-soil riverine floodplains (Cogger 2000) which are not present in the proposed development area.
Loggerhead Turtle (<i>Caretta caretta</i>)	PMST	VU	EN	Highly unlikely – This species is known to occur in Darwin Harbour, however there are no known breeding sites in the proposed development area and there is no sandy beach in the proposed development area for this species to nest.
Green Turtle (<i>Chelonia mydas</i>)	PMST	NT	VU	Highly unlikely – This species is known to occur in Darwin Harbour, however there are no known breeding sites in the proposed development area and there is no sandy beach in the proposed development area for this species to nest.
Leatherback Turtle (<i>Dermochelys coriacea</i>)	PMST	CR	EN	Highly unlikely – This species is known to occur in Darwin Harbour, however there are no known breeding sites in the proposed development area and there is no sandy beach in the proposed development area for this species to nest.

Species	Source	Conservation Status		Likelihood of occurrence (in terrestrial habitats)
		TPWC	EPBC	
Hawksbill Turtle (<i>Eretmochelys imbricata</i>)	PMST	VU	VU	Highly unlikely – This species is known to occur in Darwin Harbour, however there are no known breeding sites in the proposed development area and there is no sandy beach in the proposed development area for this species to nest.
Olive Ridley Turtle (<i>Lepidochelys olivacea</i>)	PMST	VU	EN	Highly unlikely – This species is known to occur in Darwin Harbour, however there are no known breeding sites in the proposed development area and there is no sandy beach in the proposed development area for this species to nest.
Flatback Turtle (<i>Natator depressus</i>)	PMST	DD	VU	Highly unlikely – This species is known to occur in Darwin Harbour, however there are no known breeding sites in the proposed development area and there is no sandy beach in the proposed development area for this species to nest. There are reports of this species feeding in the vicinity of the proposed development area.
Birds				
Red Goshawk (<i>Erythrotriorchis radiatus</i>)	PMST	VU	VU	Unlikely – This species inhabits coastal and subcoastal tall, open forests and woodlands, tropical savannas with tree-lined waterways and the edges of rainforests (Marchant and Higgins 1993). No suitable habitat exists within the proposed development area.
Greater Sand Plover (<i>Charadrius leschenaulti</i>)	DLRM	VU	-	Possible – This species has been recorded within 1.5 km of the proposed development area (DLRM 2013). In the Northern Territory, the Greater Sand Plover has been recorded from most of the coastline.
Gouldian Finch (<i>Erythrura gouldiae</i>)	PMST / DLRM	VU	EN	Highly unlikely – Suitable habitat in the form of open woodlands that are dominated by Eucalyptus trees and ground cover of Sorghum and other grasses (Tidemann et al. 1992) is not present within the site. The most recent record in the near vicinity of the study area was in 1948.
Partridge Pigeon (<i>Geophaps smithii smithii</i>)	PMST	VU	VU	Highly unlikely – Suitable habitat in the form of open forest and woodland dominated by Darwin Stringybark Eucalyptus tetradonta and Darwin Woollybutt E. miniata that has a structurally diverse understorey (Higgins and Davies 1996) is not present within the site.
Masked Owl (Northern) (<i>Tyto novaehollandiae kimberli</i>)	PMST	VU	VU	Highly unlikely – Suitable habitat is not present in the proposed development area. The Masked Owl (Northern) usually nests in tree hollows, within patches of closed forest (Garnett and Crowley 2000).
Bar-tailed Godwit (<i>Limosa lapponica</i>)	DLRM	VU	-	Possible – This species has been recorded within 1.5 km of the proposed development area (DLRM 2013). This species have been reported all along the Northern Territory coastline.

Species	Source	Conservation Status		Likelihood of occurrence (in terrestrial habitats)
		TPWC	EPBC	
Australian Painted Snipe (<i>Rostratula australis</i>)	PMST	VU	EN	Highly unlikely - The Australian Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. It is not common in the Northern Territory.
Eastern Curlew (<i>Numenius madagascariensis</i>)	DLRM	VU	-	Possible – This species is most common in mangrove areas in the NT. They are often solitary or in small flocks, rarely far from the coast.
Sharks and Whales				
Northern River Shark (<i>Glyphis garricki</i>)	PMST	EN	EN	Highly unlikely – This species is so far known to only occur in the Adelaide and Alligator River systems in the Northern Territory of Australia (Whitty et al. 2008).
Dwarf Sawfish (<i>Pristis clavata</i>)	PMST	VU	VU	Possible - This species may be present in Sadgroves Creek. Its distribution includes Darwin Harbour. This species will not inhabit the terrestrial areas of the proposed development.
Freshwater Sawfish (<i>Pristis pristis</i>)	PMST	VU	VU	Highly unlikely – In northern Australia, this species appears to be confined to freshwater drainages and the upper reaches of estuaries, occasionally being found as far as 400 km from the sea (Thornburn et al. 2003; Whitty et al. 2008).
Green Sawfish (<i>Pristis zijsron</i>)	PMST	VU	VU	Possible – This species may be present in Sadgroves Creek. Its distribution includes Darwin Harbour. This species will not inhabit the terrestrial areas of the proposed development.
Whale Shark (<i>Rhincodon typus</i>)	PMST	DD	VU	Highly unlikely – This species may occasionally be present near Darwin Harbour but is highly unlikely to enter Sadgroves Creek.
Great White Shark (<i>Carcharodon carcharias</i>)	PMST	LC	VU	Highly unlikely – This species has never been sighted in coastal areas of the Northern Territory.
Humpback Whale (<i>Megaptera novaeangliae</i>)	PMST	LC	VU	Highly unlikely – This species may occasionally be present near Darwin Harbour but is highly unlikely to enter Sadgroves Creek.
Blue Whale (<i>Balaenoptera musculus</i>)	PMST	DD	EN	Highly unlikely – This species may occasionally be present near Darwin Harbour but is highly unlikely to enter Sadgroves Creek.

