MHY HANDBURY JOINT VENTURE PTY LTD

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FLORA AND FAUNA ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PLAN FOR TORQUAY SANDS RESIDENTIAL LAKES AND GOLF COURSE DEVELOPMENT, TORQUAY

Ecology Australia

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FOR: ROBERT LUXMOORE SPECIALISED PROJECT AND MANAGEMENT SERVICES

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Coverplate. **The proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course development land viewed from the dunes south of The Esplanade. Moonah – Coast Wirilda Shrubland, saltmarsh, the former tip site and exotic pasture are visible.**

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Set 2 of 3

TABLE OF CONTENTS

TABLES

MAPS

FIGURES

PLATES

APPENDICES

1.0 SUMMARY

The investigation of the proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course Development, Torquay, Victoria, and surrounding areas, in December 1999 to March 2000, aimed to:

- Identify the existing conditions in the study area and on surrounding lands likely to be affected by the development with regards to the flora and fauna; and
- Develop an Environmental Management Plan (EMP) to address the issues arising from the development as required under the Surf Coast Planning Scheme Amendment R60.

The flora and fauna study and EMP address the development land and the saltmarsh to the east, the Moonah – Coast Wirilda Shrubland on the southern border of the site, and issues associated with the adjoining Torquay Public Reserve.

Flora

- A total of 202 plant species were recorded in the study area; 95 (47%) of these are indigenous and 107 (53%) are naturalised exotic species. Some introduced plant species are serious environmental weeds requiring control.
- Four vegetation communities with 11 sub-communities were identified:
    - 1.0 Dune Complex (embracing three sub-communities, most significantly the Moonah – Coast Wirilda Shrubland);
    - 2.0 Saltmarsh Complex (embracing seven sub-communities);
    - 3.0 Freshwater Herbfield (of farm dams); and
    - 4.0 Exotic Vegetation (pasture and former tip site).
- The vegetation communities and sub-communities range in conservation significance from Local to State or National; the Saltmarsh Complex and Dune Complex are of State to National Significance.

Fauna

- A total of six faunal habitat categories were identified in and adjacent to the study area:
    - Dune Complex;
    - Saltmarsh;
    - Moonah – Coast Wirilda Shrubland;
    - Pasture/Open Grassland;
    - Retarding Basin and Farm Dams (constructed wetlands); and
    - Beach/Shoreline.

Generally, the fauna habitat in the study area is of poor quality, with limited areas of remnant vegetation that are substantially degraded. Edge effects from the former tip site, pest animals (rabbits, foxes), weed invasions and human impacts have contributed to diminished habitat quality.

- A total of 25 mammal species were previously recorded from the greater study area (19 native and 6 introduced). The Smoky Mouse (Nationally significant) (yet to be confirmed), Little Forest Bat (Regionally significant), Swamp Wallaby, Bush Rat, Common Ringtail Possum and Short-beaked Echidna (all Locally significant) were the only native mammals recorded from the study area. The Smoky Mouse and Little Forest Bat were new mammal records for the area.
- The Nationally significant Smoky Mouse was detected from hair-tube sampling in the Dune Complex. It is possible that a previously unknown population of Smoky Mouse has been discovered outside the species' known distribution. Further sampling is required to confirm the species' presence and status in this area.
- A total of 168 bird species have been previously recorded from the greater study area (160 native and eight introduced). Fifty-six (56) bird species were observed during field surveys including two of State significance (Pacific Gull and Pied Cormorant). Eleven of the 56 species observed were additional to those listed by the Atlas of Victorian Wildlife, DNRE.
- The saltmarsh adjacent to the study area is (Nationally significant) Orange-bellied Parrot habitat. Careful management to ameliorate potential impacts from the development is vital to protect the saltmarsh habitat. Other significant species that utilise the saltmarsh and adjoining coastal habitat which may be indirectly impacted by the development include the Pacific Gull, Hooded Plover, Pied Cormorant, Crested Tern, Eastern Curlew, Royal Spoonbill, Great Egret and Southern Giant Petrel.
- Eight species of reptile and five species of frog (one Nationally significant: the Growling Grass Frog) have been recorded from the larger study area. Three reptile species and one frog species were observed in the study area. It is possible that the Nationally significant Swamp Skink may occur in the saltmarsh (adjacent to the study area).

Management Issues

A wide range of environmental and flora and fauna management issues have been identified and are dealt with in an Environmental Management Plan (EMP); they include:

Golden Beach (Torquay Sands) Residential Lakes and Golf Course Development

- Buffer zones, particularly abutting the Saltmarsh Complex to the east;
- Hydrological and water quality issues related to runoff;
- Turf management relating to potential for eutrophication and pollution;
- User-related impacts, such as access by people to adjacent areas;
- Management of domestic animals;
- Horticulture and amenity plantings within the development area, and revegetation adjacent to the Saltmarsh and Dune Complex;
- Retention of remnant indigenous vegetation and fauna habitat wherever possible within the development area; and
- Weed and feral animal management.

Saltmarsh Complex (to be managed by Trustees, and covenanted under a Trust for Nature agreement)

- Reinstating the former saltmarsh hydrological regime (tidal flooding) by removing the barrier, formed by the culvert on Mullet Creek, which prevents tidal penetration of the saltmarsh;
- Enhancing the quality and condition of the Saltmarsh Complex through revegetation monitoring and other management actions;
- Minimising disturbance to the saltmarsh. This includes reducing impacts from humans and domestic pets, and disturbance from the development area;
- Ensuring protection of Orange-bellied Parrot habitat;
- Increased public access to the area; and
- Weed and feral animal management.

Moonah – Coast Wirilda Shrubland (Conservation Zones to be managed by Surf Coast Shire)

- Enhancing indigenous vegetation and fauna habitat through revegetation and weed and rabbit control;
- Minimising disturbance to native vegetation and fauna;
- Managing access-related impacts on vegetation and fauna habitat; and
- Encouraging community involvement in the maintenance of the Conservation Zones.

Confirming presence of the (Nationally significant) Smoky Mouse in the Dune Complex to the south of The Esplanade.

- Create an exclusion zone in the Dune Complex pending trapping surveys.
- Conduct a trapping survey of Dune Complex habitat and supplementary surveys in the Moonah – Coast Wirilda Shrubland targeted for the Smoky Mouse.
- Depending on trapping survey results, develop a Smoky Mouse Management Plan as a supplement to this EMP.

A number of recommendations are made in relation to achieving the Environmental Management Plan objectives.

2.0 INTRODUCTION

Graeme Bentley Landscape Architects Pty Ltd, on behalf of MHY Handbury Joint Venture, commissioned Ecology Australia Pty Ltd to undertake an investigation of the flora and fauna of the proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course Development to the east of Torquay. The proposed development, embracing a golf course and residential area, will cover approximately 124 ha of land immediately west of a large expanse of saltmarsh (Map 1). Though mostly farmland, historically devoted to grazing and cropping, the site carries some remnant indigenous vegetation (coastal shrubland and grassland) on old dunes and it adjoins the large, substantially intact saltmarsh which is known to have high biological (flora and fauna) significance. To the south is a large dune system and beach managed by Torquay Public Reserves.

MHY Handbury Joint Venture as the owner of the saltmarsh land has transferred the saltmarsh to Trustees (representing the Council, the owner and the Trust for Nature) to preserve and maintain the saltmarsh and associated wetlands consistent with their conservation significance. The Surf Coast Shire, under a 173 Planning Agreement, requires the protection of biological values of the saltmarsh as well as some of the remnant indigenous shrubland on the site. Some of the remnant shrubland will be incorporated into Council reserves or Public Open Space (Conservation Zones) to protect flora and fauna values and will be managed by Surf Coast Shire.

The Shire has indicated that approvals for the golf course and residential development are contingent on MHY Handbury Joint Venture preparing an Environmental Management Plan (EMP) which addresses issues related to the protection and management of these natural resources on and adjacent to the subject land. Acceptance of this EMP by Council and other interested parties is required before development approvals are given.

Ecology Australia conducted a study of the site to document flora and fauna on and adjacent to the proposed development land - in the latter case, land which may receive impacts from the adjoining golf course and residential development. The brief for this study is outlined below.

Issues to be addressed in the Environmental Management Plan

Broadly, the issues to be addressed in the EMP were as follows:

1. Documentation of flora and fauna values as requisite background to the EMP;
2. Maintenance and enhancement of flora or indigenous vegetation values, notably the saltmarsh vegetation and Moonah stands;
3. Horticultural applications of indigenous flora;
4. Maintenance and/or enhancement of specific fauna habitat values or attributes and/or resident populations of significant species including:
    - Appropriate buffer types and widths to minimise disturbance to fauna,
    - Feasibility of measures to minimise potential impacts of household pets in residential areas, and
    - Provision of habitat enhancement measures, for example, revegetation and constructed wetlands as fauna habitats.
5. Weed management, including obligations under the *Catchment and Land Protection Act 1994* and realistic measures to enhance habitat values;

6. Hydrological issues as they relate to maintenance of existing values, especially of the saltmarsh, and maximising habitat and landscape values of constructed wetlands;
7. Reuse water quality and its potential impacts;
8. Turf management, especially the potential for nutrient enrichment and pollution (nutrients, herbicides and pesticides);
9. Mosquitoes – design and wetland management guidelines to minimise mosquito problems;
10. Soil erosion management as it relates to protection of environmental values;
11. Management of user-related impacts (i.e. people);
12. Pest animal management (notably rabbits); and
13. Monitoring requirements to satisfy environmental management objectives, for example, types, intensity and frequency of monitoring.

We present the results of the flora and fauna investigations and the Environmental Management Plan in this report.

3.0 STUDY AREA

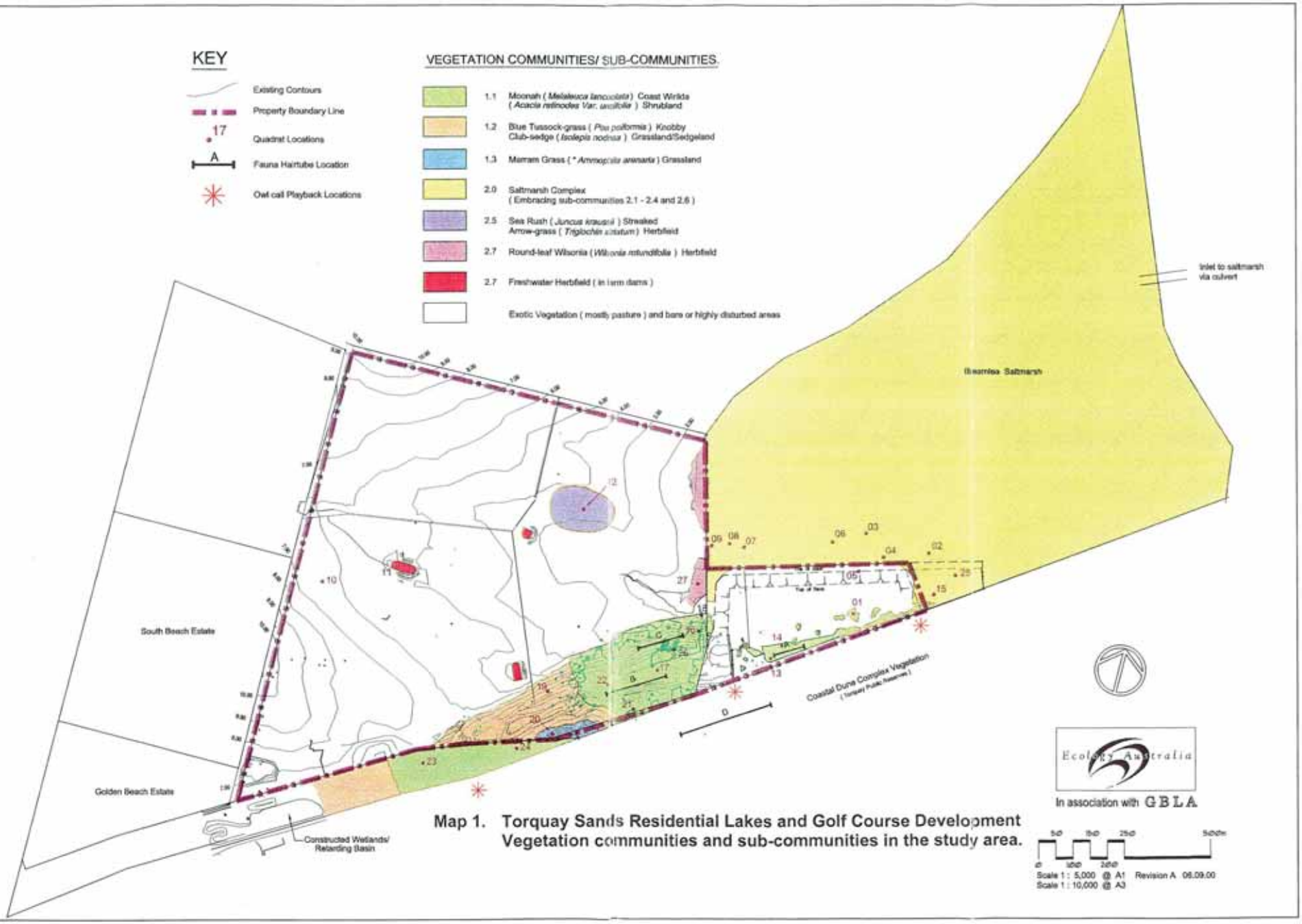
The proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course Development is located to the immediate east of Torquay, between Breamlea and Barwon Heads on the western Victorian coast (Map 1). The 124 ha site is within the Surf Coast Shire and is located east of Horseshoe Bend Road, Torquay.

The study area is part of the Otway Plain Natural Region (Conn 1993), characterised by low relief and Tertiary and Quaternary sediments as well as volcanic geology. The climate is temperate with warm, dry summers and cool, wet winters. Average daily maximum and minimum temperatures are 19.6° C and 9.4° C respectively, and the average annual rainfall is 551.8 mm with the annual mean number of rain days being 151 (Bureau of Meteorology 2000, Geelong Weather Station records).

The geomorphology of the study area has been described in detail by Pedler (1999) and Marshall et al. (1999). The site is located on Quaternary aged beach and dune sand with estuarine silt and clay to the south and sandy clay and clayey sands (deposited after Newer Volcanic basalt flows) to the north (Pedler 1999). Clay-rich swamp deposits are the main sediment type of the study area (Marshall et al. 1999). The coast to the south of the study area consists of surf beaches backed by high Holocene dunes (Bird 1998). The dunes are underlain by Pleistocene calarenite rock and form a continuous dune system west from Point Impossible (Bird 1998). Coverplate and Plates 1 – 18 illustrate features of the study area.

Most of the study area is cleared agricultural land with a long history of grazing by sheep and cattle. The western boundary is an interface between cleared paddocks and neighbouring residential developments. A former rubbish tip is located on the east of the site (Map 1). The largest remaining areas of natural habitat include the adjoining saltmarsh and Thompson Creek to the east, and scattered remnants of Moonah – Coast Wirilda Shrubland and coastal scrub. The topography of the study area is generally flat (e.g. saltmarsh and floodplain) to gently undulating (coastal scrub). The coastal Dune Complex to the south of the study area is managed by Torquay Public Reserves and it dominates otherwise understated topographic features.

A retarding basin exists in the south-west corner of the site (Map 1). This was constructed by the Surf Coast Shire Council to detain storm water and runoff from adjoining residential development.



Map 1. Torquay Sands Residential Lakes and Golf Course Development Vegetation communities and sub-communities in the study area.

4.0 METHODS

4.1 Flora

4.1.1 Sources of Data

Most of the data used in this report was generated during the present study. A search of the Flora Information System (FIS) maintained by the Department of Natural Resources and Environment (DNRE) was undertaken and data from one quadrat was found in the vicinity of the study area, in saltmarsh to the east, close to the estuary of Thompson Creek. This was from a survey for Orange-bellied Parrot habitat undertaken by Ecology Australia (McMahon et al. 1994) and it is incorporated in the plant species list given for the site (Appendix 1). Notes on the vegetation of the site have been made in several reports: Trengove (1998, 1999), Marshall et al. (1999), Ralston (1996) and Sinclair Knight Merz (1994). Plant species noted in these reports and not observed during this study are also included in the species list (Appendix 1). The report on the proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course site by Walters (1999) does not address flora issues.