4.2.1 Biting Insects

Intertidal mangrove communities in the area provide ideal breeding sites for biting midges. The proposed development area is subject to high numbers of biting midges, particularly during the late Dry Season.

Mosquitoes have also been recorded in the Bayview area, although do not cause as much of a nuisance as the biting midges (Logan *et al.* 1991).

The Medical Entomology Branch of the Department of Health and Community Services undertook a biting insect study of the Sadgroves Creek Basin in 1993 (Whelan and Hayes 1993). The study found the following:

- there are major potential pest problems for the biting midge *Culicoides ornatus*;
- Bayview Haven has ten times the number of biting midges as Stuart Park;
- *C. ornatus* breeding sites are in the neap tide zone of the mangroves;
- midges can disperse in high numbers up to 1.5 km from the mangroves and are often found in the highest numbers up to 1 km from the mangrove margins at the top of escarpments;
- control of the midges would require the elimination of the neap tide zone in the mangroves by filling or permanent flooding;
- temporary insecticide control measures are not likely to result in an appreciable reduction in pest problems;
- some form of buffer with wind zones, vegetation clearing, semi-rural development or diversionary light and animals may reduce pest problems; and
- *Aedes vigilax* (the salt marsh mosquito) and *Culex annulirostris* (the common banded mosquito) will be the major mosquito pest species, and together with *Anopheles farauti* (the malaria mosquito) pose the greatest potential public health problems.

Dover will mitigate the impact of biting insects during construction through various measures including the design of surface and subsurface drainage to minimise water ponding and biting insect breeding (Section 5).

4.3 Cultural Environment

4.3.1 Archaeology

An archaeological survey of the proposed site was not undertaken prior to submission of this NOI.

A search of the Northern Territory Heritage Site Register has shown that no Heritage Places have been listed within the proposed development area.

O'Ferrals Rock was nominated to be listed as a Declared Heritage Place on the Northern Territory Heritage Register, however the Northern Territory Heritage Council resolved not to proceed to a listing status because the site is now located in a Conservation Zone under the Northern Territory Planning Scheme.

The Rock is a natural landmark that rises to 16 m in Sadgroves Creek estuary, and was originally a rocky island. It is highly valued by the local residents. O'Ferrals Rock contains an Anadara midden which holds the potential to yield new information to contribute to our understanding of past environmental change and of an Aboriginal hunter-gatherer way of life prior to European settlement.

O'Ferrals Rock was named after Corporal Denis John O'Ferral, one of the Darwin Mobile Force soldiers in World War II. He supported the surveyors that had provided the first detailed maps of Darwin since Stokes and Goyder. Along with Australian Army installations, the Rock is labelled as a significant landscape feature in early 1940s maps of the Darwin defence area; and is included in detailed plans of the Frances Bay Explosives Complex area compiled by the United States Navy (Northern Territory Heritage Branch 2013).

The proposed development will protect the cultural and heritage values of the site by including O'Ferrals Rock as a cultural and heritage park. This park will also provide a link to the open space corridor bordering the development.

4.3.2 Sacred Sites

The AAPA manages a register of sacred sites in the Northern Territory. All sacred sites (even if not registered) are protected under the Act, and it is an offence to enter or carry out work on a sacred site without permission or a certificate issued by the AAPA.

An AAPA Authority Certificate (C2013/229) was issued to Dover in December 2013. It covers all works associated with the extension of the existing Bayview residential development, and is valid provided works commence within 24 months of the issue of the certificate (i.e. December 2015) Dover will comply with the conditions set by AAPA. European Heritage

Sites relating to European cultural significance were located as part of the EIS for the Bayview Haven Canal Estate (Dames and Moore *et al.* 1991). These relate to the Frances Bay Explosives Complex located along the western boundary of the Bayview Haven Canal Estate.

According to the Northern Territory Heritage Register, no European cultural sites have been recorded within the proposed development site.

4.3.3 Native Title

The Register of Native Title Claims, Register of Indigenous Land Use agreements, the Native Title Register and unregistered applications indicates that the proposed site was assessed under native title tribunal number DCD2006/001 Larrakia (Part A – consolidated proceeding). It was determined that 'native title does not exist'. The Federal Court determination was made on 17 May 2006. Records show the claim because a ruling was made.

4.3.4 Community Consultation

Dover is conscious of the importance of undertaking community consultation and implementing an effective strategy to ensure the community is informed and understands the scope of the project. This will also ensure that community views and opinions are captured, acknowledged and considered in the development process.

A number of mechanisms and activities are being developed and implemented as part of the strategy to enable the capture and documentation of community and stakeholder issues, opinions and feedback at each stage of the project.

A key element will be ensuring that at the end of the consultation and design process, those members of the community that participated in the consultation process are aware of the outcomes and understand how their inputs have influenced the decision making process.

Consultation activities for the project (recently commenced) include:

- Door knocking - introduction and discussion of the development concept with a select group of Bayview residents nearest to the proposed development;

- broader community information and feedback sessions as well as mail and email dissemination; and
- there are opportunities for the community to provide input and opinions through a project website (www.theboulevarde.com), and other communication pathways to be undertaken throughout the project.

4.4 Estate Management

The final management responsibility for various parts of the development is proposed as described in Table 4-7 below.

Table 4-7 Long-term management responsibility

Aspect	Responsible Party
Provision of services	PWC
Maintenance of roads	Department of Infrastructure
Maintenance of public roads	Department of Transport for the Tiger Brennan Drive road reserve including the permanent access road. Darwin City Council where public roads are internal to the estate. Body Corporate* where road is on Body Corporate Land.
Maintenance of sea wall and pathway perimeter	Each individual Body Corporate (within their designated perimeter).
Maintenance of Public Open Space and Conservation Reserve (O'Ferrals Rock)	Darwin City Council
Maintenance of stormwater drainage system	Each individual Body Corporate (within their designated perimeter). Darwin City Council where under Public Roads.
Waste management	Darwin City Council

*There will be individual Body Corporates for the individual medium and high density lots.

4.5 Economics

The development of the Project offers the following potential benefits to the broader Darwin community:

- employment during construction of development;
- residential land close to the city;
- waterfront land; and
- satisfaction of demand for particular types of real estate. .

5. Potential Impacts and Mitigation Measures

This section describes the potential impacts to the physical and cultural environment from activities associated with construction and operation of the proposed development, and the steps that will be taken to mitigate these impacts. The mitigation measures below provide a broad approach to impact management (Table 5-1).

Table 5-1 Environmental aspects / activity – potential impacts and mitigation measures

Environmental Aspect / Activity	Impact Description	Mitigation Measures
Soil		
Soil (Pollution) Storage and use of machinery that contains hazardous materials such as petrol, oils and lubricants during construction.	Localised impact to soil and potential localised impact to surface water and / or groundwater as a result of runoff / leaching of contaminated soils from the development area.	An existing laydown area will be used and Temporary fencing will be used to secure an area for the storage of fuels, materials and machinery in accordance with Australian Standards. All spills (any uncontrolled release of hydrocarbon, chemicals, liquid waste or other hazardous substance) will be reported and cleaned up immediately. Spill-response materials and equipment (including personal protective equipment and Material Safety Data Sheets (MSDS) will be made available at all times and will be appropriate to the substances being stored on site. Contaminated soils will be contained and placed in red contamination bins with covers that will be provided onsite. These will be moved offsite and disposed of appropriately.
Soil and Water (Pollution) Ground disturbance, vegetation clearing and construction earthworks.	In the event that ASS is disturbed, potential impacts include: <ul style="list-style-type: none"> • oxidation of ASS leading to generation of sulfuric acid; • acidification and heavy metal contamination of surrounding soil, surface water and groundwater; and • impact on growth and health of flora and fauna. 	An Acid Sulfate Soil Management Plan (ASSMP) will be submitted to and approved by the consent authority on the advice of a suitably qualified professional. The ASSMP will include details of management, neutralisation, validation and disposal options for acid sulphate soils.

Environmental Aspect / Activity	Impact Description	Mitigation Measures
<p>Soil (Instability) Application of engineering fill over mangrove mud</p>	<p>Fill could create acidic and saline conditions and possible settlement problems. Engineering and environmental impacts inside and outside of proposed development footprint.</p>	<p>Sea wall and development will generally be limited to areas where the mud depth does not exceed 3-4 m.</p> <p>Mud will be covered with depth of 3 m of engineering fill to prevent swelling and to reduce potential for acid generation.</p> <p>Geotechnical testing will be carried out on bund wall alignment to determine mud depths and compressibility and long-term settlement predictions prior to construction commencing.</p> <p>Geotextile fabric will be placed over unconsolidated mangrove muds prior to construction of bund, sea wall and high density residential blocks.</p>
<p>Soil (Erosion and Sedimentation) Dust and soils disturbance and relocation due to movement of vehicles and machinery on and off the site.</p> <p>Application of water for dust suppression activities and use of water for construction and wash down / clean-up activities on site.</p> <p>Construction earthworks and ground disturbance.</p>	<p>Short-term decrease in water quality, which may or may not be localised, as a result of discharge of (potentially contaminated) sediment or soil into waterways and loss of top soil / subsoil exposure on site.</p>	<p>An Erosion and Sediment Control Plan (ESCP) will be developed by suitably qualified professional and implemented for the site construction and operation.</p> <p>Earthworks construction will be carried out in the Dry Season.</p> <p>Each stage will be separately bunded to prevent soil loss.</p> <p>During the initial bund wall construction the outer portion of the embankment will contain more rock in order to prevent erosion by tidal movements, waves and storm surges. This will minimise the turbidity of tidal waters in the mangroves outside the bund wall during the construction phase.</p> <p>During the construction phase silt fences and other sediment control devices will be constructed around disturbed areas in anticipation of the Wet Season and during the Dry Season when water spraying will be used for dust suppression.</p> <p>Long-term sediment control will be formalised before the lots are developed and landscaped.</p>
<p>Surface Water and Groundwater</p>		
<p>Water (Pollution) Storage and / or use of machinery and equipment that contains hazardous materials such as fuel, oils and lubricants during construction.</p>	<p>Reduction in water quality in Sadgroves Creek and Frances Bay as a result of leaks and spills contaminating surface water runoff.</p>	<p>All spills (any uncontrolled release of hydrocarbon, chemicals, liquid waste or other hazardous substance) will be reported and cleaned up in a timely manner.</p> <p>Spill-response materials and equipment (including personal protective equipment and MSDS) will be made available at all times and will be appropriate to the substances being stored on site.</p>

Environmental Aspect / Activity	Impact Description	Mitigation Measures
<p>Water (Pollution) Sediment and pollution runoff from stormwater drains and built environment.</p>	<p>Increase sedimentation in Sadgroves Creek and Frances Bay.</p> <p>Increase household pollutants such as detergents and petrol and oils.</p> <p>Discharge of potentially contaminated stormwater into Sadgroves Creek and subsequently into Darwin Harbour.</p>	<p>All clearing, excavation and earthworks will be scheduled during the Dry Season.</p> <p>During construction, run-on water will be directed away from the development site via drainage systems.</p> <p>During construction, runoff water will be directed to on-site holding bunds, the silt will be collected and decanted water will be released to Sadgroves Creek on high falling tides.</p> <p>Mitigation measures will be outlined in a Construction Environmental Management Plan (CEMP).</p> <p>During the construction phase, silt fences and other sediment control devices will be constructed around disturbed areas in anticipation of the Wet Season and during the Dry Season when water spraying will be used for dust suppression.</p> <p>Once construction is completed there will be few bare areas of land likely to contribute sediment to the runoff.</p> <p>A stormwater management system is proposed that will include silt traps and oil interceptors.</p> <p>A concrete formed drain currently existing along the northern perimeter of the Bayview Haven Canal Estate will be continued east around the perimeter of the proposed development and discharge into Sadgroves Creek sub branch at the north-eastern corner of the site. The form of the drain extension is yet to be resolved.</p> <p>There are currently two existing stormwater drains entering the site from the Bayview Haven Canal Estate. These will be connected with the new underground drainage system and discharged to Sadgroves Creek.</p> <p>All road drainage within the proposed development will be directed to a number of suitably, tidally flushed locations along the perimeter of the development adjacent to Sadgroves Creek. These outfalls will have flood gates to prevent reverse flows during extreme sea level events such as cyclones.</p>