4.1.2 Field-work

Botanical field surveys were carried out over three days: 15, 19 and 21 February 2000. Vegetation was sampled from circular quadrats of 30 m diameter (equivalent to approximately 700 m^2) located to cover the observed range of floristic and structural variation present in the vegetation. Locations of the 27 quadrat sites are shown on Map 1. In each quadrat, all vascular plant species were recorded and assigned a visually-assessed cover/abundance value from the modified Braun-Blanquet scale (Gullan 1978):

- \+ cover <5%, few individuals
- 1 cover <5%, any number of individuals
- 2 cover 5-20%, any number of individuals
- 3 cover 20-50%, any number of individuals
- 4 cover 50-75%, any number of individuals
- 5 cover 75-100%, any number of individuals.

Notes were made on the vegetation structure and other features in the vicinity of each quadrat pertaining to ecological interpretation (e.g. height of vegetation, soil type, slope, aspect, grazing and weed invasions). Quadrat data are given in Appendix 2, while species frequency data for quadrats are given in Appendix 3.

Indigenous and exotic vascular plant species seen outside quadrats were recorded; these, along with the previous quadrat found in the FIS search, and information from other reports were compiled with the quadrat data to produce a comprehensive floristic inventory (Appendix 1). Photographs were taken at various sites in the study area (Coverplate, Plates 1 to 18).

4.1.3 Data storage and analysis

The quadrat data have been stored permanently on the computer system at Ecology Australia Pty Ltd, and will be lodged with the Flora Information System, DNRE, Arthur Rylah Institute for Environmental Research, Heidelberg.

Analysis of the data was in the form of a computer-based numerical classification procedure, coupled with hand-sorting, to determine and characterise the floristic vegetation communities present, as outlined by Gullan et al. (1981). This produced a two-way table classification of the vegetation which arranges quadrats according to floristic similarity, as well as arranging plant groups commonly found in association.

The table contains all species that occurred in at least 35% of quadrats occurring in that community or sub-community. The two-way table (Table 4) is set out as follows:

- The vertically aligned numbers across the top represent quadrat sites (E04727 – E04753), each vertical column of figures represents a list of species found at one site, and each horizontal row of figures represents all sites at which a given species was recorded.
- If a species occurred in less than 35% of quadrats but its occurrence was ecologically significant, it was also included in the table.

An asterisk (*) denotes an exotic species.

Vegetation terminology

The terminology used for the vegetation classification follows Gullan et al. (1981) viz:

Community: A collection of one or more quadrats with floristic and environmental affinities. The communities may represent highly discrete vegetation types with sharp boundaries, or more-or-less arbitrary divisions drawn for convenience along a floristic continuum to delimit vegetation.

Sub-community: A vegetation unit comprised of an association of plants which share similar environmental requirements, e.g. aspect, moisture availability and soil type. A number of quadrats may be grouped together to characterise a particular sub-community.

Character species: A species that occurs frequently and consistently in the quadrats of a community/sub-community. It is often a useful indicator species of that community - alone or when considered with a suite of other character species.

Associated species: Any species which occurs in the community or sub-community.

4.1.4 Vegetation Mapping

Mapping of the vegetation (Map 1) was carried out utilising the analysis of vegetation data (Section 5.1.2), ground-truthing and interpretation of a 1993 colour air photo (at the scale of 1:2500). This has been coupled with interpretation of the 1:25 000 topographic map and an additional more recent smaller scale (1:10 000) colour aerial photograph.

4.1.5 Vegetation Quality

The quality of vegetation of the site was assessed using the procedure developed by Ecology Australia (Carr et al. 1997) which rates vegetation on a five-point scale according to several major criteria: historic and recent disturbance, structural and floristic intactness, and weed invasions (Appendix 4).

4.1.6 Plant Names

Taxonomy (plant names) follows Ross (2000) with a few informal names used by Ecology Australia. An asterisk (*) denotes exotic species.

4.1.7 Limitations

The timing of sampling in late summer means that some indigenous and exotic species, such as annuals or summer-dormant perennials may have been overlooked. This does not adversely affect the conclusions drawn or management issues noted. The entire saltmarsh was not sampled or traversed but this does not affect the assessment of significance or determination of management issues.

4.2 Fauna

4.2.1 Field surveys

Field surveys were conducted on 8 December 1999, 11 February and 16-18 February 2000. Surveys were conducted in accordance with conditions of the *Wildlife Act 1975* and the DNRE Research Permit number 10000840.

Hair-tube sampling

Generally the quality of fauna habitat was considered too low (refer to Section 5.2.1) to warrant Elliott trapping for small mammals. Hair-tube sampling was employed as an alternative method to detect native mammal fauna. This method of sampling is considered safer than Elliott traps (the mammal is not caught overnight and there is less risk of exposure to damp, cold or other stresses), it employs less effort (hair-tubes are set once and not checked until they are closed) and it is more efficient (a greater sampling time is possible as they can be left out indefinitely).

The hair-tubes were of the design now manufactured by Faunatech Pty Ltd. Each hair-tube was baited with a mixture of rolled oats, peanut butter and honey and a sheet laced with glue was placed in the roof. Mammals attracted to the scent of the bait enter the hair-tube and hairs that brush against the glue are deposited. Mammal species have a unique hair structure and most hair samples are identified to species. Four lines were laid (Table 1, Map 1) on 16 February and collected on March 1, 2000.

Table 1. Location and number of hair-tubes in the four lines laid at the proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course, Torquay, February 2000.

LINE	NO. OF HAIR–TUBES	HABITAT
A	10	Moonah - Coast Wirilda Shrubland (east)
B	7	Coastal
C	8	Moonah - Coast Wirilda Shrubland (west)
D	25	Dune Complex vegetation

Active searching

Searching was conducted throughout the day to locate birds, reptiles and frogs. Searching was timed to coincide with foraging periods of birds and reptiles. Searching was conducted in all habitat categories and involved inspection of surface rocks, remnant indigenous vegetation and bird-watching.

General observations

All incidental observations of fauna were recorded (tracks, scats, nests, diggings) and identified to species where possible. An inspection of the ocean beach at Point Impossible, the mouth of Thompson Creek and further upstream, at the Breamlea saltmarsh, was undertaken, to search for coastal birds (particularly threatened species, e.g. Hooded Plover, Great Egret, Little Tern).

Predator scat analysis

Analysis of predator (Fox, Cat and Dog) scats is a useful means of detecting rare species (especially trap-shy and cryptic small mammals) otherwise difficult to detect by conventional techniques, such as hair tubing or Elliott trapping. Hair samples (and bone fragments) of mammals can be teased from scats and identified to species level via the unique hair structure. Predator scats (i.e. those containing hair and/or bone fragments) were collected during the site inspection from the Dune Complex and Moonah - Coast Wirilda Shrubland and forwarded to Hans Brunner for identification of mammal species. The main limitation with the technique is that predatory carnivores have large home ranges. Subsequently, caution must be exercised when assessing the prey species distribution in an area from such records, as species appearing in predator scats may not necessarily occur where predators deposit scats.

Spotlighting

Spotlighting was employed to detect small ground-dwelling and arboreal mammals (e.g. Common Ringtail Possum, Common Brushtail Possum). Spotlighting can also be used to detect nocturnal birds, including owls. Spotlighting was conducted from 2230 – 0100 and 2100 - 0000 hours on 16 and 17 February respectively. A 12 V spotlight (10 cm sealed-beam) and a 12 V *Yuasa* rechargeable battery (*model NP7-12*) were used. The Moonah - Coast Wirilda Shrubland, and Dune Complex were spotlighted simultaneously by two observers. The Retarding Basin was also visited on both nights to spotlight and listen for frogs.

Bat sonar call recording

Whilst undertaking spotlighting surveys, sonar calls of active insectivorous bats were recorded using an ANABAT sonar call detector. The procedure involved walking (whilst spotlighting) with the detector and recording a call once a bat call activated a response from the detector. Recorded calls were forwarded to Dr Greg Richards (Greg Richards and Associates, NSW) for analysis and species identification.

Tape playback of bird vocalisations

One record of the Masked Owl (State significant and Endangered in Victoria, DNRE 1999) exists from the study area (Atlas of Victorian Wildlife, DNRE). Five minutes of tape playback (using a Sony Walkman and a Toa ER77 megaphone) of vocalisations of a Masked Owl were undertaken at the former tip entrance, the eastern boundary of the study area and on the edge of coastal scrub east of the Retarding Basin at *c.* 0030 and 2330 h on 16 and 17 February respectively (Map 1). This was followed by 5 minutes of listening for a response. This procedure aims to elicit territorial or alarm calls of this species.

4.2.2 Specialist consultation, literature and database searches

Local and/or unpublished information on the fauna of Torquay, the status of various species (particularly threatened species) and other fauna issues in the study area was obtained from consultation with representatives from Birds Australia, DNRE (Geelong Office), Surf Coast Shire Council, Torquay Public Reserve Management Committee Inc., Geelong Field Naturalists Club and local residents.

A literature review was conducted to identify relevant biological and conservation issues within the study area.

A list of all species recorded in the area bounded by 37°14'N, 38°23'S, 145°16'W and 144°30'E was obtained from the Atlas of Victorian Wildlife, DNRE on 8 December 1999. These grid cells include the study area plus a broader area of surrounding land: Barwon Heads to the east, Torquay to the west and Lake Connewarre to the north.

Thus, the Atlas of Victorian Wildlife list is likely to include some records of species which are found rarely, if at all, in or near the subject land; these species are annotated accordingly in Appendix 5. This information enabled the field investigation to be carefully targeted.

4.2.3 Habitat assessment

Habitat assessment

The study area was inspected on foot, and assessed for potential value as vertebrate fauna habitat. Attention focussed on the following major determinants of fauna habitat quality:

- floristic composition and structure of vegetation;
- edge effects and level of disturbance to indigenous vegetation;
- prevalence of dead standing trees and tree hollows;
- presence of microhabitats (e.g. surface rocks, leaf litter, grass tussocks and fallen timber);
- signs of introduced predators; and
- connectivity to other native vegetation remnants.

The representation of favoured habitat attributes for significant species (e.g. Orange-bellied Parrot) was also assessed.

Aerial photographs (1: 2500) were examined to assess the extent of each habitat and to ensure that the major vegetation communities were visited. The photographs were also used to identify the distribution of vegetation communities in the area, and to evaluate the study area in a broader landscape context.

4.2.4 *Pest animal assessment*

The site was inspected on 21 February 2000 to ascertain current and potential pest animal management problems. The inspection took place under overcast conditions and in the early morning – a time when one would expect to see a high proportion of rabbits above ground. Transects were walked throughout the site (including saltmarsh, Dune Complex, coastal scrub and Moonah – Coast Wirilda Shrubland) and observations of rabbit density were made, based on the Gibb Activity Index (Coman 1992). The Gibb Scale is a general and qualitative estimate of rabbit density based on observations of dung present on the ground and the number of dunghills (Table 2).

Table 2. The Gibb Activity Index (1-10) for estimating rabbit densities.

SCALE	DESCRIPTION OF DUNG DENSITIES
1	Very few droppings, sometimes grouped, overlooked.
2	Very infrequent heaps; little if any scatter.
3	Infrequent heaps; very light and patchy scatter.
4	Frequent heaps; light and patchy scatter.
5	Heaps occasionally within five paces of each other; moderate scatter almost over whole area.
6	Heaps often within five paces of each other; moderate scatter over whole area.
7	Usually two or three heaps within five paces of each other; dense scatter.
8	Usually three or more heaps within five paces of each other; dense scatter over whole area.
9	Some heaps almost merging; scatter very dense.
10	Some heaps merging; very dense scatter overall.

General observations were made on rabbit activity, including the number of opportunistic sightings. Active warren openings were counted, as this provides useful indices of rabbit densities (Williams et al. 1995). Warren counts also contribute information useful to establish the amount of effort required for warren ripping.

Observations of fox tracks, scats and other signs (e.g. dens) during the walked transects contributed to a qualitative estimate of fox abundance at the site.

The report deals only with rabbits and foxes. While some pest bird species and other mammal species, such as feral cats may be present, we believe that they are of relatively minor management significance.

4.2.5 *Nomenclature*

Scientific nomenclature and taxonomy follows Christidis and Boles (1994) (birds), Cogger (1996) (reptiles and amphibians) and Strahan (1995) (mammals).

4.2.6 *Limitations*

The limitations of this study relating to sampling of fauna and to issues required to be covered in the EMP, are as follows:

Field-work for fauna was carried out during summer and the salt-pans in the saltmarsh were dry at the time of survey. It is possible that wader and other bird species were under-sampled. Similarly, the status of certain winter migrant species (e.g. Double-banded Plover) in the study area remains unknown because the survey took place in summer.

The Orange-bellied Parrot is known to visit mainland foraging and roosting habitats between March and September. The timing of the field survey was too early to detect the potential presence of the Orange-bellied Parrot in the saltmarsh or coastal Dune Complex.

5.0 FLORA AND FAUNA RESULTS

5.1 Flora

5.1.1 Plant Species

The statistics for the vascular flora recorded in the study area are given in Table 3. A higher number of exotic taxa were recorded than indigenous, reflecting the degraded nature of the vegetation of much of the site.

Table 3. Vascular flora statistics for the proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course, Torquay, February 2000.

	Indigenous taxa	Exotic taxa	Total taxa
Monocotyledons	39	43	82
Dicotyledons	56	64	120
Totals	95	107	202
	(47%)	(53%)	

5.1.2 Vegetation Communities

Four vegetation communities with 10 sub-communities are recognised for the study area (Map 1). The communities and sub-communities are as follows:

1.1 Dune Complex

1.2 Moonah (*Melaleuca lanceolata*) - Coast Wirilda (*Acacia retinodes* var. *uncifolia*) Shrubland
1.3 Blue Tussock-grass (*Poa poiformis*) – Knobby Club-sedge (*Isolepis nodosa*) Grassland/Sedgeland
1.4 Marram Grass (**Ammophila arenaria*) Grassland

2.1 Saltmarsh Complex

2.2 Shrubby Glasswort (*Sclerostegia arbuscula*) Shrubland
2.3 Blackseed Glasswort (*Halosarcia pergranulata*) Shrubland
2.4 Beaded Glasswort (*Sarcocornia quinqueflora* ssp. *quinqueflora*) Herbfield
2.5 Blue Tussock-grass (*Poa poiformis*) – Sea Rush (*Juncus kraussii*) Grassland/Sedgeland
2.6 Sea Rush (*Juncus kraussii*) – Streaked Arrow-grass (*Triglochin striatum*) Herbfield
2.7 Long-fruit Water-mat (*Lepilaena cylindrocarpa*) Submerged Herbfield
2.8 Round-leaf Wilsonia *(Wilsonia rotundifolia)* Herbfield

3.0 Freshwater Herbfield

4.0 Exotic Vegetation

Table 4 presents the two-way table upon which this classification is based.

Table 4: Two-way table of vegetation communities and sub-communities recorded for the Golden Beach development, Torquay, February 2000.