Environmental Aspect / Activity	Impact Description	Mitigation Measures
Flora and Fauna		
<p>Air (Noise and Vibration)</p> <p>Use of heavy machinery and equipment during construction e.g. earthmovers, trucks, compactors, etc.</p>	<p>Short-term and localised disturbance to fauna in adjacent bushland.</p> <p>Short-term and localised nuisance, disturbance.</p>	<p>Construction activities will be managed consistent with:</p> <ul style="list-style-type: none"> AS 2436:2010, Guide to noise and vibration control on construction, maintenance and demolition sites; and Noise guidelines for development sites in the Northern Territory (NT EPA 2013). <p>Noise level assessments will be undertaken for all plant without a noise rating or if complaints about noise are received.</p> <p>Vibration from machinery is to be kept to an acceptable level, with change of compaction machinery if required.</p> <p>Vibration monitoring is recommended where fauna may be adversely affected by predicted vibration levels in accordance with AS 2436:2010.</p> <p>There is the potential for unexpected delays in the construction schedule to be addressed via extended work hours. As a consequence of works occurring outside of "standard" hours, the contractor requires that mitigation measures consistent with the noise guidelines for development sites in the Northern Territory (NT EPA 2013) be implemented on the site.</p>
<p>Air (Dust)</p> <p>Movement of an increased number of heavy vehicles on site and on unformed roads during construction.</p> <p>Deliveries to and from site, and storage on site, of excavated material, fill, sand, soil and gravel.</p>	<p>Short-term and localised loss of air quality.</p>	<p>Use of water to reduce dust emission, when and where necessary during the Dry Season and when prevailing winds are likely to direct dust towards neighbouring residences.</p> <p>Dust-suppression techniques to protect vegetation, worker health and amenities will be implemented and may include spraying surfaces with water trucks, irrigation or stabilisation of cleared areas.</p> <p>During construction, the periodic application of water will be used for dust suppression on dirt tracks.</p>
<p>Biodiversity (Weeds)</p> <p>Spread of weeds / weed seed onto and off site through movement of machinery; and delivery / removal of materials.</p>	<p>Introduction of new weed species to the area and / or localised spread of existing weed populations to new locations.</p>	<p>The CEMP will outline weed mitigation measures including the inspection and cleaning of machinery and vehicles prior to entering the site.</p> <p>Infestations of declared weeds will be controlled on site and along the access roads in order to avoid contamination to vehicles and machinery during roadwork and grading activities.</p> <p>Imported materials, equipment and supplies will be certified weed free.</p>

Environmental Aspect / Activity	Impact Description	Mitigation Measures
<p>Biodiversity (Fauna) Vegetation clearing. Use of heavy machinery and equipment during construction e.g. earthmovers and trucks etc.</p>	<p>Fragmentation and loss of natural habitat across the breadth of the proposed subdivision.</p> <p>Direct injury / mortality of animals as a result of clearing and habitat destruction.</p> <p>Disturbance and or decline of native fauna.</p> <p>Non-compliance with threatened species legislation (Commonwealth and / or Northern Territory) or migratory species agreements.</p>	<p>Retention of a buffer zone between the proposed development and Tiger Brennan Drive.</p> <p>Site clearance will be confined to minimum requirements.</p> <p>Targeted survey to detect presence / absence of threatened species and habitat assessment could be undertaken.</p>
<p>Biodiversity (Flora) Vegetation clearing Use of heavy machinery and equipment during construction e.g. earthmovers and trucks etc.</p>	<p>Localised disturbance and / or damage to native vegetation in surrounding environment.</p> <p>Disturbance of habitat areas and / or individual plants/animals during infrastructure development activities.</p>	<p>Finalisation of the site boundary along Sadgroves Creek to minimise the zone of mangroves affected by the development.</p> <p>Areas of vegetation to be removed will be marked to avoid clearing unintended areas.</p> <p>GPS equipment uploaded with the approved clearing boundary will be used to verify areas to be cleared.</p> <p>Large-scale vegetation clearing and earthworks will be planned to be undertaken in Dry Season conditions where practicable. If further clearing is required during the Wet Season, it will be undertaken in accordance with the mitigation measures outlined within the ESCP.</p> <p>The retention of native trees will be encouraged where appropriate. This will have a positive effect on the development by preserving native flora and habitat, and providing the development with vegetation and visual amenity.</p>
<p>Cultural Heritage</p>		
<p>Heritage (Sacred Sites) Excavation, ground disturbance and other construction activities including simple access.</p>	<p>Exposure of, or damage to Aboriginal or cultural heritage artefacts such as sacred rocks, middens, skeletal remains etc.</p>	<p>An AAPA Certificate (C2013/229) has been issued for the subject land . All conditions will be complied with.</p>

Environmental Aspect / Activity	Impact Description	Mitigation Measures
<p>Heritage (Archaeology) Excavation, ground disturbance and other construction activities including simple access.</p>	<p>Damage or disturbance to O'Ferrals Rock.</p>	<p>O'Ferrals Rock will not be cleared for the development. The area will be clearly marked to prevent it from being disturbed during construction.</p> <p>In the event that artefacts are encountered during excavation or clearing, all works will cease in that area and the relevant authorities will be notified. No work will be carried out until approval to continue is granted from the relevant authority.</p> <p>Works will be undertaken following consultation with Larrakia Traditional Owners.</p>
<p>Heritage (European) Excavation, ground disturbance and other construction activities including simple access.</p>	<p>Exposure of or damage to European heritage artefacts such as World War II artefacts.</p>	<p>In the event that an archaeological item is located during excavation or clearing, all works will cease in that area and the relevant authorities will be notified. No work will be carried out until approval to continue is granted from the relevant authority.</p>
<p>Community</p>		
<p>Access (Security) Excavation and construction activities, stockpiles and stock storage on site, access roads and general site housekeeping.</p>	<p>Risk of unlawful access to construction sites which may result in safety risks to intruders and damage to site equipment.</p>	<p>Temporary fencing will be used to secure an area for the storage of fuels, materials and machinery in accordance with Australian Standards.</p> <p>Fencing is proposed for the boundary between the construction area and the existing Bayview Haven Canal Estate where existing private property is currently unfenced.</p> <p>Security lighting may be used for machinery and site offices.</p>
<p>Traffic (Management) Increased traffic from construction and operation.</p>	<p>Potential for increased traffic, creating safety risks.</p>	<p>A Traffic Management Plan will be developed to manage potential traffic impacts during construction.</p> <p>A Traffic Impact Assessment will be conducted.</p> <p>Traffic flow will be encouraged from the inclusion of:</p> <ul style="list-style-type: none"> • a new main intersection at the estate entrance; • two proposed minor roads linking the existing Bayview Haven Canal Estate providing access to Benison Road for entry and egress; and • two roundabouts including a turning circle in the south of the boulevard. <p>The completed development will have internal linkages and two external access points allowing ease of traffic movements.</p> <p>The development Master Plan includes allowances for footpaths and bike paths. This will allow safe pedestrian access and the opportunity for</p>

Environmental Aspect / Activity	Impact Description	Mitigation Measures
<p>Community (Biting Insects) Accumulation of water in open containers around site, and in machinery capable of holding water, particularly in the Wet Season. Water ponding in surcharged areas, blocked culverts, drainage lines, and upstream of erosion prevention structures, particularly following heavy rains.</p>	<p>Localised breeding sites created for mosquitoes and other biting insects that may carry disease.</p>	<p>residents to interact with the neighbourhood.</p> <p>Equipment and materials will be stored so as to minimise localised breeding sites, e.g. open containers, storage of machinery that may carry water in the Wet Season.</p> <p>During construction, ground levels will be engineered to minimise ponding.</p> <p>Personal protective equipment including insect repellent, long trousers and shirts will be worn by construction personnel.</p> <p>Surface and subsurface drainage designed to minimise water ponding and mosquito breeding.</p> <p>Areas of the development within 1.5 km of potentially significant <i>C. ornatus</i> breeding sites will have a notification in titles stating there will be seasonal biting midge pest problems.</p>
<p>Community (Consultation) Aesthetics of development. Vegetation clearing, and associated noise, dust, traffic impacts associated with additional development. Inadequate estate management</p>	<p>Current Bayview and Woolner residents' views of Sadgroves Creek and Charles Darwin National Park impacted by new development.</p> <p>Aesthetics from Sadgroves Creek and Charles Darwin National Park looking toward Bayview.</p> <p>Noise impacts from Tiger Brennan Drive on residents of the estate.</p> <p>Noise and vibration on current Bayview residents during construction.</p> <p>Inadequate estate management will result in adverse environmental and social impacts.</p>	<p>A public consultation strategy will be implemented as discussed in Section 4.3.4. This will include the presentation of design photo montages from various viewpoints to illustrate potential visual impacts.</p> <p>Dover will inform the community of proposed activities and potential interruptions to service supply and provide a contact for comments and complaints.</p> <p>Working hours, noise and vibration, air quality, and pollution control will be managed as part of a project specific CEMP. Construction activities will be managed as above and consistent with:</p> <ul style="list-style-type: none"> AS 2436:2010, Guide to noise and vibration control on construction, maintenance and demolition sites; and Noise guidelines for development sites in the Northern Territory (NT EPA 2013). <p>A 25 m landscaped buffer strip containing an extension of the stormwater easement north of the Bayview Haven Canal Estate will exist between the development and Tiger Brennan Drive.</p> <p>Clear lines of responsibility for the maintenance and operation of the estate once established.</p>
<p>Waste, Climate Change and Greenhouse Gas</p>		
<p>Waste (Management) Increased waste from construction</p>	<p>Construction waste will be generated through clearing of vegetation (with</p>	<p>There are opportunities to minimise waste by implementing waste management principles including:</p>

Environmental Aspect / Activity	Impact Description	Mitigation Measures
and operation.	possible displacement by wind) and use of construction materials. The construction workforce will generate putrescible waste, litter, and waste oil. General waste and recyclables will be generated by the future households of Bayview - The Boulevarde	<ul style="list-style-type: none"> • Avoidance: The generation of waste will be limited to the construction footprint. • Reuse: Topsoil and soil will be reused in rehabilitation, landscaping, and as fill where possible. • Recycling: During operation recycling services will be provided by Darwin City Council and their contractors. • Disposal: During the construction of individual dwellings, the development / land owner is responsible for the generation and disposal of all waste materials. During operation waste services will be managed by Darwin City Council and their contractors.
<p>Climate Change (Storm Surge)</p> <p>Storm surge during severe weather event.</p>	Site being flooded by storm surge. Development experiencing substantial damage.	<p>The minimum level around the perimeter of the development is 6.5 m AHD (the sea wall) to allow for potential impacts of climate change. This gives reasonable freeboard to current predictions of 1000 year cyclonic surge levels.</p> <p>As the sea wall will shelter the development, it is possible to adopt lower landfill levels than 6.5 m AHD. A minimum ground level for building sites of 5.5 m AHD has been adopted, which, at 1.3 m above current Highest Astronomical Tide (HAT) level, still allows for an abnormally high tide that may eventuate from a storm surge.</p> <p>Outer sea wall will have a toe protection apron and the face will consist of large rocks designed to resist maximum waves predicted for life of the structure.</p> <p>Filter layers of intermediate sized rock and geotextile fabric.</p>
<p>Air (Greenhouse Gases)</p> <p>Clearing of vegetation and use of machinery and vehicles on site during construction.</p>	Output of carbon dioxide from construction activities contributes to climate change.	<p>It is estimated that approximately 13.8 ha of vegetation will be cleared during construction.</p> <p>This is a relatively small figure and would generate a low carbon dioxide output that would have a negligible impact on climate change or the Northern Territory's contribution to climate change.</p> <p>It is proposed that 32.5 ha of mangrove spp. be conserved through the back zoning of Future Development zoning to Conservation zoning.</p> <p>Machinery and vehicles powered by diesel and petrol will be used onsite. The number and frequency of vehicles that will be used is yet to be determined. It is anticipated that carbon dioxide emissions from the required plant would have a negligible impact on climate change.</p>