Vegetation Community	1.0													2.0												3.0
Sub-community	1.1										1.2		1.3	2.1	2.2		2.3	2.4				2.5	2.6	2.7		
Quadrats	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
	2	3	4	4	4	4	5	4	4	5	4	4	4	2	3	3	5	2	3	3	4	3	3	5	3	
	7	9	0	7	8	9	0	2	3	2	4	5	6	9	2	4	1	8	0	5	1	8	3	3	7	
Melaleuca lanceolata ssp. *lanceolata 2150*	5	5	5				3		2																	
Tetragonia implexicoma 3343	1	1	2	2	3	2	2	1	1	2									1							
Rhagodia candolleana ssp. *candolleana 2927*	3	1	1	2	1		2	1										+	+							
**Lycium ferocissimum 2078*	3					1		2																		
**Lagurus ovatus 1864*	1	+	1	1	2		2	2	1	1	1	2	1						+							
**Vulpia* sp. *9223*	1	1	1	1	1		1			1		1														
**Bromus hordeaceus* ssp. *hordeaceus 0501*	3						1					1						1	2	1						
Austrodanthonia racemosa var. *racemosa 0977*	2	1		1		1	1		2		1	1														
Cynoglossum australe 0908	1	1	1								1	1	+													
**Catapodium rigidum 0687*	1	1	1		1		1					1														
**Chenopodium album 0736*	1																									
**Chenopodium murale 0746*	+																									
**Chrysanthemoides monilifera 0770*	+	1	1			+	+																			
Clematis microphylla var. *microphylla 4312*	+	1	1				1		1																	
**Brassica fruticulosa 0488*	1				3																					
**Anagallis arvensis 0223*	1			1	1	1												+		+						
Dianella brevicaulis 4412	+	1	1	1		1																				
Dichondra repens 1036	1		1								1		1							+						
**Ehrharta erecta 1128*	1			1	1	2																				
**Nassella trichotoma 2263*	1			1		+																				
**Phalaris aquatica 2476*	1					1													2							
**Plantago lanceolata 2561*	1					1	1												1							
**Rhamnus alaternus 2932*	+	1	1		1																					
Solanum laciniatum 3179	+																									
**Sonchus oleraceus 3204*	1															+		1	1	1	+					+
Acacia retinodes var. *uncifolia 4210*		2	2	2	4	2	2	2	4	3		+														
Leucopogon parviflorus 1987		2	1	4	1	2	2		1	2		1	1						1							
Poa poiformis var. *poiformis 4833*		2	1	1		1	2			+	2	4	1	1				3	3	1	3					
Austrodanthonia caespitosa 0981		2	1	1				1	2	1																
Carex breviculmis 0627		2	1																							
**Rapistrum rugosum 2919*		1	1			1		1		1		+														
Austrostipa flavescens 3276		1	1	1	1			2	3	3	1															
Isolepis nodosa 1782		1		1		1	1		1		2	2	2					1	1		2					
Lepidosperma gladiatum 1922		+	1	2																						
Leptospermum laevigatum 1957		1																								
**Vulpia ciliata 3545*			1		1		1																			
Schoenus nitens 3051			1									1							3							
Acacia paradoxa 0072			1							2																
**Ammophila arenaria 0205*				1			1						5													
**Arctotheca calendula 0259*					1																					
Allocasuarina verticillata 0665						2																				
Acaena novae-zelandiae 0105						1	1												+							
**Galenia pubescens 1399*						1																				
Carpobrotus rossii 0657							+																			
Agrostis billardierei var. *billardierei 4221*							1																			
**Leontodon taraxacoides 1895*							1				1		1								+					1
Microlaena stipoides var. *stipoides 2179*								1																		
**Cirsium vulgare 0782*												1	1					+	1	1						
**Plantago coronopus 2553*												1	1					1	2		1	2				1
Solenostegia arbuscula 3084														5	1			1								
Frankenia pauciflora var. *gunnii 1375*														3		1	1	2	1	1						
Sarcocornia quinqueflora ssp. *quinqueflora 4947*														+	1	2	5	1	1	1	1	1	1			
**Polypogon monspeliensis 2640*														1	+	1	1	1			1	1		1		1
Disphyma crassifolium ssp. *clavellatum 1073*														1				2	1	1						
Halosarcia pergranulata ssp. *pergranulata 4578*															3	4		1		2						
Hemichroa pentandra 1656																		1	1	1						
**Helminthotheca echioides 2511*																		1	2		+					
Samolus repens 3001																		1	1		1	1				
Sarcocornia blackiana 3011																			1							
Disdichla distichophylla 1076																			1	2	2					
Gahnia filum 1389																			+	3						
Olearia axillaris 2301																			+							
**Parapholis strigosa 2419*																				1		1				
**Critesion marinum 1702*																				1		1				1
Juncus krausii ssp. *australiensis 1826*																					3	2				
**Aster subulatus 0297*																					+					
Prata irrigua 2731																						1				
Puccinellia stricta var. *perlaxa 4838*																						1			1	
Puccinellia stricta var. *stricta 4849*																						1				
Spergularia sp. *1 4666*																						1				
Isolepis cernua 1772																						2				
Bolboschoenus caldwellii 0416																						1				
Triglochin striatum 3449																						3				
**Cotula coronopifolia 0848*																						1			+	1
Mimulus repens 2197																						+				
Lepilaena cylindrocarpa 1934																							5			
Wilsonia rotundifolia 3575																									4	
Eleocharis acuta 1139																										2
Agrostis avenacea 0151																										2
Amphibromus nervosus 3628																										1
Potamogeton ochreatus 2690																										1

1.0 Coastal Dune Complex

1.1 Moonah (*Melaleuca lanceolata*) - Coast Wirilda (*Acacia retinodes* var. *uncifolia*) Shrubland

Character Species	Common Name	Percentage Frequency	Cover/ Abundance
Trees			
Acacia retinodes var. *uncifolia*	Coast Wirilda	90	3
Melaleuca lanceolata ssp. *lanceolata*	Moonah	50	4
Shrubs			
Leucopogon parviflorus	Coast Beard-heath	80	2
Rhagodia candolleana ssp. *candolleana*	Seaberry Saltbush	70	2
**Lycium ferocissimum*	African Box-thorn	30	2
**Chrysanthemoides monilifera* ssp. *monilifera*	Boneseed	50	1
**Rhamnus alaternus*	Italian Buckthorn	50	1
Vines			
Clematis microphylla var. *microphylla*	Small-leaved Clematis	50	1
Dicot Herbs			
**Anagallis arvensis*	Pimpernel	40	1
Cynoglossum australe	Australian Hound's-tongue	30	1
Tetragonia implexicoma	Bower Spinach	100	2
Grasses			
**Bromus hordeaceus* ssp. *hordeaceus*	Soft Brome	20	2
**Catapodium rigidum*	Fern Grass	50	1
**Lagurus ovatus*	Hare's Tail	90	1
**Vulpia* sp.	Fescue	70	1
Austrodanthonia caespitosa	Common Wallaby-grass	60	2
Austrodanthonia racemosa var. *racemosa*	Stiped Wallaby-grass	60	1
Austrostipa flavescens	Coast Spear-grass	70	2
**Ehrharta erecta*	Panic Veldt Grass	40	1
Poa poiformis var. *poiformis*	Blue Tussock-grass	60	1
Other Monocot Herbs			
Dianella brevicaulis	Short-stalk Flax-lily	50	1
Isolepis nodosa	Knobby Club-sedge	50	1

Number of Quadrats in Group : 11
Number of Character Species in Group : 22
Mean species number and range : 20 (10-29)
Mean non-native number and range : 44% (2 - 69)
Mean non-native cover and range : 36% (12-57)
Ratio of number of Character Species to Mean Number of Species per Quadrat : 35%
Total number of species in group : 76
Total number of non-native species in group : 41
Total regional rare species in group : 3
Total national rare species in group : 1

Illustrations: Coverplate, Plates 1 and 2.

NOTES:

This shrubland vegetation complex is developed on old calcareous landward dunes on deep to shallow sand or on dune limestone. Moonah and Coast Wirilda are the structural dominants and Coast Beard-heath may also have high cover. The vegetation has been much degraded by sheep and cattle grazing (part of the site), rabbit grazing and weed invasion. Many indigenous species have been lost from the community and introduced species (weeds) have high cover and/or representation in the vegetation. Despite these structural and floristic modifications, the vegetation, at best, is among the most intact regionally on calcareous coastal sites. Nearly all such vegetation in the region has been grossly weed invaded, notably at Point Lonsdale and Queenscliff (e.g. Muir and Collinson 1997).

This vegetation community with Coast Wirilda as a major structural component is confined to the Bellarine Peninsula and to Point Nepean on calcareous soil, it occurs no further west than Torquay and is probably best represented in the present study area and around Ocean Grove. Coast Wirilda (*Acacia retinodes* var. *uncifolia*) is a highly restricted and rare taxon (Walsh 1996) in Victoria largely confined to the Bellarine Peninsula. Stands of Coast Wirilda in the study area are almost certainly the largest in Victoria.

The vegetation described here as Moonah – Coast Wirilda Shrubland is the same vegetation type (Ecological Vegetation Class) as that listed under the *Flora and Fauna Guarantee Act 1988* as Coastal Moonah Woodland.

1.2 Blue Tussock-grass (*Poa poiformis*) – Knobby Club-sedge (*Isolepis nodosa*) Grassland/Sedgeland

Character Species	Common Name	Percentage Frequency	Cover/ Abundance
Dicot herbs			
Cynoglossum australe	Australian Hound's-tongue	100	1
Grasses			
Poa poiformis var. *poiformis*	Blue Tussock-grass	100	3
**Lagurus ovatus*	Hare's Tail	100	2
**Bromus diandrus*	Great Brome	100	1
Austrodanthonia racemosa var. *racemosa*	Stiped Wallaby-grass	100	1
**Holcus lanatus*	Yorkshire Fog	100	2
Other monocot herbs			
Isolepis nodosa	Knobby Club-sedge	100	2

Number of Quadrats in Group : 2 Number of Character Species in Group : 7
Mean species number and range : 16 (12-20)
Mean non-native number and range : 51% (5 - 60) Mean non-native cover and range : 46% (40-52)
Ratio of number of Character Species to Mean Number of Species per Quadrat : 44%
Total number of species in group : 25 Total number of non-native species in group : 14
Total regional rare species in group : 1 Total national rare species in group : 0

Illustrations: Plate 4

NOTES:
This grassland/sedgeland community on calcareous sand of old dunes is an artefact of clearing and sheep and rabbit grazing of the original Moonah – Coast Wirilda Shrubland. Blue Tussock-grass and Knobby Club-sedge form, at best development, a dense tussock-dominated vegetation with few other species present. Currently the vegetation is being actively invaded by the bird dispersed Coast Beard-heath which is abundant on the seaward coastal dunes, and as a component of the Moonah – Coast Wirilda Shrubland.

1.3 Marram Grass (**Ammophila arenaria*) Grassland

Character Species	Common Name	Percentage Frequency	Cover/ Abundance
Shrubs			
Leucopogon parviflorus	Coast Beard-heath	100	1
Dicot herbs			
**Plantago coronopus*	Buck's-horn Plantain	100	1
**Leontodon taraxacoides*	Hairy Hawkbit	100	1
**Hypochoeris radicata*	Cat's Ear	100	1
Dichondra repens	Kidney-weed	100	1
**Cirsium vulgare*	Spear Thistle	100	1
Grasses			
Poa poiformis var. *poiformis*	Blue Tussock-grass	100	1
**Ammophila arenaria*	Marram Grass	100	5
**Lagurus ovatus*	Hare's Tail	100	1
Other monocot herbs			
Isolepis nodosa	Knobby Club-sedge	100	2

Number of Quadrats in Group : 1 — Number of Character Species in Group : 10

Mean species number and range : 12 (12-12)

Mean non-native number and range : 50% (6 - 50) — Mean non-native cover and range : 63% (63-63)

Ratio of number of Character Species to Mean Number of Species per Quadrat : 100%

Total number of species in group : 12 — Total number of non-native species in group : 6

Total regional rare species in group : 0 — Total national rare species in group : 0

Illustrations: Plate 5

NOTES:

The exotic Marram Grass is a dominant of coastal dunes throughout Victoria and is extremely abundant in the dune complex vegetation between the present study area and the beach (Plate 5). In the proposed development area Marram Grass Grassland occupies a restricted area of more elevated dunes on deep sand; the former vegetation of this site was Moonah – Coast Wirilda Shrubland. Marram Grass Grassland grades into Blue Tussock-grass – Knobby Club-sedge Grassland/Sedgeland.

2.0 Saltmarsh Complex

2.1 Shrubby Glasswort (*Sclerostegia arbuscula*) Shrubland

Character Species	Common Name	Percentage Frequency	Cover/ Abundance
Shrubs			
Sclerostegia arbuscula	Shrubby Glasswort	100	5
Dicot Herbs			
Disphyma crassifolium ssp. *clavellatum*	Rounded Noon-flower	100	1
Sarcocornia quinqueflora ssp. *quinqueflora*	Beaded Glasswort	100	+
Sub-shrubs			
Frankenia pauciflora var. *gunnii*	Southern Sea-heath	100	3
Grasses			
**Polypogon monspeliensis*	Annual Beard-grass	100	1
Poa poiformis var. *poiformis*	Blue Tussock-grass	100	1

Number of Quadrats in Group : 1 Number of Character Species in Group : 6

Mean species number and range : 6 (6-6)

Mean non-native number and range : 17% (1 - 17) Mean non-native cover and range : 9% (9-9)

Ratio of number of Character Species to Mean Number of Species per Quadrat : 100%

Total number of species in group : 6 Total number of non-native species in group : 1

Total regional rare species in group : 0 Total national rare species in group : 0

Illustrations: Plates 6

NOTES:

Shrubby Glasswort Shrubland to 2 m high is the universally dominant vegetation of lower saltmarsh in Victoria subject to regular and frequent tidal inundation – 'wet' saltmarsh (Carr 1982). In the study area much of the saltmarsh vegetation consists of Shrubby Glasswort Shrubland but it is likely to be in decline because of greatly reduced frequency and amplitude of tidal inundation in the saltmarsh. The road to Point Impossible substantially blocks the tidal channel (Mullet Creek) in the estuary of Thompson Creek feeding the saltmarsh to the west (Bird 1998). Shrubby Glasswort in the saltmarsh is exhibiting signs of severe dieback over large areas which is likely to be related to reduced tidal inundation, hence reduced salinity of the saltmarsh.

2.2 Blackseed Glasswort (*Halosarcia pergranulata*) Shrubland

Character Species	Common Name	Percentage Frequency	Cover/ Abundance
Shrubs			
Halosarcia pergranulata ssp. *pergranulata*	Blackseed Glasswort	100	4
Dicot herbs			
Sarcocornia quinqueflora ssp. *quinqueflora*	Beaded Glasswort	100	2
Grasses			
**Polypogon monspeliensis*	Annual Beard-grass	100	1

Number of Quadrats in Group : 2
Number of Character Species in Group : 3
Mean species number and range : 5 (4-5)
Mean non-native number and range : 33% (1 - 40)
Mean non-native cover and range : 14% (9-18)
Ratio of number of Character Species to Mean Number of Species per Quadrat : 67%
Total number of species in group : 6
Total number of non-native species in group : 2
Total regional rare species in group : 0
Total national rare species in group : 0

Illustrations: Plate 7

NOTES:

Blackseed Glasswort is the woody dominant of upper or 'dry' coastal saltmarsh in Victoria (Carr 1982, Yugovic 1984), generally occurring in slightly more elevated situations than Shrubby Glasswort. It is assumed to be tolerant of higher salinity than Shrubby Glasswort (*Sclerostegia arbuscula*) (because of concentration of salt through evaporation where water ponds in the saltmarsh) and to be more tolerant of dry conditions. In coastal Victoria the saltmarshes of the study area are essentially the western limit of Blackseed Glasswort distribution (Walsh 1996).

2.3 Beaded Glasswort (*Sarcocornia quinqueflora* ssp. *quinqueflora*) Herbfield

Character Species	Common Name	Percentage Frequency	Cover/ Abundance
Sub-shrubs			
Frankenia pauciflora var. *gunnii*	Southern Sea-heath	100	1
Dicot herbs			
Sarcocornia quinqueflora ssp. *quinqueflora*	Beaded Glasswort	100	5
Grasses			
**Polypogon monspeliensis*	Annual Beard-grass	100	1

Number of Quadrats in Group : 1
Number of Character Species in Group : 3
Mean species number and range : 3 (3-3)
Mean altitude and range :
Mean non-native number and range : 33% (1 - 33)
Mean non-native cover and range : 14% (14-14)
Ratio of number of Character Species to Mean Number of Species per Quadrat : 100%
Total number of species in group : 3
Total number of non-native species in group : 1
Total regional rare species in group : 0
Total national rare species in group : 0

Illustrations: Plate 8

NOTES:

Beaded Glasswort is the universal herbaceous dominant of coastal Victorian saltmarsh, with very wide ecological tolerances (e.g. Carr 1982). It is found as a component of most or all saltmarsh vegetation communities or sub-communities; including waterlogged sites to those frequently inundated by tides, to dry sites on the extreme landward side of saltmarshes. Where conditions favour its development, it forms almost monospecific herbfields in upper saltmarshes as described here, as well as in lower saltmarshes.

2.4 Blue Tussock-grass (*Poa poiformis*) – Sea Rush (*Juncus kraussii*) Grassland/Sedgeland

Character Species	Common Name	Percentage Frequency	Cover/ Abundance
Sub-shrubs			
Frankenia pauciflora var. *gunnii*	Southern Sea-heath	75	1
Dicot herbs			
**Cirsium vulgare*	Spear Thistle	100	1
**Sonchus oleraceus*	Common Sow-thistle	100	1
Sarcocornia quinqueflora ssp. *quinqueflora*	Beaded Glasswort	100	1
**Plantago coronopus*	Buck's-horn Plantain	75	1
Disphyma crassifolium ssp. *clavellatum*	Rounded Noon-flower	75	1
Hemichroa pentandra	Trailing Hemichroa	75	1
**Helminthotheca echioides*	Ox-tongue		
Samolus repens	Creeping Brookweed	75	1
Grasses			
Poa poiformis var. *poiformis*	Blue Tussock-grass	100	3
**Bromus hordeaceus* ssp. *hordeaceus*	Soft Brome	75	1
Distichlis distichophylla	Australian Salt-grass	75	1-2
Other Monocot Herbs			
Isolepis nodosa	Knobby Club-sedge	75	1
Juncus kraussii ssp. *australiensis*	Sea Rush	25	3

Number of Quadrats in Group : 4
Number of Character Species in Group : 13
Mean species number and range : 21 (16-27)
Mean non-native number and range : 47% (7 - 50)
Mean non-native cover and range : 38% (28-48)
Ratio of number of Character Species to Mean Number of Species per Quadrat : 19%
Total number of species in group : 47
Total number of non-native species in group : 24
Total regional rare species in group : 0
Total national rare species in group : 0

Illustrations: Plate 9

NOTES:

Blue Tussock-grass and Sea Rush frequently form extensive communities in upper saltmarsh at the interface of the saltmarsh and landward dryland vegetation, in this case the dune system. In these situations where inundation and waterlogging are frequent or a saline water table is near the surface, associated species include a range of saltmarsh herbs (e.g. Beaded Glasswort and Creeping Brookweed). The actually local structural dominant or co-dominants of the vegetation are determined by gradients in salinity and waterlogging resulting from variations in saltmarsh microtopography as well as frequency of inundation. For example, Sea Rush is tolerant of more-or-less permanent waterlogging while Knobby Club-sedge tolerates only temporary waterlogging. Blue Tussock-grass has a wide ecological amplitude and also is found in much more elevated dry sites of the Coastal Shrubland complex.

2.5 Sea Rush (*Juncus kraussii*) – Streaked Arrow-grass (*Triglochin striatum*) Herbfield

Character Species	Common Name	Percentage Frequency	Cover/ Abundance
Dicot herbs			
**Cotula coronopifolia*	Water Buttons	100	1
Spergularia marina s.s.	Lesser Sea-spurrey	100	1
**Spergularia rubra s.l.*	Red Sand-spurrey	100	1
Sarcocornia quinqueflora ssp. *quinqueflora*	Beaded Glasswort	100	1
Samolus repens	Creeping Brookweed	100	1
Pratia irrigua	Salt Pratia	100	1
**Plantago coronopus*	Buck's-horn Plantain	100	2
Mimulus repens	Creeping Monkey-flower	100	+
Grasses			
Sporobolus virginicus	Salt Couch	100	1
Puccinellia stricta var. *stricta*	Australian Saltmarsh-grass	100	1
Puccinellia stricta var. *perlaxa*	Plains Saltmarsh-grass	100	1
**Puccinellia fasciculata*	Borrer's Saltmarsh-grass	100	1
**Polypogon monspeliensis*	Annual Beard-grass	100	1
**Parapholis strigosa*	Slender Barb-grass	100	1
**Critesion marinum*	Sea Barley-grass	100	1
Other monocot herbs			
Triglochin striatum s.l.	Streaked Arrow-grass	100	3
Bolboschoenus caldwellii	Salt Club-sedge	100	1
Juncus revolutus	Creeping Rush	100	1
Juncus kraussii ssp. *australiensis*	Sea Rush	100	2
Isolepis cernua	Nodding Club-sedge	100	2

Number of Quadrats in Group : 1
Number of Character Species in Group : 20
Mean species number and range : 20 (20-20)
Mean non-native number and range : 35% (7 - 35)
Mean non-native cover and range : 33% (33-33)
Ratio of number of Character Species to Mean Number of Species per Quadrat : 100%
Total number of species in group : 20
Total number of non-native species in group : 7
Total regional rare species in group : 0
Total national rare species in group : 0

Illustrations: Plate 10

NOTES:

This is a small sub-community of highly unusual saltmarsh vegetation occupying a more-or-less circular area c.100m wide in pasture away from and upslope of the main saltmarsh. Surrounding plant species in the pasture are non-halophytes (species intolerant of high salinity).

In this location, where a few basalt rocks occur at the surface, the soil is wet in summer with a surface veneer of salt, indicating an upslope saline seepage area which allows the development of saltmarsh vegetation.

The site has a long history of sheep and rabbit grazing and is thus, to an indeterminate extent, an artefact of this landuse. Nonetheless the vegetation dominants are indigenous and weeds have relatively low cover/abundance. Floristically the vegetation is most unusual and similar vegetation has apparently not been reported before. The occurrence of the diminutive saltmarsh form of Streaked Arrow-grass as a vegetation dominant, along with Sea Rush, is of considerable interest.

2.6 Long-fruit Water-mat (*Lepilaena cylindrocarpa*) Submerged Herbfield

Character Species	Common Name	Percentage Frequency	Cover/ Abundance
Dicot herbs			
Sarcocornia quinqueflora ssp. *quinqueflora*	Beaded Glasswort	100	1
Monocot herbs			
Lepilaena cylindrocarpa	Long-fruit Water-mat	100	5

Number of Quadrats in Group : 1
Number of Character Species in Group : 2
Mean species number and range : 2 (2-2)
Mean non-native number and range : 0% (0 - 0)
Mean non-native cover and range : 0% (0-0)
Ratio of number of Character Species to Mean Number of Species per Quadrat : 100%
Total number of species in group : 2
Total number of non-native species in group : 0
Total regional rare species in group : 0
Total national rare species in group : 0

Illustrations: Plate 7

NOTES:

Long-fruit Water-mat is a submerged annual herb of ephemeral saline ponds or salt-pans in regional saltmarshes (e.g. Carr 1982). These pools, to c.30cm deep, dry out in late spring or early summer and the Water-mat dies; it again germinates with the onset of autumn rains.

Examples of Long-fruit Water-mat Submerged Herbfields in the study area, a relatively rare vegetation type in Victoria, are particularly large because of the size of the seasonally inundated clay-pans where they occur.

2.7 Round-leaf Wilsonia *(Wilsonia rotundifolia)* Herbfield

Character Species	Common Name	Percentage Frequency	Cover/ Abundance
Dicot herbs			
Wilsonia rotundifolia	Round-leaf Wilsonia	100	4
**Cotula coronopifolia*	Water Buttons	100	+
Grasses			
Puccinellia stricta var. *perlaxa*	Plains Saltmarsh-grass	100	1
**Polypogon monspeliensis*	Annual Beard-grass	100	1

Number of Quadrats in Group : 1
Number of Character Species in Group : 4
Mean species number and range : 4 (4-4)
Mean non-native number and range : 50% (2 - 50)
Mean non-native cover and range : 23% (23-23)
Ratio of number of Character Species to Mean Number of Species per Quadrat : 100%
Total number of species in group : 4
Total number of non-native species in group : 2
Total regional rare species in group : 0
Total national rare species in group : 0

Illustration: Plate 11

NOTES:

This small area of distinctive vegetation is at the extreme upper edge of the saltmarsh in an area with a history of sheep grazing. A cross-fence comparison with adjoining saltmarsh vegetation indicates that the Round-leaf Wilsonia Herbfield is an artefact of grazing and that the saline site subject to seasonal inundation formerly carried Blackseed Glasswort (*Halosarcia pergranulata*) Shrubland (now eliminated by grazing). The Wilsonia is evidently immune to elimination by grazing because it tightly hugs the soil.

Similar vegetation is known elsewhere in central Victorian saltmarsh (e.g. at Lake Connewarre and the Murtcaim saltmarshes near Point Wilson) (Yugovic 1985, Carr et al. 1995) but it is rare.

3.0 Freshwater Herbfield

Character Species	Common Name	Percentage Frequency	Cover/ Abundance
Dicot herbs			
**Trifolium glomeratum*	Cluster Clover	100	1
**Sonchus oleraceus*	Common Sow-thistle	100	+
**Sonchus asper* ssp. *asper.*	Rough Sow-thistle	100	1
**Solanum nigrum*	Black Nightshade	100	1
**Cotula coronopifolia*	Water Buttons	100	1
Chenopodium pumilio	Clammy Goosefoot	100	1
Senecio sp.	Groundsel	100	+
**Rumex crispus*	Curled Dock	100	1
**Rumex conglomeratus*	Clustered Dock	100	+
**Polygonum aviculare s.l.*	Prostrate Knotweed	100	1
**Plantago coronopus*	Buck's-horn Plantain	100	1
Persicaria prostrata	Creeping Knotweed	100	+
**Medicago polymorpha*	Burr Medic	100	+
**Arctotheca calendula*	Cape Weed	100	+
Lythrum hyssopifolia	Small Loosestrife	100	1
**Leontodon taraxacoides*	Hairy Hawkbit	100	1
Epilobium hirtigerum	Hairy Willow-herb	100	1
Grasses			
**Polypogon monspeliensis*	Annual Beard-grass	100	1
**Lolium rigidum*	Wimmera Rye-grass	100	1
**Cynodon dactylon* var. *dactylon*	Couch	100	+
**Critesion marinum*	Sea Barley-grass	100	1
Amphibromus nervosus	Common Swamp Wallaby-grass	100	1
Agrostis avenacea	Common Blown-grass	100	2
Other monocot herbs			
Eleocharis acuta	Common Spike-sedge	100	2
Potamogeton ochreatus	Blunt Pondweed	100	1
Juncus bufonius	Toad Rush	100	1

Number of Quadrats in Group : 1
Number of Character Species in Group : 26
Mean species number and range : 26 (26-26)
Mean non-native number and range : 62% (16 - 62)
Mean non-native cover and range : 55% (55-55)
Ratio of number of Character Species to Mean Number of Species per Quadrat : 100%
Total number of species in group : 26
Total number of non-native species in group : 16
Total regional rare species in group : 0
Total national rare species in group : 0

NOTES:

This vegetation, comprised of indigenous and exotic wetland herbs (amphibious, and emergent and submergent aquatic species) generally occupies a narrow band around the edge of farm dams subject to summer draw-down; or occurs in the deep more-or-less permanent water (submergent aquatics). The indigenous and exotic plant species involved are opportunistic colonisers, many of which have been dispersed to the site(s) by waterfowl. The floristic composition of the dams indicates that water ranges from relatively fresh to seasonally brackish. The sites are highly disturbed, with a history of sheep and cattle grazing on dam edges, but stock have now been removed. Waterfowl and Australian White Ibis and Straw-necked Ibis have also had a pronounced impact on vegetation, by trampling and faecal eutrophication.

Plate 1. **A very large Moonah specimen in a remnant stand of Moonah (*Melaleuca lanceolata*) - Coast Wirilda (*Acacia retinodes* var. *uncifolia*) Shrubland.**

Plate 2. **Coast Wirilda dominated vegetation in Moonah (*Melaleuca lanceolata*) - Coast Wirilda (*Acacia retinodes* var. *uncifolia*) Shrubland of the Conservation Zone.**

Plate 3. **Dune Complex vegetation in high dunes of the coastal reserve south of The Esplanade.**

Plate 4. **Blue Tussock-grass (*Poa poiformis*) – Knobby Club-sedge (*Isolepis nodosa*) Grassland/Sedgeland with stands of Coast Beard-heath (*Leucopogon parviflorus*).**

Plate 5. Marram Grass (**Ammophila arenaria*) Grassland with a small stand of the serious environmental weed Cape Wattle (**Paraserianthes lophantha*).

Plate 6. Shrubby Glasswort (*Sclerostegia arbuscula*) Shrubland bordering the former tip site; note the dieback in the Shrubby Glasswort.

Plate 7. **Blackseed Glasswort (*Halosarcia pergranulata*) Shrubland fringing bare salt-pans with Shrubby Glasswort Shrubland in the middle distnace. The summer-bare pans support Long-fruit Water-mat (*Lepilaena cylindrocarpa*) Submerged Herbfields in winter – spring.**

Plate 8. **Beaded Glasswort (*Sarcocornia quinqueflora* ssp. *quinqueflora*) Herbfield of upper saltmarsh fringing Blue Tussock-grass – Sea Rush Grassland/Sedgeland.**

Plate 9. **Blue Tussock-grass (*Poa poiformis*) – Sea Rush (*Juncus kraussii*) Grassland/Sedgeland bordering Dune Complex shrubland dominated by Coast Beard-heath and Coast Wirilda.**

Plate 10. **Sea Rush (*Juncus kraussii*) – Streaked Arrow-grass (*Triglochin striatum*) Herbfield. The small bright green tussocks are young Sea Rush plants.**

Plate 11. **Round-leaf Wilsonia *(Wilsonia rotundifolia)* Herbfield west of the fence with the former tip in the background.**

Plate 12. **Exotic grassland characteristic of the pasture areas.**

5.1.4 Exotic vegetation

The greater part of the subject land carries exotic or substantially exotic vegetation on natural soil profiles of the pastures, and the former tip area now covered with imported fill. Indicative structure and species composition of this vegetation can be seen by reference to the quadrat data (Quadrat E04731 – quadrat 05 on Map 1) and (E04736 – quadrat 10 on Map 1) (Appendix 2). The former vegetation of the areas carrying pasture is considered to have been grassy and sedgy woodland dominated by Swamp Gum (*Eucalyptus ovata*), Coast Manna Gum (*E. viminalis* ssp. *pryoriana*), Bellarine Yellow Gum (*E. leucoxylon* ssp. *bellarinensis*), Drooping Sheoke (*Allocasuarina verticillata*), Blackwood (*Acacia melanoxylon*), Late Black Wattle (*A. mearnsii*) and Golden Wattle (*A. pycnantha*).

Exotic or substantially exotic vegetation has little conservation significance except as faunal habitat, it is not discussed further.

Illustration: Plate 12

5.1.5 Vegetation quality

The quality of the vegetation present in the study area has been assessed against the qualitative vegetation quality criteria of Carr et al. (1997) as given in Appendix 4. These criteria embrace: level of weed invasion, major physical disturbances, other disturbances, retention of original vegetation structure and retention of 'original' species richness. Vegetation quality for each community/sub-community is given in Table 8.

5.2 Fauna

5.2.1 Habitats

Six categories of habitat (Map 1) were identified during surveys. These were broadly grouped on the basis of vegetation floristic composition, structure and geomorphological setting. The six habitat categories are:

- Dune Complex;
- Saltmarsh Complex;
- Moonah Woodland - Coast Wirilda Shrubland;
- Pasture/Open Grassland;
- Retarding Basin and Farm Dams (constructed wetlands); and
- Beach/Shoreline.