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Appendices

Appendix A – EPBC Protected Matters Search Tool Results



EPBC Act Protected Matters Report

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 is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 25/03/15 13:15:35

[Summary](#)

[Details](#)

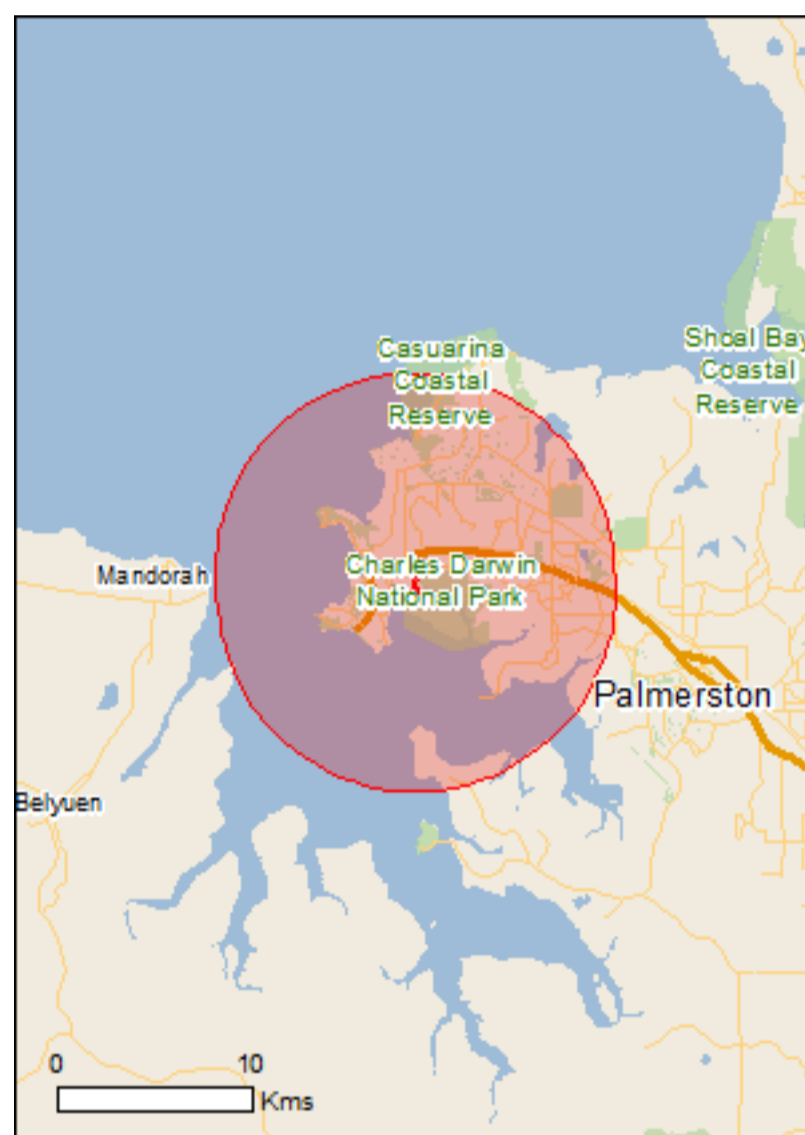
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

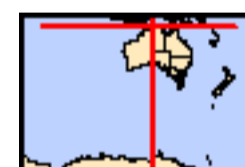
[Acknowledgements](#)



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

[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](#).

World Heritage Properties:	None
National Heritage Places:	3
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	25
Listed Migratory Species:	51

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.

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.

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.

Commonwealth Land:	25
Commonwealth Heritage Places:	10
Listed Marine Species:	101
Whales and Other Cetaceans:	12
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine	None

Extra Information

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

Place on the RNE:	92
State and Territory Reserves:	6
Regional Forest Agreements:	None
Invasive Species:	31
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

National Heritage Properties		[Resource Information]
Name	State	Status
Historic		
Catalina 4	NT	Nominated place
Catalina 5	NT	Nominated place
Catalina 6	NT	Nominated place

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat known to occur within area
Geophaps smithii smithii Partridge Pigeon (eastern) [64441]	Vulnerable	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Conilurus penicillatus Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma [132]	Vulnerable	Species or species habitat may occur within area
Dasyurus hallucatus Northern Quoll [331]	Endangered	Species or species habitat known to occur

Name	Status	Type of Presence within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat likely to occur within area
Phascogale pirata Northern Brush-tailed Phascogale [82954]	Vulnerable	Species or species habitat likely to occur within area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheathtail Bat [66889]	Critically Endangered	Species or species habitat known to occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Acanthophis hawkei Plains Death Adder [83821]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Sharks		
Carcharodon carcharias Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat likely to occur within area
Pristis pristis Largetooth Sawfish, Freshwater Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		

Name	Threatened	Type of Presence
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Species or species habitat may occur within area
Migratory Marine Species		
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
Carcharodon carcharias Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat 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
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area

Name	Threatened	Type of Presence
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Roosting known to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to 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
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Glareola maldivarum Oriental Pratincole [840]		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

Name	Threatened	Type of Presence
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]		Roosting known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land

[\[Resource Information \]](#)

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.