Generally, the fauna habitat in the study area is of poor quality. There are limited areas of remnant vegetation, and those that are present are generally degraded. Edge effects from the former tip, pest animals, weed invasion and human impacts have contributed to diminished habitat quality.

Dune Complex (Plate 3)

This habitat encompasses the dune system and open beach to the south of the study area. Dunes and swales characterise the topography of this habitat. The introduced Marram Grass dominates the dunes and forms large, homogenous swards across this habitat. There is little evidence of native fauna in this area (with the exception of some common birds, such as the Silvereye and Superb Fairy-wren), and rabbits are prevalent. Stands of Coast Wattle and Coast Beard-heath are common along the roadside and on the slopes of the back dunes and provide potential shelter and forage to mammals, such as the Common Ringtail Possum and the Swamp Wallaby and potentially the Smoky Mouse (Nationally significant). Marram Grass tussocks provide potential habitat for reptiles.

Humans have had a heavy impact on the dunes. Numerous tracks, some badly eroded and heavily used, are present throughout the dunes, and some of these also show evidence of domestic dog visitation. There is no fencing, except at the car-park, to regulate access and the dunes slope steeply to the surf beach.

Saltmarsh (Coverplate, Plates 6-9 and 11)

The saltmarsh is dominated by Shrubby Glasswort and other salt-tolerant plants. It is adjacent to the former tip along the eastern boundary of the study site, and forms a continuous band running along the estuary to the west of Breamlea (incorporating Breamlea Flora Reserve). The Esplanade, a road accessing Point Impossible Road with its culvert, has disrupted tidal inundation to the saltmarsh (Plate 16) (Section 7.2.2). Despite altered flow regimes, and encroachment of the tip, the floristic diversity and structure in the saltmarsh provides potential habitat for numerous seabirds and waders [e.g. Pacific Gull (State significance), Ruddy Turnstone, Common Greenshank, Red-kneed Dotterel and Masked Lapwing]. This saltmarsh is a known feeding ground of the Orange-bellied Parrot (National significance) (J. Starks, Birds Australia, pers. comm.) and provides potential habitat for the Swamp Skink, *Egernia coventryi* (National significance) and other reptiles. The Red-capped Dotterel (Local significance) utilises the (bare) saltpans which are devoid of saltmarsh vegetation; and the White-fronted Chat and Striated Fieldwren were also detected in this habitat during the field investigation. A foraging Swamp Harrier was also observed flying above the saltmarsh. Species recorded on the estuary include: Australian Pelican, Australian White Ibis, White-faced Heron, Black Swan, Black-winged Stilt, Pacific Gull (State significance), Masked Lapwing and Common Greenshank.

Erosion from the tip has degraded the edges of the saltmarsh where the tip borders this habitat (immediately adjacent to the development site).

Moonah Woodland - Coast Wirilda Shrubland (Coverplate, Plates 1 and 2)

This habitat is a complex dominated either by Moonah or Coast Wirilda (see Section 5.1.2), which forms a single fauna habitat type. Vegetation has been fragmented by clearing, resulting in increased edge-effects on the stand of Moonah, and disturbance of this habitat. Roading has resulted in disruption of the formerly unbroken sequence of habitat types running from the beach northwards, including the Dune Complex, Coast Shrubland and Moonah Woodland.

There are some old, large Moonah trees in this stand, with closely spaced trees, as well as specimens isolated by partial clearing. The Moonah Woodland provides particularly good habitat for species preferring dense shrubland. There is also an abundance of fallen timber which potentially provides good habitat for reptiles.

Generally, the Moonah – Coast Wirilda Shrubland is suffering from the effects of weed invasion and rabbit grazing and it was also previously grazed by livestock. The effects include a general lack of recruitment of Moonah plants, extensive burrowing and browsing of the ground layer vegetation by rabbits, and the presence of exotic plant and animal species, including foxes.

A total of 25 native bird species were recorded using the Moonah Woodland - Coast Wirilda Shrubland, including honeyeaters, thornbills, fantails, fairy-wrens and silvereyes. These species particularly prefer foraging on shrubby substrates, and tended to occur throughout the broad vegetation community.

Pasture and Grassland (Plate 12)

These cleared areas, by far the largest habitat type in the study area, have a long history of grazing by livestock and rabbits. There are some large swathes of Slender Wallaby-grass, but overall this habitat type offers very little habitat for native fauna, except for some common Locally significant species (e.g. Australian Magpie, Magpie-lark, Richard's Pipit, and raptors such as the Black-shouldered Kite) which feed in open grasslands or pastures. These open areas also offer habitat for some Locally significant species which may feed on open ground but roost or perch in dense shrubbery (e.g. Yellow-rumped Thornbill and Superb Fairy-wren) where they border the Moonah Woodland-Coast Wirilda Shrubland.

Retarding Basin and Farm Dams (Plate 15)

The Retarding Basin and Farm Dams contain open water with sparse to dense wetland herbfields. The most prominent vegetation consists of emergent Cumbungi (*Typha* sp.) herbfield in the western section of the Retarding Basin. The open water provides habitat for the Hoary-headed Grebe (detected during the field survey) and probably locally significant ducks (e.g. Australian Shelduck). At least two Little Pied Cormorants (locally significant), one Little Black Cormorant (locally significant) and one Pied Cormorant (State significant) use the Retarding Basin as a perch site. The Cumbungi beds provide habitat for the Clamorous Reed-Warbler and the Spotted Marsh Frog, and potential habitat for the Nationally significant Growling Grass (Warty Bell) Frog, although this species was not detected during two nights of observations during the field investigation. The edges of the Retarding Basin and Farm Dams also provide habitat for other locally significant species, including the Black-fronted Dotterel and Masked Lapwing.

Beach/Shoreline

This habitat type occurs between the dune complex and shoreline. It is identified for its importance for birds including the Nationally significant Hooded Plover, State significant Pacific Gull (recorded during the field survey), and more common species (recorded during the field survey), including the Silver Gull, Red-capped Dotterel, Great Cormorant and Little Pied Cormorant. The Hooded Plover has been recorded on numerous occasions at Point Impossible, as well as at the Black Rock sewage treatment outfall, to the east of the beach fronting the development site.

The following discussion of specific fauna groups includes the combined results from database and literature searches, specialist consultation and field surveys.

5.2.2 Mammals

A total of 25 mammal species have previously been recorded from the vicinity of the study area (Atlas of Victorian Wildlife, DNRE); they are listed in Appendix 5. None of the terrestrial mammals listed is considered threatened (DNRE 1999). Of the eight marine mammals listed, two are of National significance (Blue Whale and Southern Right Whale) and another is of State significance (Australian Fur Seal). These species are not relevant to this EMP and are not considered further.

The most significant mammalian species recorded during this study (but needing confirmation) was the (Nationally significant) Smoky Mouse which was detected in the Dune Complex (Line D) by a hair-tube. This species occurs in disjunct populations in the Otways, the Grampians, the highlands north-east of Melbourne and in the coastal woodlands of East Gippsland (see Section 6.2.2). The Smoky Mouse has not been previously recorded from this area (Atlas of Victorian Wildlife, DNRE), thus, a new population has apparently been discovered, although this on face value appears unlikely.

No native mammals were directly observed in the study area. Those mammals that were recorded (Smoky Mouse, Swamp Wallaby, Bush Rat, Common Ringtail Possum, Little Forest Bat and Short-beaked Echidna) (Appendix 5), were detected by indirect observations, such as scats, scat and hair analysis and recording of vocalisations.

Only four hair-tubes were successful in sampling hair. No hair was recorded in the hair-tubes along Line B. Hair-tube results are summarised in Table 5 and Map 1 shows the locations of the hair-tube lines.

Scats of the Swamp Wallaby were noted, and there are reports of sightings of this species in the study area (G. Shomaley, Torquay Coast Action Inc., pers. comm.). A trapping survey in the coastal scrub conducted by the Geelong Field Naturalists Club approximately three years ago found no native species (G. Shomaley pers. comm.). Fox and dog scats were numerous.

No native species were observed during spotlighting. Many rabbits, a cat (whether domestic or feral is unknown) and one Black Rat were observed during spotlighting.

One bat was recorded during the field survey. Analysis of the call identified the bat as a Little Forest Bat (*Vespadelus vulturnus*) (L. Lumsden, Arthur Rylah Institute for Environmental Research, pers. comm.). The Little Forest Bat is generally common and widespread throughout Victoria, occupying a range of habitats including wet forests, woodlands and modified environments (Menkhorst 1995). It is of Regional significance in the study area as it has a disjunct and limited distribution in the Otway Plain region.

Only common species were recorded from the predator (Red Fox) scats. Species identified in the five scats included: Sheep, Bush Rat, Common Ringtail Possum and European Rabbit. The Bush Rat and Common Ringtail Possum were not otherwise detected during the survey.

Table 5. Results of Hair-tube sampling, proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course, Torquay

LINE A Moonah Woodland (east) and Coastal Wirilda Shrubland	LINE C Moonah Woodland (west) and Coastal Wirilda Shrubland	LINE D Dune Complex
European Rabbit	Sheep	Smoky Mouse European Rabbit

5.2.3 Birds

A total of 168 bird species (159 native and nine introduced) has been recorded in and adjacent to the study area (Appendix 5) and a total of 56 bird species was observed during the field survey. This indicates that the study area provides suitable habitat to support a range of (at least) Locally and Regionally significant species. Eleven species (10 native and one introduced) additional to the Atlas records were observed during field-work (Table 6). Two species observed were of State significance (Pacific Gull and Pied Cormorant). During our field visits, the Retarding Basin, despite its limited habitat quality, was utilised regularly by several Little Pied Cormorants, and it was also here that the Pied Cormorant (State significant) was observed.

Within the larger study area, seven species are considered to be of National significance: Orange-bellied Parrot, Hooded Plover, Fairy Tern, Little Tern, Painted Snipe, Australasian Bittern and Masked Owl. Twenty-five bird species from the wider study area are of State significance (Appendix 5). Significant species considered to have a moderate to high likelihood of occurrence in the study area or its direct surrounds (e.g. the saltmarsh and Whites Beach) are discussed further in Section 6.2.2. For significance criteria see Section 6.2.1.

The Red-capped Plover has been observed breeding along the dune complex opposite the study area for a number of years (G. Shomaley pers. comm.). The Great Egret (State significant) and the Hooded Plover (Nationally significant) have been observed further east of the study area, nearer the mouth of Thompson Creek and the saltmarsh at Breamlea, where the Blue-winged Parrot has also been observed (S. Howlles, RAMSAR Awareness Committee, Geelong, pers. comm.).

Australia has international conservation treaties with China (CAMBA: China - Australia Migratory Bird Agreement) and Japan (JAMBA: Japan - Australia Migratory Bird Agreement), which aim to protect feeding habitat for migratory species. At least 30 species covered by these treaties have been recorded in the vicinity of the study area (Appendix 5). CAMBA/JAMBA species are discussed further in Section 6.2.2.

Table 6. Bird species observed in the proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course, Torquay study area additional to Atlas of Victorian Wildlife, DNRE records.

COMMON NAME	SCIENTIFIC NAME
Rufous Fantail	*Rhipidura rufifrons*
Striated Pardalote	*Pardalotus striatus*
Striated Thornbill	*Acanthiza lineata*
Buff-rumped Thornbill	*Acanthiza reguloides*
Striated Fieldwren	*Calamanthus fuliginosus*
Fan-tailed Cuckoo	*Cacomantis flabelliformis*
Clamorous Reed-Warbler	*Acrocephalus stentoreus*
Little Black Cormorant	*Phalacrocorax sulcirostris*
Common Bronzewing	*Phaps chalcoptera*
Australian Raven	*Corvus coronoides*
Spotted Turtle-Dove*	*Streptopelia chinensis*

* Indicates an introduced species

5.2.4 *Reptiles*

Eight reptile species have been recorded from the larger study area. One Blue-tongue Lizard (*Tiliqua* sp.) was observed in the Dune Complex habitat. Two other reptile species were recorded in the study area and both were dead specimens. They were identified as the Lowland Copperhead (*Austrelaps superbus*) and the Eastern Three-lined Skink (*Bassiana duperreyi*) (P. Robertson, Wildlife Profiles, pers. comm.); both are common throughout Victoria. The Lowland Copperhead is usually found in or near marshlands and swamps while the Eastern Three-lined Skink occurs in woodlands and grassy clearings (Cogger 1996, Bennett 1997).

No other reptiles were observed despite active searches. Observations of the Marbled Gecko (*Christinus marmoratus*) and a Jacky Lizard (*Amphibolurus muricatus*) have been made in the Dune Complex (G. Shomaley pers. comm.).

5.2.5 *Frogs*

Five frog species have been recorded in the vicinity of the study area (Atlas of Victorian Wildlife, DNRE). One of these, the Growling Grass Frog (*Litoria raniformis*) is Nationally significant. Only one frog species, the Spotted Marsh Frog (*Limnodynastes tasmaniensis*), a new record for the area, was identified during observations at the Retarding Basin. The Spotted Marsh Frog is a very common, widespread species occupying marshy areas, grass-lined streams, ponds and flooded paddocks (Barker et al. 1995).

5.2.6 *Feral animal populations*

Status of rabbit populations

The site at the proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course is in a recognised rabbit-prone area. In common with much of the coastal land in this area, it combines adequate cover (by way of dense vegetation) with good burrowing soils and adjacent pasturelands with an abundance of the shorter, introduced grasses favoured by rabbits. At the time of inspection, all evidence pointed to a moderate population density, certainly much less than in the recent past. During the course of a 2.5 hour inspection of the site (walking), only 11 rabbits were seen.

Currently, most rabbits on the site are to be found in the remnant bushland (Moonah – Coast Wirilda Shrubland) on the old dune system. Here, there are numerous tracks, scratchings and dunghills (Plate 14). Most warrens are on the north-facing dune slopes. Typically, warrens are of only 3-4 holes, but judging from the huge amount of sand excavated, they are very large underground and clearly capable of harbouring large numbers of rabbits. A typical walk transect on the dune slope indicated that warren density was about 10/ha. About two thirds of all warren openings were active, suggesting that the current rabbit population was far below its potential peak. In this area, and on the margins of the nearby grazed paddocks, a Gibb activity index of 4 (on a scale from 1-10) (Table 2) was indicated. If historical evidence is included (old dunghills and scratches), the Gibb Index would be 6 or 7.

The saltmarsh area to the north and east of the site appears to be almost devoid of rabbits and only very occasional evidence of rabbits was seen on the former tip site. In the grazed paddocks to the west, rabbit activity was confined to the isolated boxthorn bushes (Plate 13). Here, most of the larger boxthorns harboured large and active warrens.

Most rabbit feeding activity seems to be confined to the proximal borders of the grazed paddocks and to the lower slopes of the dunes where some grassy ground cover occurs below the Moonah – Coast Wirilda scrub. In places, rabbit grazing pressure is severe, and there is some evidence of browsing damage to seedling Moonahs.

Fox populations

Although no live foxes were seen, there is abundant evidence of a high population of these animals in the Moonah – Coast Wirilda Shrubland. Numerous fox scats are present and fox tracks (as well as the tracks of domestic dogs) were everywhere in evidence. Some scats contained fur and feather remains, suggesting that predation on local fauna does occur. The extent and significance of this predation is unknown but the evidence of the scat analysis (Section 5.2.2) indicates that some native animals are prey species.

We have no way of arriving at current density estimates for foxes, but given the abundant cover and historically high rabbit numbers (staple prey in many areas), very high densities are likely. Given that densities of 4-5 foxes/square kilometre have been recorded for relatively open farmland in central Victoria, it is likely that a much higher density may occur at the Golden Beach (Torquay Sands) site.

6.0 SIGNIFICANCE

6.1 Flora

6.1.1 Definition of significance

Significance in the biological context has a similar meaning as in general usage, *significant* being defined as noteworthy or of considerable importance (Oxford Dictionary). Sites of biological significance are areas where features of the flora and fauna meet defined biological criteria. These assessments are independent of land-use classifications (e.g. biological reserves) or land ownership (e.g. public or private), instead being an assessment of the qualities of the remnant indigenous vegetation and habitat in the context of its current distribution, conservation status and integrity.

Significance has two components - scale and degree. The assessment of *degree* of significance (e.g. high or moderate) is based on the values of the site in relation to the overall distribution, condition or importance of sites possessing these values - within the range delineated by the *scale* of reference, that is, national, state, regional or local. In general usage, scale and degree are combined into levels of significance denoted by scale alone. In the context of the present study the following areas apply to the scale of botanical and zoological significance:

Local:	Surf Coast Shire
Regional:	Otway Plain natural region (Conn 1993)
State:	Victoria
National:	Australia

6.1.2 Indigenous Plant Species

The assessment of significance of plant species recorded from the sites during this study is based on the application of one or more of the following criteria:

- Naturally uncommon or rare in Australia, Victoria, the region or the municipality;
- Formerly widespread in Australia, Victoria, the region or the municipality but now depleted through habitat destruction or degradation;
- Remnant population(s) with important information content on floristics of the regional or local vegetation;
- Species which are taxonomically or biogeographically interesting, for example, alpine forms of more widespread species, and disjunct populations; and
- Species which may play a keystone role in particular environments or display unusual characteristics.

Plant species are of National Significance if they are either rare or threatened on an Australia-wide basis. Many of these taxa are listed as Rare or Threatened Australian Plant Species (ROTAPS) by Briggs and Leigh (1996), ANZECC (1993) or listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*; listings are updated on the basis of new data.

Species which are rare or threatened in Victoria are listed in Ross (2000), although additional species may be similarly categorised as further information comes to hand. All such species are considered to be of at least State significance.

Regionally significant species are assessed on the basis of regional studies and our knowledge of the regional flora. All indigenous species are at least **Locally** significant given the massive loss of vegetation on the Bellarine Peninsula.

During the present study two species of State Significance and 26 species of Regional Significance were recorded. Significant plant species are listed in Table 7.

Table 7. Significant plant species recorded for the proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course, Torquay, February 2000.

r denotes species considered to be rare in Victoria by Gullan et al. (1990).

STATE SIGNIFICANT		
Botanical name	**Common name**	**Quadrat(s)**
r *Acacia retinodes* var. *uncifolia*	Coast Wirilda	13, 14, 16, 17, 19, 21-24, 26
r *Juncus revolutus*	Creeping Rush	02, 12

REGIONALLY SIGNIFICANT		
Botanical name	**Common name**	**Quadrat(s)**
Agrostis billardierei var. *billardierei*	Coast Blown-grass	24
Allocasuarina verticillata	Drooping She-oak	23
Epilobium billardierianum ssp. *intermedium*	Variable Willow-herb	15
Frankenia pauciflora var. *gunnii*	Southern Sea-heath	02, 03, 04, 08, 09, 25
Gahnia filum	Chaffy Saw-sedge	04, 09
Halosarcia pergranulata ssp. *pergranulata*	Blackseed Glasswort	02, 06, 08, 09
Hemichroa pentandra	Trailing Hemichroa	02, 04, 09
Lepidosperma congestum	Clustered Sword-sedge	near Retarding Basin
Lepidosperma curtisiae	Little Sword-sedge	13
Lepilaena cylindrocarpa	Long-fruit Water-mat	07
Melaleuca lanceolata ssp. *lanceolata*	Moonah	01, 13, 14, 16, 26
Mimulus repens	Creeping Monkey-flower	12
Olearia axillaris	Coast Daisy-bush	04
Persicaria prostrata	Creeping Knotweed	11
Pratia irrigua	Salt Pratia	12
Puccinellia stricta var. *perlaxa*	Plains Saltmarsh-grass	12, 27
Puccinellia stricta var. *stricta*	Australian Saltmarsh-grass	12
Samolus repens	Creeping Brookweed	D19725, 02, 04, 12, 15

REGIONALLY SIGNIFICANT		
Botanical name	**Common name**	**Quadrat(s)**
Sarcocornia blackiana	Thick-head Glasswort	04
Spergularia marina s.s.	Lesser Sea-spurrey	12
Sporobolus virginicus	Salt Couch	12
Swainsona lessertiifolia	Coast Swainson-pea	14
Threlkeldia diffusa	Coast Bonefruit	01
Triglochin striatum s.l. (dwarf saltmarsh form)	Streaked Arrowgrass	12
Veronica gracilis	Slender Speedwell	24
Wilsonia rotundifolia	Round-leaf Wilsonia	27

6.1.3 Vegetation communities / sub-communities

The significance of a particular vegetation community or sub-community is primarily a function of rarity. This is represented by the following criteria:

- Distribution and abundance (of the community) in the study area, in the region, and the state;
- Level of depletion since European settlement;
- Number and ranking of significant species (of which rarity is an important criterion) occurring in the community; and
- Size and extent of contiguous vegetation of comparable floristic composition and structure. This criterion primarily assesses the ground coverage of a plant community in a given area. Other factors being equal, larger stands of a particular plant community are generally of higher conservation value than smaller areas.

Secondly, the overall condition of the plant community is considered, synonymous terms being 'quality' or 'naturalness'. In botanical jargon this is often referred to as the degree of 'intactness'. This aspect of the plant community is primarily a function of disturbance and is outlined in Section 5.1.4 and Appendix 4.

The significance assessment of the vegetation should be independent of land tenure, that is, whether the community occurs on private or public land. In a practical sense however, the security of the community depends very much on the tenure of the land. In general, most security is provided by biological reserves and least by freehold land.

The extent to which a particular vegetation community is present in biological reserves is termed 'reservation status'. Terminology appropriate for a continuum of increasing reservation status may include:

- very poor to nil;
- poorly represented;
- moderate representation; and

- substantial areas reserved (or, in the case of naturally restricted vegetation types, most of the remaining occurrences).

Vegetation of the study area (excluding pasture and wholly exotic vegetation) overall has **National significance** based on the assessment of significance given in Table 8.

Table 8. Significance and quality of vegetation communities and sub-communities, proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course, Torquay.

State – National Significance	
1.0 Dune Complex	
1.1 Moonah *(Melaleuca lanceolata)* - Coast Wirilda *(Acacia retinodes* var. *uncifolia)* Shrubland	**Vegetation Quality: 3**
2.0 Saltmarsh Complex	
2.1 Shrubby Glasswort (*Sclerostegia arbuscula*) Shrubland	**Vegetation Quality: 1**
2.2 Blackseed Glasswort (*Halosarcia pergranulata*) Shrubland	**Vegetation Quality: 1**
2.3 Beaded Glasswort (*Sarcocornia quinqueflora* ssp. *quinqueflora*) Herbfield	**Vegetation Quality: 1**
2.4 Blue Tussock-grass (*Poa poiformis*) – Sea Rush (*Juncus kraussii*) Grassland/Sedgeland	**Vegetation Quality: 1**
2.6 Long-fruit Water-mat (*Lepilaena cylindrocarpa*) Submerged Herbfield	**Vegetation Quality: 1**
Regional Significance	
2.0 Saltmarsh Complex	
2.5 Sea Rush (*Juncus kraussii*) – Streaked Arrow-grass (*Triglochin striatum*) Herbfield	**Vegetation Quality: 3**
2.7 Round-leaf Wilsonia *(Wilsonia rotundifolia)* Herbfield	**Vegetation Quality: 3**
Local Significance	
1.0 Dune Complex	
1.2 Blue Tussock-grass (*Poa poiformis*) – Knobby Club-sedge (*Isolepis nodosa*) Grassland/Sedgeland	**Vegetation Quality: 4**
3.0 Freshwater Herbfield has not been rated because it is 'artificial' vegetation of Farm Dams.	
4.0 Exotic vegetation is of no botanical conservation significance.	

Vegetation Quality Ratings (from Carr et al. 1997)

1. **Intact.** Vegetation structurally and floristically **intact** or almost so; weed invasions **minimal** or weeds absent; disturbance **minimal** or absent.
2. **Substantially intact.** Vegetation structurally and floristically **substantially intact**; low levels of weed invasion; **low levels** of disturbance.
3. **Partially intact**. Vegetation **partially intact** structurally and/or floristically; **moderate** levels of weed invasion: woody vegetation intact and herbaceous vegetation greater than 50% cover; **moderate** levels of disturbance.

4. **Highly modified**. Vegetation comprised of **less than 50% cover** of indigenous species and/or with **much reduced** species richness; in the case of woody vegetation the upper strata may provide moderate to high cover but field layer substantially exotic; **high** levels of disturbance.

5. **Very highly modified.** Vegetation **grossly modified** with scattered to rare dominants of upper strata only persisting; **very high cover** of weeds; current or former levels of disturbance **high or very high**.

6.1.4 Legislation

The vegetation community, Coastal Moonah Woodland, is listed on Schedule 2 of the Victorian *Flora and Fauna Guarantee Act 1988*. It is listed because:

- It previously occupied a wider band on coastal calcareous soils of Victoria, west of Phillip Island. Much of this has been cleared for agriculture, residential and other developments, leaving remnants that have become degraded due to weed invasion and recreational pressures. The distribution of this community has greatly diminished and degrading pressures are continuing; and
- It has a restricted distribution in the state because of its occurrence on coastal calcareous soils.

The better quality Coastal Moonah – Coast Wirilda Scrubland dominated by Moonah recorded for the study area, accords with the Coastal Moonah Woodland listed under the *Flora and Fauna Guarantee Act* in its structure and floristic composition. The areas of higher quality Moonah-dominated vegetation in the study area are deemed to be of State conservation significance. The more degraded areas have the potential for recovery with protection and appropriate management (Section 7.0).

6.2 Fauna

6.2.1 Criteria for determining significant species

The following criteria have been applied in the present study to determine the significance of fauna species:

Local All indigenous fauna is considered significant at a Local level, because of the overall decline in the fauna since European settlement, and the continued incremental loss of habitat and reduction in abundance due to development.

Regional A taxon is considered significant at a Regional level if:

- it has a disjunct distribution in the region; or
- it is represented in high concentrations in terms of colonial nesting, roosting or feeding sites; or
- it is substantially depleted or restricted in the region; or
- it has an unusual ecological or biogeographical occurrence.

State A taxon is considered significant at a State level if it is:

- listed under *Threatened Vertebrate Fauna in Victoria – 1999* (DNRE 1999);
- listed under Schedule 2 of the Victorian *Flora and Fauna Guarantee Act 1988*;

National A taxon is considered significant at a National level if it is:

- listed as Endangered, Vulnerable or Presumed Extinct on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*; or
- listed under the following Australian Action Plans and similar documents: Cogger et al. (1993), Garnett (1993), Lee (1995), Maxwell et al. (1996), Tyler (1997) or Wager and Jackson (1993).

6.2.2 Criteria for determining significant sites

The criteria used here for determining the zoological significance of sites are generally based on the criteria developed by Schulz et al. (1991) and Beardsell (1997) for their sites of faunal significance studies in the Greater Melbourne region. These criteria have been adapted for the present study to incorporate limiting factors associated with small-scale fauna surveys and environmental impact assessment studies.

In such cases, study areas are frequently small, and fauna surveys are usually brief. Given these constraints there is seldom the opportunity for repeated observations over time or surveying over seasons to enable recording of breeding and seasonal migrants. Consequently, they may fail to record rare, transient or cryptic species.

Where the available data for a site are insufficient to determine significance based on these criteria, a category of 'potential' significance is designated. The level of potential significance (local, regional, state, national) is judged on the basis of extrapolation from possible nearby, better known habitats, and the nature and quality of the habitat (e.g. size, links to other areas, degree of historical disturbance/weed invasions, etc.). In such instances, more survey work is recommended to confirm the level of significance.

In the significance criteria presented below, the term 'regularly supports' refers to the presence in a habitat of the subject species for a period in its life cycle critical to its survival (e.g. migration, winter or nomadic nectar feeding) or regularly at times of population dispersal (seasonal or long-term).

Local Significance

A site is designated as being of Local significance if:

- it has moderate to high potential for serving as a habitat link between two sites of Regional significance or as a link to suburban areas to enable native species to disperse into such areas; or
- it has moderate to high potential for rehabilitation and management for the public appreciation of fauna values.

Regional Significance

A site is designated as being of Regional significance if:

- it regularly supports species that are classified as Regionally significant; or
- it regularly supports a disjunct population, unusual ecological or biogeographical occurrence or extraordinary concentration in a regional context of a naturally restricted (e.g. colonial nesting, roosting or feeding) or substantially depleted or restricted taxon in the region; or
- it supports a high level of species richness for the Otways region (e.g. The number of species required to fulfil this criterion will vary depending on the size, scope and season of the survey. For the Greater Melbourne region Schulz et al. (1991) used 2' latitude by 2' longitude blocks with a six year survey period. Their species richness criteria required 7 to 21 native mammal species, 50 to 100 native bird species, or 8 to 24 species of native frogs and reptiles); or
- it contains a partial habitat link between two sites of state fauna significance, or a Regional and State site, or a primary habitat link between two sites of regional significance, or between a site of State significance and large urban areas.

State Significance

A site is designated as being of State significance if:

- it regularly supports a population of a taxon listed under the *Flora and Fauna Guarantee Act 1988*; or
- it supports species listed as Endangered in Victoria (DNRE 1999) that visit the site sporadically, and are not recorded breeding at the site; or

- it regularly supports species listed as Vulnerable in Victoria (DNRE 1999). For birds this only includes records of breeding, a single sighting of a large population or repeated sightings of individuals; or
- it regularly supports a population of a taxon listed as Low Risk – near threatened or Data Deficient in Victoria (DNRE 1999), or four or more species of international migratory waders, or a roosting colony of cave-dwelling bats, or more than 1,000 waterfowl; or
- it supports very high species richness in the region. For the greater Melbourne region, Schulz et al. (1991) specified 22 or more native mammal species, 110 to 150 native bird species, or 25 or more species of native frogs and reptiles for 2' latitude by 2' longitude blocks surveyed over six years. The number of species required to fulfil this criterion will vary depending on the size, scope and season of the survey, and a knowledge of the fauna of the region; or
- it regularly supports 5% or more of the Victorian population, or an extraordinary concentration in a state context of a native mammal, reptile or frog taxon; or
- it represents an intact primary habitat link containing comparable habitat attributes to two connecting sites or series of sites of state or higher zoological significance; or
- it has high scientific significance, e.g. it forms a long-term study or monitoring site, or it has biogeographical significance in the region.

National Significance

A site is designated as being of National significance if:

- it regularly supports a population of a species listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, or by Cogger et al. (1993), Garnett (1993), Lee (1995), Maxwell et al. (1996), Tyler (1997) or Wager and Jackson (1993); or
- it regularly supports two or more species listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, or by Cogger et al. (1993), Garnett (1993), Lee (1995), Maxwell et al. (1996), Tyler (1997) or Wager and Jackson (1993); or
- it regularly supports a large population (exceeding 5% of the total known population) of a taxon listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, Cogger et al. (1993), Garnett (1993), Lee (1995), Maxwell et al. (1996), Tyler (1997) or Wager and Jackson (1993).

6.2.3 Significant species

All native fauna species of the study area are considered at least Locally significant.

Nine species are known to be of National significance, while 26 of State significance occur within the study area (Table 9). National and State significant species are discussed in more detail below if their likelihood of regular occurrence in the study area is considered moderate or high, or they have been confirmed at the site.

Table 9. Faunal species of State or National Significance recorded in the proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course study area, Torquay.

Direct Impact

L Loss of feeding habitat associated with construction of the proposed development.

Indirect Impact

HD Human-induced disturbance leading to disruption of feeding or breeding behaviour.

AH Altered hydrological regimes resulting in degradation of estuarine and saltmarsh habitats.

P Increased risk of predation or disturbance from domestic pets (dogs, cats) associated with residential development.