Name

Commonwealth Land -
Commonwealth Land - Australian Customs Service
Commonwealth Land - Australian Government Solicitor
Commonwealth Land - Department of Administrative Services
Commonwealth Land - Department of Community Services & Health
Commonwealth Land - Department of Immigration Local Government & Ethnic Affairs
Commonwealth Land - Department of Transport & Regional Development
Commonwealth Land - Deputy Crown Solicitor
Commonwealth Land - Director of Property Services Defence Estate
Defence - AUSTRALIAN ARMY BAND - DARWIN
Defence - BERRIMAH ONE
Defence - DARWIN - AP10 RADAR SITE - LEE POINT
Defence - DARWIN - TRANSMITTING STATION '11 MILE'
Defence - DARWIN RELOCATIONS CENTRE
Defence - DEFENCE FORCE CAREERS REFERENCE CENTRE
Defence - Esanda Building
Defence - HMAS COONAWARRA (Berrimah)
Defence - LARRAKEYAH BARRACKS
Defence - LEANYER BOMBING RANGE
Defence - Patrol Boat Base (DARWIN NAVAL BASE)
Defence - RAAF BASE DARWIN
Defence - SHOAL BAY RECEIVING STATION
Defence - STOKES HILL OIL FUEL INSTALLATION
Defence - WINNELLIE ONE
Defence - WINNELLIE TWO

Commonwealth Heritage Places		[Resource Information]
Name	State	Status
Historic		
Burnett House	NT	Listed place
Larrakeyah Barracks Headquarters Building	NT	Listed place
Larrakeyah Barracks Precinct	NT	Listed place
Larrakeyah Barracks Sergeants Mess	NT	Listed place
Mines House	NT	Listed place
RAAF Base Commanding Officers Residence	NT	Listed place
RAAF Base Precinct	NT	Listed place
RAAF Base Tropical Housing Type 2	NT	Listed place
RAAF Base Tropical Housing Type 3	NT	Listed place
Water Tower 129	NT	Listed place

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Roosting known to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to 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 Long-toed Stint [861]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]		Roosting known to occur within area
Charadrius dubius Little Ringed Plover [896]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]		Roosting known to occur within area

Name	Threatened	Type of Presence
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]		Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting known to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Heteroscelus incanus Wandering Tattler [59547]		Roosting known to occur within area
Himantopus himantopus Black-winged Stilt [870]		Roosting known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		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
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew [847]		Roosting known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur

Name	Threatened	Type of Presence within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Sterna albifrons Little Tern [813]		Species or species habitat may occur within area
Stiltia isabella Australian Pratincole [818]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Fish		
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys haematopterus Reef-top Pipefish [66201]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus spirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribbioned Pipehorse, Ribbioned Seadragon [66226]		Species or species habitat may occur within area

Name	Threatened	Type of Presence area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys parvicarinatus Short-keel Pipefish, Short-keeled Pipefish [66230]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Solenostomus paegnius Rough-snout Ghost Pipefish [68425]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species

Name	Threatened	Type of Presence
Aipysurus eydouxii Spine-tailed Seasnake [1117]		habitat may occur within area Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnston's River Crocodile [1773]		Species or species habitat may occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Enhydrina schistosa Beaked Seasnake [1126]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis atriceps Black-headed Seasnake [1101]		Species or species habitat may occur within area
Hydrophis coggeri Slender-necked Seasnake [25925]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis inornatus Plain Seasnake [1107]		Species or species habitat may occur within area
Hydrophis mcdowelli null [25926]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Hydrophis pacificus Large-headed Seasnake, Pacific Seasnake [1112]		Species or species habitat may occur within area
Lapemis hardwickii Spine-bellied Seasnake [1113]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Parahydrophis mertoni Northern Mangrove Seasnake [1090]		Species or species habitat may occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [[Resource Information](#)]

Name	Status	Type of Presence
Mammals		
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
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat likely to occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to 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 aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
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	State	Status
Natural		
Casuarina Beach, Lee Point, Buffalo Creek Area	NT	Indicative Place
Darwin Harbour Wetlands	NT	Indicative Place
Leanyer Swamp	NT	Indicative Place
Darwin Foreshores	NT	Registered
Holmes Jungle & Swamp & Micket Creek Complex	NT	Registered
Indigenous		
Minjamarmarr	NT	Registered
Stone Fish Trap	NT	Registered
Historic		
Bradley Residence	NT	Indicative Place
Brazier Residence	NT	Indicative Place
Casuarina Home Improvements Roof Structure	NT	Indicative Place
Coleman Residence	NT	Indicative Place
Command Blockhouse	NT	Indicative Place
Commercial Bank of Aust (former)	NT	Indicative Place
Credit Union House	NT	Indicative Place
Darwin Hospital (former)	NT	Indicative Place
Darwin Mobile Force Precinct	NT	Indicative Place
Dermoudy Residence	NT	Indicative Place
Draper House	NT	Indicative Place
Dripstone Strong Points	NT	Indicative Place
Emery Point Lighthouse	NT	Indicative Place
Emery Point Precinct	NT	Indicative Place
Flint Residence	NT	Indicative Place
Gardens Cemetery	NT	Indicative Place
Green Can House	NT	Indicative Place
HMAS Coonawarra House Type F1	NT	Indicative Place
Holy Spirit Primary School House	NT	Indicative Place
House Type G	NT	Indicative Place
Kaiplinger Residence	NT	Indicative Place
Lawler Residence	NT	Indicative Place
Melocco House	NT	Indicative Place
No 1 Water Tower	NT	Indicative Place
No 2 Water Tower	NT	Indicative Place
No 3 Water Tower	NT	Indicative Place
No 9 Water Tower	NT	Indicative Place
North Australia Railway Darwin to Pine Creek	NT	Indicative Place
Northern Territory Museum of Arts and Sciences	NT	Indicative Place
Pise House	NT	Indicative Place
Safety House	NT	Indicative Place
TEM House	NT	Indicative Place
Territory Insurance Office	NT	Indicative Place
Tropical House	NT	Indicative Place
Troppos House	NT	Indicative Place