SPECIES AND SIGNIFICANCE	LIKELIHOOD OF REGULAR OCCURRENCE	SPECIES POTENTIALLY IMPACTED IN THE STUDY AREA	TYPE OF IMPACT	
			DIRECT	INDIRECT
NATIONAL				
Smoky Mouse	to be determined	to be determined		
Orange-bellied Parrot	Mod-High	Yes	L	HD, AH, P
Hooded Plover	Mod-High	Yes		HD, P
Pacific Gull	Confirmed, Mod-High	Yes		HD, AH, P
Fairy Tern	Low	No		
Little Tern	Low-Mod	No		
Painted Snipe	Low	No		
Australasian Bittern	Low	No		
Masked Owl	Low	No		
Growling Grass Frog	Low-Mod	No		
Swamp Skink	Low-Mod	Yes		AH, P
STATE				
Fairy Prion	Low	No		
Common Diving Petrel	Low	No		
Pied Cormorant	Confirmed, Mod-High	Yes		HD, AH, P
Australasian Gannet	Low	No		
Whiskered Tern	Low-Mod	No		
Gull-billed Tern	Low	No		
Crested Tern	Mod	Yes		HD, AH, P
Caspian Tern	Low-Mod	No		
Eastern Curlew	Mod-High	Yes		HD, AH P
Glossy Ibis	Low	No		
Royal Spoonbill	High	Yes		HD, AH, P
Little Egret	Low-Mod	No		
Great Egret	Mod-High	Yes		HD, AH, P
Nankeen Night Heron	Low	No		
Little Bittern	Low	No		
Magpie Goose	Low	No		

SPECIES AND SIGNIFICANCE	LIKELIHOOD OF REGULAR OCCURRENCE	SPECIES POTENTIALLY IMPACTED IN THE STUDY AREA	TYPE OF IMPACT	
			DIRECT	INDIRECT
Australasian Shoveler	Low	No		
STATE				
Hardhead	Low	No		
Musk Duck	Low-Mod	No		
Grey Goshawk	Low	No		
Southern Giant Petrel	Low-Mod	No		
Northern Giant Petrel	Low-Mod	No		
Pectoral Sandpiper	Low	No		
Kelp Gull	Low	No		

Nationally Significant Species

Smoky Mouse (*Pseudomys fumeus*) (to be confirmed)

- Listed as Rare in Australia (Lee 1995)
- Listed as Endangered in Australia (ANZECC 1999)
- Listed as Endangered in Victoria (DNRE 1999)
- Nominated for listing under the *Flora and Fauna Guarantee Act 1988*, Nomination No. 421.

Distribution

The Smoky Mouse is known from two sites in the ACT and from several disjunct populations in Victoria (Menkhorst 1995). In Victoria populations are known from the Grampians, coastal slopes of the Otway Ranges, the Central Highlands and coastal East Gippsland (Lee 1995).

Ecology

The Smoky Mouse is known to inhabit a variety of habitats, such as heath (including coastal and subalpine communities), dry forests and subalpine woodlands (Lee 1995, Menkhorst 1995). The species has also been known to occur in much wetter habitats, such as fern gullies in wet forests (Menkhorst 1995). The Smoky Mouse is vegetarian, eating mainly berries, seeds and fungi. The understorey of most Smoky Mouse sites is dominated by heathy shrubs (particularly from the plant families Fabaceae and Epacridaceae) which provide such food resources (Menkhorst 1995). The development of these heathy understorey species is dependent on fire, and changes in fire regimes are identified as a threatening process for this species (Lee 1995). Other threatening processes include loss of habitat due to vegetation clearing, and isolation of populations (Anon. 1997).

Status in the study area

The Smoky Mouse was detected from hairs sampled in the Dune Complex along hair-tube Line D (Map1). The Dune Complex mainly consists of introduced Marram Grass and Moonah Woodland – Coastal Wirilda Shrubland and is generally not representative of the habitat preferred by the Smoky Mouse. However, Coast Beard-heath (*Leucopogon parviflorus*) (Epacridaceae) was well represented in the Dune Complex (occurring in 11 quadrat sites, see Appendix 2) and would provide a suitable forage resource. The hair sample was confidently identified as Smoky Mouse and the result was also discussed between two researchers adept in hair analysis (H. Brunner and B. Triggs) (H. Brunner, pers. comm.).

The Smoky Mouse was not listed on the Atlas of Victorian Wildlife, DNRE records accessed for the larger study area (see section 4.2.2 and Appendix 5). Following the hair analysis results, we requested another Atlas search to ascertain the closest known record to Torquay of the Smoky Mouse. The search focussed on an area from Geelong to approximately Warrnambool in south western Victoria. Only 10 records exist, and all are at least 15 years old. The 10 records are from around Cape Otway (e.g. Blanket Bay and Parker River), Beech Forest west of Lorne and at least 105 km west of Torquay (Atlas of Victorian Wildlife, DNRE).

Until further trapping surveys are undertaken, the study area record must be treated as legitimate and it is possible that a previously unknown population is resident in this area.

Orange-bellied Parrot (*Neophema chrysogaster*)

- Listed as Endangered in Schedule 3 (Part 1) of the Tasmanian *Threatened Species Protection Act 1995*;
- Listed as Endangered on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*;
- Listed on the *Flora and Fauna Guarantee Act 1988* (Action Statement No. 43, Edgar and Menkhorst 1993);
- Listed as Endangered in Australia (Garnett 1993); and
- Listed as Critically Endangered in Victoria (DNRE 1999).

Distribution

The Orange-bellied Parrot has a restricted distribution: breeding only in south-western Tasmania (within the World Heritage Area) in spring and summer, then migrating to coastal Victoria and South Australia for winter. Most of the population winters around the western shores of Port Philip Bay and the Bellarine Peninsula in Victoria. Numbers on the mainland increase from March, peak in July and decline from August onwards, as birds return to Tasmania (Loyn et al. 1986).

Ecology

During winter the Orange-bellied Parrot feeds on the ripe or developing seeds of several saltmarsh or coastal herbs and shrubs, including *Sarcocornia quinqueflora*, *Sclerostegia arbuscula* and **Cakile maritima* (Brown and Wilson 1982, Loyn et al. 1986).

Factors threatening the Orange-bellied Parrot are habitat loss and fragmentation resulting from development (particularly feeding grounds), predation by foxes and cats, competition from introduced granivorous birds, loss of genetic variation due to small population size, and vulnerability to sudden catastrophes (e.g. disease and unfavourable climatic conditions when crossing Bass Strait) (Anon. 1991, Edgar and Menkhorst 1993). The widespread destruction of wintering habitat is thought to have been a critical factor in the decline of the species to its current low population levels. In 1981, the population was estimated at 150 individuals and from at least 1979-1990 the population is thought to have remained relatively stable (Starks et al. 1992). To address these issues, an Orange-bellied Parrot Recovery Team was formed in 1983, comprising representatives of Government conservation agencies and other ornithologists. Conservation activities include habitat management and protection in Victoria, South Australia and Tasmania, and annual winter counts.

Based on observations from the early 1980s to 1994 by the Tasmanian National Parks and Wildlife Service (TPWS), the major habitat requirements for the species appear to be a combination of saltmarsh feeding habitat and woodland, forest or scrub roosting habitat. Little information is available on the roosting preferences of migrating or over-wintering Orange-bellied Parrots. A one-year study of the Orange-bellied Parrot at Point Wilson in Victoria revealed only one roosting site, although another site was probably also used (Hill 1995).

Status in the study area

The saltmarsh adjacent to the study area is a known Orange-bellied Parrot site and is included in the Victorian surveys during the winter count (J. Starks, Birds Australia, pers. comm.). The saltmarsh is considered critical or 'core habitat' for the Orange-bellied Parrot in the region (M. Holdsworth, TPWS, pers. comm.; Carr and Kinhill Planners 1979; McMahon et al. 1994). The location provides preferred foraging areas (saltmarsh), supplemented by exotic pasture grasses that are known to supplement their diet (Loyn et al. 1986). Nearby dense coastal scrub provides potential roosting sites.

There were 63 records of the Orange-bellied Parrot in the vicinity of the study area (Atlas of Victorian Wildlife – Appendix 5). The majority of these are from Lake Connewarre to the north-east of the study area. The Orange-bellied Parrot was last reported from the saltmarsh in 1991 (J. Starks, pers. comm.; Atlas of Victorian Wildlife, DNRE).

Core Orange-bellied Parrot habitat may be defined as the habitat where the Orange-bellied Parrot carries out activities essential to its survival (e.g. feeding, roosting or breeding). The protection of core habitat may be integral to the conservation of the Orange-bellied Parrot. If this habitat is changed, fragmented or disturbed, its usage by the Orange-bellied Parrot may decline. To ensure short-term and long-term conservation of the species, the core habitat must encompass currently used areas and additional areas which are of comparable quality and which may be used in future (e.g. potential roosting habitat).

Hooded Plover (*Thinornis rubricollis*)

- Listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*;
- Listed as Rare in Australia (Garnett 1993);
- Listed on the *Flora and Fauna Guarantee Act 1988* (Action Statement No. 9, Schulz 1996)
- Listed as Endangered in Victoria (DNRE 1999)

Distribution

The Hooded Plover occurs on and around the coast of southern Australia and in inland lakes in south-western Australia (Garnett 1993). In Victoria, the species rarely enters Port Phillip Bay beyond Mud Islands, or Western Port Bay beyond Phillip Island and Sandy Point (Emison et al. 1987).

Ecology

In eastern Australia, the Hooded Plover occurs on ocean beaches and open salt lakes immediately behind these beaches, and breeds above the high tide mark or in sheltered, unvegetated dunes behind the beach (Marchant and Higgins 1993). Here, its nest is vulnerable to destruction by humans, introduced predators and off-road vehicles and this has lead to a decline in its numbers in the more settled parts of the mainland Australian coastline (Garnett 1993).

The Hooded Plover feeds on sandy ocean beaches, particularly among beach-washed seaweed and on rocky shore platforms where it takes a range of food, including crustaceans, shellfish and insects (Marchant and Higgins 1993). Introduced predators (e.g. dogs) are considered a major threat to nesting Hooded Plovers (Retallick and Bolitho 1993, Schulz and Bamford 1987, Emison et al. 1987).

Status in the Study Area

There are 31 records of the Hooded Plover from the larger study area (Atlas of Victorian Wildlife, DNRE). Of these, 12 were approximately 4 km north-east of the study area, in the vicinity of Thompson Creek, Point Impossible and Black Rocks (Appendix 5). S. Howlles (pers. comm.) has also recently reported seeing pairs bathing near the drain outlet, Thompson Creek, immediately west of Breamlea. Two breeding pairs were recorded in 1989 near the sewerage outfall north of Black Rocks (Atlas of Victorian Wildlife, DNRE). Potential foraging and breeding habitat occurs close to the study area (e.g. Whites Beach and the saltmarsh).

Pacific Gull (*Larus pacificus*)

- Listed as Rare in Australia (Garnett 1993); and
- Listed as Lower Risk – near threatened in Victoria (DNRE 1999).

Distribution

The Pacific Gull predominantly occurs along the Victorian coast westward from Wilsons Promontory to the South Australian border. Individuals can be observed as far north as Sydney and may be vagrants to Queensland, although they are most abundant in Bass Strait (Garnett 1993).

Ecology

The Pacific Gull, a restricted colonial breeding species (Garnett 1993) has experienced substantial population declines since the late 1980s. The Pacific Gull prefers gently shelving sandy beaches, estuaries and sand-bars that are protected from ocean waves and surf action (Garnett, 1993, Higgins and Davies 1996). They can occur on mudflats and wetlands and may forage here, as well as along coasts and sandy beaches (Higgins and Davies 1996). Breeding is colonial and usually occurs off-shore on rocky islets or on rocky beaches.

Status in the Study Area

Two individuals were observed, one on Whites Beach (Beach/Foreshore habitat) and another flying over the saltmarsh. There are 11 records from the larger study area, the most recent being from Black Rock in 1996 (Atlas of Victorian Wildlife, DNRE). There is ample foraging habitat for this species in the saltmarsh and along the coastline south of the study area.

Swamp Skink (*Egernia coventryi*)

- Listed as Rare or Insufficiently Known in Australia (Cogger et al. 1993); and
- Listed as Vulnerable in Victorian (DNRE 1999).

The Swamp Skink only occurs in south-eastern Australia, from Mt Gambier in the west, across southern Victoria to just beyond the NSW border in the east (Robertson 1998). Preferred habitat includes densely vegetated freshwater swamps and associated watercourses as well as wet sedgelands and saltmarshes (Robertson 1998). While the species was not recorded in the area in the Atlas of Victorian Wildlife, the dense and often impenetrable nature of the species' habitat often makes detection difficult. The species is thought to have experienced severe declines throughout much of its distribution due to loss and fragmentation of habitat, changed hydrological regimes of wetlands, pollution of wetlands and urban development (Robertson 1998). Suitable habitat occurs in the saltmarsh adjacent to the study area and it is recommended that the status of the species in this area is determined.

State Significant Species

Pied Cormorant (*Phalacrocorax varius*)

- Listed as Lower Risk – near threatened in Victoria (DNRE 1999).

The Pied Cormorant is widespread on coastal , sub-coastal and inland waters of the mainland excluding the drier areas of Western Australia (Marchant and Higgins 1990). In Victoria, the Pied Cormorant occurs on large freshwater and saline wetlands as well as tidal bays along the coast. It is a colonial breeder and the only large permanent breeding colony occurs on Lake Borrie in the Werribee Sewage Farm (Emison et al. 1987). While there are no known breeding colonies in the study area, Thompson Creek and the Retarding Basin provide suitable foraging habitat. It is also possible that the birds may be utilising and moving through this area *en route* to Lake Connewarre where other sightings have been recorded (Atlas of Victorian Wildlife; see Appendix 5).

Crested Tern (*Sterna bergii*)

- Listed as Lower Risk – near threatened in Victoria (DNRE 1999).

The Crested Tern is widespread in all coastal regions of mainland Australia and Tasmania. Habitat includes exposed ocean beaches where it feeds, and more sheltered estuaries and bays (Higgins and Davies 1996). It often roosts on bare, flat, sandy beaches above the water-mark or near the edge of the water in exposed intertidal zones (Higgins and Davies 1996). Breeding occurs colonially on the ground on near-coastal islands (Emison et al. 1987). Several records exist from the Breamlea area (Atlas of Victorian Wildlife; see Appendix 5) and the larger study area (e.g. Thompson Creek estuary and Beach/Foreshore) provides suitable roosting and foraging habitat.

Eastern Curlew (*Numenius madagascariensis*)

- Listed as Lower Risk – near threatened in Victoria (DNRE 1999); and
- Listed under CAMBA and JAMBA

The Eastern Curlew is a summer migrant to Victoria from breeding grounds in Siberia (Emison et al. 1987). During summer large aggregations regularly occur on tidal mudflats at Port Phillip and Western Port Bays and Corner Inlet. Smaller numbers occur elsewhere on mudflats and sometimes on the muddy shores of inland saline lakes (Emison et al. 1987). The Eastern Curlew feeds, by probing, on mudflats and in rock pools, and roosts in saltmarshes and spits. The world population is small and the JAMBA and CAMBA legislation acts to protect areas in Victoria which are vital for their conservation (Emison et al. 1987). The saltmarsh, the muddy edges of the Thompson Creek estuary and the Beach/Foreshore provide potential roosting and foraging habitat for this migratory wader.

Great Egret (*Ardea alba*)

- Listed as Endangered in Victoria (DNRE 1999); and
- Listed on the *Flora and Fauna Guarantee Act 1988*.

The Great Egret occurs throughout mainland Australia, excluding the drier western interior. It occurs throughout Victoria, but is less common in the north-west and east of the state (Marchant and Higgins 1990). The Great Egret is considered rare in terms of abundance and distribution in Victoria (Anon. 1994). Preferred habitat includes terrestrial wetlands, estuarine and littoral areas as well as tidal reaches of watercourses, saltmarshes and dry saltpans (Marchant and Higgins 1990). The Great Egret has been observed at the Thompsons Creek estuary at Breamlea (S. Howlles pers. comm.) and these areas, including the saltmarsh, provide suitable foraging habitat. There have been 16 records of the Great Egret in the larger study area (Appendix 5), five of these are within close proximity of the study area.