Name	State	Status
Winnellie Water Tower	NT	Indicative Place
Admiralty House	NT	Registered
Bagot Beach Strong Point	NT	Registered
Bagot Community Medical Centre	NT	Registered
Bank of New South Wales (former)	NT	Registered
Barr Residence	NT	Registered
British Australian Telegraph Company Residence	NT	Registered
Browns Mart	NT	Registered
Burnett House	NT	Registered
Casurina Beach Strong Points	NT	Registered
Christ Church Portico	NT	Registered
Chung Wah Temple	NT	Registered
Commonwealth Bank	NT	Registered
Darwin Chinese Cemetery	NT	Registered
Darwin Police Station and Courthouse (former)	NT	Registered
East Point Fortifications	NT	Registered
Fannie Bay Gaol (former)	NT	Registered
Frances Bay Explosives Complex	NT	Registered
Giese Residence	NT	Registered
Government House, Flagpole and Cannon	NT	Registered
HMAS Coonawarra House Type E1 (now Chapel) House	NT	Registered
House Type A1	NT	Registered
Incinerator (former)	NT	Registered
Larrakeyah Barracks Headquarters Building	NT	Registered
Larrakeyah Barracks Precinct	NT	Registered
Larrakeyah Barracks Sergeants Mess	NT	Registered
Mines House	NT	Registered
Navy Tunnels	NT	Registered
Navy Victualling Sheds (former)	NT	Registered
Nightcliff Cliffs World War 2 Dump	NT	Registered
Palmerston Cemetery	NT	Registered
Parap Hangar	NT	Registered
RAAF Base Commanding Officers Residence	NT	Registered
RAAF Base Precinct	NT	Registered
RAAF Base Tropical Housing Type 2	NT	Registered
RAAF Base Tropical Housing Type 3	NT	Registered
RAAF Operations Room (ruins)	NT	Registered
Railway House	NT	Registered
Sidney Williams Hut	NT	Registered
Steam Pump House	NT	Registered
Stone Footpath Kerbing	NT	Registered
Stone Footpath Kerbing	NT	Registered
Sue Wah Chin Building	NT	Registered
Town Hall Ruins	NT	Registered
Tropical Executive Housing Precinct	NT	Registered
Vesteys Water Tank (former)	NT	Registered
Victoria Hotel (in part)	NT	Registered
Water Tower 129	NT	Registered

State and Territory Reserves [\[Resource Information \]](#)

Name	State
Buffalo Creek Management Area	NT
Casuarina	NT
Charles Darwin	NT
George Brown Darwin	NT
Holmes Jungle	NT
Knuckey Lagoons	NT

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
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Bubalus bubalis Water Buffalo, Swamp Buffalo [1]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Plants		
Andropogon gayanus Gamba Grass [66895]		Species or species habitat likely to occur within area
Annona glabra Pond Apple, Pond-apple Tree, Alligator Apple, Bullock's Heart, Cherimoya, Monkey Apple, Bobwood, Corkwood [6311]		Species or species habitat may occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Hymenachne amplexicaulis Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		Species or species habitat likely to occur within area
Jatropha gossypifolia Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to 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 likely to occur within area
Mimosa pigra Mimosa, Giant Mimosa, Giant Sensitive Plant, Thorny Sensitive Plant, Black Mimosa, Catclaw Mimosa, Bashful Plant [11223]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Pennisetum polystachyon Mission Grass, Perennial Mission Grass, Missiongrass, Feathery Pennisetum, Feather Pennisetum, Thin Napier Grass, West Indian Pennisetum, Blue Buffel Grass [21194]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
Lepidodactylus lugubris Mourning Gecko [1712]		Species or species habitat likely to occur within area
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat likely to occur within area
Nationally Important Wetlands		[Resource Information]
Name		State
Port Darwin		NT

Coordinates

-12.432855 130.860392,-12.433506 130.860436,-12.433351 130.862005,-12.434597 130.862683,-12.435425 130.862027,-12.437261 130.862469,-12.438303 130.862032,-12.442288 130.863322,-12.443026 130.863327,-12.443104 130.862515,-12.443203 130.862428,-12.443248 130.862309,-12.443219 130.862173,-12.443143 130.862092,-12.443182 130.861689,-12.443429 130.861635,-12.4434 130.8615,-12.443809 130.86141,12.443014 130.860995,12.441655 130.860499,12.440982 130.860621,12.440881 130.861003,12.440813 130.861111,12.439497 130.860584,12.438607 130.860284,12.439475 130.86019,12.439313 130.860303,12.439204 130.860369,12.439481 130.85997,12.438817 130.860067,12.438594 130.860197,12.43879 130.860126,12.438262 130.860163,12.436599 130.860893,12.436378 130.860569,12.43621 130.860639,12.436341 130.860963,12.436007 130.861103,12.435734 130.860427,-12.435757 130.860351,-12.434177 130.859782,-12.43306 130.859664,-12.432855 130.860392

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 the distribution of birds listed under the EPBC Act 1999. Maps mapped locations of World Heritage and Ramsar Sites, National Estuarine and Wetlands of Importance, Commonwealth and State Terrestrial Reserves, Threatened Migratory 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.

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](#)
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- [-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](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- 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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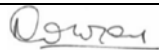
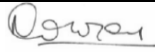


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