Royal Spoonbill (*Platalea regia*)

- Listed as Vulnerable in Victoria (DNRE 1999).

The Royal Spoonbill occurs in eastern and northern Australia, occupying wetlands, sheltered marine habitats and inundated grasslands, as well as permanent and ephemeral waters in the arid interior of Australia (Marchant and Higgins 1990). Within those habitats, it prefers large areas of shallow water where it catches its food while wading. The Royal Spoonbill usually nests in the crowns of trees overhanging water, or in emergent vegetation over water, such as reeds, rushes and lignum (Marchant and Higgins 1990). One Royal Spoonbill was observed at the mouth of Thompson Creek and sightings have been made widely in the general area, including at the saltmarsh, Thompson Creek at Breamlea, and further north-east around swamps at Barwon Heads (Appendix 5).

International Migratory Waders – CAMBA/JAMBA Species

Thirty (30) bird species are listed on CAMBA and/or JAMBA. Many of these species may have been recorded from Lake Connewarre, as the Atlas search included this area (see Section 4.2.2). While Lake Connewarre offers extensive and less disturbed habitat compared to the immediate study area, potential habitat occurs, for the majority of these listed species, in the saltmarsh and Thompson Creek adjacent to the study area. During field surveys and observations of Thompson Creek estuary at Breamlea, several JAMBA/CAMBA species were observed: Common Greenshank, Marsh Sandpiper and Common Sandpiper. If these species, (and the other CAMBA/JAMBA listed species) do occur in the saltmarsh and the study area, they are considered to be at least Regionally significant.

Other species

Other Regionally significant species were observed in Moonah - Coastal Wirilda Shrubland in the study area. The Spiny-cheeked Honeyeater and Singing Honeyeater are considered Regionally significant in the context of the Otway Plains. They both have disjunct distributions and isolated populations in Southern Victoria compared to their main strongholds in the north-west of the State (Emison et al. 1987). The Little Forest Bat is considered Regionally significant in the Otway Plains for similar reasons. Records of the Little Forest Bat along the coast in the Otway Plains are scattered and disjunct (Menkhorst 1995).

6.2.4 Conservation significance of study area

The study area (i.e. the proposed development site) is considered to be of **Regional** zoological significance. It supports a variety of Locally significant and several Regionally significant bird species (e.g. Spiny-cheeked Honeyeater and Singing Honeyeater). The study area also contains potential foraging habitat (exotic pasture and grasslands) and roosting habitat (Moonah - Coastal Wirilda Shrubland) for the Nationally significant Orange-bellied Parrot and potential habitat for the Smoky Mouse (e.g. Moonah - Coastal Wirilda Shrubland and stands of Coast Beard-heath). Confirmation that the Orange-bellied Parrot and the Smoky Mouse are utilising such areas could potentially elevate the significance of the study area to a National level.

While there is limited conservation value within the study area *per se* (i.e. the area proposed for development) the habitats adjacent to the study area (the larger study area) possesses fauna conservation values at all levels of significance. Several species of bird considered significant at Regional, State or National levels are residents, or suspected residents in adjoining Beach/Foreshore and saltmarsh habitats. These areas are of **State** (potentially **National)** zoological significance. The saltmarsh and the associated Thompson Creek and its estuary support several State significant water birds. This area also provides habitat for numerous migratory waders including birds listed under the CAMBA and JAMBA international treaties. The potential National significance level reflects the known Orange-bellied Parrot site at the saltmarsh, the record of Smoky Mouse from the Dune Complex and the occurrence of the Hooded Plover at Point Impossible. There is also potential habitat for the Nationally significant Swamp Skink in the saltmarsh.

Conservation values of the study area and larger study area can be summarised as follows:

- The most significant species is the Orange-bellied Parrot (National significance). The nearby saltmarsh of Thompson Creek is known habitat. The saltmarsh in the larger study area is prime foraging habitat, supplemented by neighbouring pasture. Dense coastal shrubland within the study area could provide cover for roosting.
- The record of Smoky Mouse from the Dune Complex needs to be further investigated. The possibility of a population in this area is of great interest and potentially important for the conservation of this species, and it heightens the conservation value of the larger study area.
- The Beach/Foreshore to the south of the study area contains suitable habitat for the Hooded Plover and Pacific Gull (National significance). The beach also provides habitat for Locally significant water birds (Great Cormorant) and the Dune Complex is an important habitat corridor for coastal fauna.
- The Retarding Basin within the study area regularly supports Locally significant species including the Little Pied Cormorant, Little Black Cormorant, Clamorous Reed-Warbler, Hoary-headed Grebe, Black-fronted Dotterel and White-fronted Chat. The State significant Pied Cormorant has also been observed here.
- The Moonah – Coast Wirilda Shrubland is the last remaining treed remnant habitat in the study area in an otherwise cleared and disturbed landscape. In view of the scarcity of similar habitat remnants along the coast from Torquay to Breamlea, this area provides important habitat for Locally significant mammals (e.g. Bush Rat, Swamp Wallaby, Short-beaked Echidna) as well as Locally and Regionally significant assemblages of birds (e.g. Singing Honeyeater and Spiny-cheeked Honeyeater).
- The Nationally significant Swamp Skink and Growling Grass (Warty Bell) Frog warrant further surveys to assess the presence or status of these species in potential habitats (saltmarsh and Retarding Basin respectively) within the study area.
- The study area is considered to be of **Regional** zoological significance, supporting numerous Locally and Regionally significant birds and Locally significant mammals. It provides important remnant habitat for native fauna in an otherwise cleared and developed landscape.

- The habitats to the south (Beach/Foreshore) and the east (saltmarsh) of the study area are considered zoologically significant at a **State** (potentially **National**) level. Adjacent habitats have high conservation values due to the presence of international migratory waders, State-significant water birds, and Nationally significant species, such as the Smoky Mouse, Orange-bellied Parrot and Hooded Plover.

Figure 1.

Torquay Sands Residential Lakes and Golf Course Development
Detailed Development Plan

GBLA
LANDSCAPE ARCHITECTS

7.0 ENVIRONMENTAL MANAGEMENT PLAN ELEMENTS

7.1 Environmental Management Plan requirements

The proponent for the Golden Beach (Torquay Sands) Residential Lakes and Golf Course development is required under Section 2 to the Comprehensive Development Zone in the Planning Scheme and the Section 173 Agreement to prepare an Environmental Management Plan (EMP). The following sets out in detail the context and content of the EMP (with points marked accordingly in the Agreement).

The specific environmental issues[+] to be addressed include:

8.1 making recommendations on any need to modify the content and layout of the Golden Beach (Torquay Sands) Concept Plan to ensure the objectives of the EMP will be achieved (General);

8.2 making recommendations as to the siting of the 14th golf course green to avoid encroachment upon or damage to the adjacent Moonah woodland area (EMP Elements 3 and 7);

8.3 making recommendations as to the siting and construction of a pathway between the 14th golf course green and the 15th tee, taking into account the environmental sensitivity of the area (EMP Elements 3 and 7);

8.4 making detailed design recommendations concerning the layout of the 5th golf course hole and adjoining amenity lake adjacent to the saltmarsh, including appropriate buffer distances from the saltmarsh area, landscape construction and drainage (EMP Elements 7 and 9);

8.5 protecting the salt marsh and dunes from site preparation and building, including sedimentation, dust, physical protection and noise abatement, and shall consider the requirement to provide a bay for the washing down of vehicles before entry to the site (EMP Element 14);

8.6 protecting the saltmarsh from contamination by any construction activities (EMP Element 14);

[+] The issues broadly follow the sequence of issues covered by the EMP Elements in Section 7.2. The relevant EMP Element or Elements are given in parenthesis after each of these 20 issues of the Agreements.

8.7 specifying that existing surface runoff flows emanating directly from the land to the saltmarsh will be maintained and monitored within accepted tolerances (EMP Element 6);

8.8 specifying that any reformation of the ponds adjacent to The Esplanade or reconfiguration of overflow water systems from the ponds will ensure reasonable measures are taken to preserve / transplant existing native vegetation around the ponds and that any overflow drainage line or pipe is aligned to avoid significant remnant vegetation and dune systems (EMP Element 6);

8.9 specifying the means by which the ground water of the dune system will be protected in the long term from contamination from nutrients and leachate entering the dune systems from artificial watering regimes; including investigation and recommendation on the use of treated effluent to irrigate fairways on the old tip site having regard to environmental impact on the dune (remnant vegetation) and saltmarsh system (EMP Elements 5 and 6);

8.10 ensuring that no part of any fairway is to encroach down the tip face or onto any area where Moonah woodland either exists or previously existed prior to the unlawful clearing undertaken in 1998 (EMP Elements 3 and 7);

8.11 making recommendations on the barriers and signs needed to limit human movement in the Moonah woodland and saltmarsh communities during construction phases (EMP Element 14);

8.12 recommending a system for monitoring of environmental parameters for the sustainability of the saltmarsh and Moonah woodlands which will demonstrate indications of environmental change, and contingencies for amelioration of such change (EMP Elements 1 and 2);

8.13 recommending a turf management plan* for the golf course which describes design considerations and management practices that will minimise risk and impact to the natural and aesthetic environment of the surrounding land (EMP Elements 5 and 6);

8.14 recommending species of plants for street tree planting and landscaping (EMP Element 9);

8.15 preventing the planting of any drainage lines and wetlands with invasive aquatic species (EMP Elements 4, 6 and 9);

8.16 recommending a system for the eradication and prevention of assisted spread of serrated tussock and other noxious and environmental weeds (EMP Element 4);

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* As part of the Turf Management Plan, provision will be made for the disposal of grass clippings to the satisfaction of Council.

8.17 recommending the most effective means of incorporating a buffer zone along the eastern boundary of the development to protect the saltmarsh. Within the buffer zone, appropriate fencing shall be constructed to the satisfaction of Council, and the area revegetated with indigenous species using local seed stock. This buffer shall be kept clear of machinery, fill, weeds and other associated materials (EMP Element 7);

8.18 addressing and making recommendations on methods to control the invasion of domestic plants and activities into the saltmarsh buffer area (EMP Elements 4 and 7);

8.19 providing for the erection of a 1.8 metre wire mesh fence at the toe of the northern slope of the former tip site to prevent access to the saltmarsh by animals, visitors and golfers seeking to retrieve golf balls; and providing for planting of the tip face with indigenous vegetation to be established and maintained to the requirement and satisfaction of Council (EMP Elements 3 and 7);

8.20 making recommendations on the keeping of domestic pets on the estate including appropriate 'no cat and dog zones' to protect the saltmarsh and dune system adjacent to the development (EMP Element 10).

The EMP includes 15 elements embracing the above issues agreed between Council and the Developer. These are discussed below. EMP elements are structured to help interested parties to identify the *reasons* for management measures, *how* they will be achieved and *how* their *success* will be measured.

Some EMP elements are specific to the saltmarsh or Moonah – Coast Wirilda Shrubland. These elements and others pertaining to more general impacts will assist in protecting ecological values in areas not directly impacted by the development.

General guidelines only are given for most of the EMP elements, further work will be required to provide more detail about how management objectives will be achieved. Such elements will need to be refined when the final details of design and operation of the residential and golf course development are available.

The Comprehensive Development Plan (Figure 1), dated 26 June 2001, shows the general layout of the Golden Beach (Torquay Sands) development and establishes precinct boundaries in accordance with the associated legend.

In their March 2000 report, the Advisory Committee considered this proposed development in respect of Amendment R60 to the Surf Coast Planning Scheme. The Advisory Committee (McKenzie and Westwood 2000) addressed these and other issues raised by submissions from objectors to the development. The Committee made specific comments and recommendations on a range of issues which are also addressed in this EMP.

The authors of this EMP believe that environmental protection and enhancement objectives (as detailed in the EMP elements) can be met, providing the recommendations are implemented and appropriate operational, monitoring, review and auditing protocols are in place. Successful realisation of these objectives also presupposes that obligations and responsibilities of parties other than the Developer and Golf Course Manager are met, notably those of the Surf Coast Shire, the Department of Natural Resources and Environment, the Trust for Nature and the Environmental Protection Authority (see Section 7.2).

The EMP elements are summarised below and the recommendations, responsible parties/authorities, timing and frequency of monitoring/review are given. An additional activity, the proposed Smoky Mouse survey by the Department of Natural Resources and Environment in the coastal reserve on the south side of The Esplanade, is also noted in this EMP.

7.2 Summary of Environmental Management Plan Elements for the proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course

Element 1 – **Council Conservation Zones**

This element outlines and addresses the issues related to the Dune Complex and Moonah – Coast Wirilda Shrubland contained within two proposed Conservation Zones. Important requirements for managing the vegetation of these areas include weed control, revegetation, rabbit control, and potential fire hazard. These areas are also important in providing fauna habitat and management measures to maintain and enhance the conservation zones in this capacity are included.

Element 2 – **Saltmarsh Complex Management**

Management of the Saltmarsh Complex resides with the EMT, membership of which includes Surf Coast Shire, Trust for Nature and the developer and this element outlines the major relevant issues. Restoration of the hydrological regime (tidal flooding) is foremost, followed by the development of an appropriate management structure and preparation of a detailed management plan.

Element 3 – **Revegetation and Retention of Native Vegetation of Fauna Habitat**

Guiding principles for the revegetation of the Moonah – Coast Wirilda Shrubland and saltmarsh are given, including the aim to compensate for vegetation clearance carried out in 1998. Expansion and enhancement of the remnant vegetation edging the golf course and development areas are also covered.
Retention of Native vegetation and habitat addresses the issues related to minimising the loss of native vegetation and fauna habitat on the site. Location of significant ecological attributes is a key factor, as is minimising impacts on these areas during construction and when the residential lakes and golf course development is operational.

Element 4 – **Weed Management**

Weed management involves several issues, firstly, a pre-development stage addressing weed issues in the Conservation Zone, targeting particularly serious weed species and site preparation for revegetation. Secondly, post-development control of potential horticultural escapees from the residential area is an issue.

Element 5 – **Water Quality Management Procedures**

Procedures, guidelines and practices are summarised for protecting runoff water quality within and from the development site. Necessary procedures both during and after the development phase are covered. The major site issues are wastewater irrigation practices, sediment and nutrient generation and mitigation, and site maintenance practices.

Element 6 – **Hydrology, Drainage and Constructed Wetlands**

Concepts developed by Consultants to manage stormwater runoff and treated effluent for golf course irrigation are outlined with several options that need to be tested. Of overriding concern is the need to protect the downstream saltmarsh from excessive freshwater impacts.

Element 7 – **Buffer and Interface Zones**

Mitigation of direct and indirect edge effects are outlined in this element. Buffer zones play a key role in reducing potential adverse edge effects, such as increased noise or light, disturbance by people and introduction of weed species. The extent and nature of buffers in different zones as well as complementary actions (. e.g. fences) are given.

Element 8 – **User-related Issues**

The Golden Beach (Torquay Sands) development will result in increased human traffic in and around the site. This element addresses such issues as beach access, including erosion problems, increased rubbish and recreational use (e.g. dogs, bikes). Addressing these issues will involve co-operative management or arrangements between MHY Handbury Joint Venture, Torquay Public Reserves and the Surf Coast Shire.

Element 9 – **Indigenous Landscape and Amenity Planting**

The use of indigenous vegetation in a horticultural context is outlined. In character with the remaining indigenous vegetation, the use of the local flora is advocated in amenity and landscape plantings to complement the broad environments present.

Element 10 – **Domestic Animals**

The impact of domestic animals on the natural environment is discussed with actions to ameliorate potential problems. It is acknowledged that pets are an integral part of human society and solutions are offered, such as pet exclusion zones (e.g. a 'no cat zone' over most of the site), to control of the movement of pets, provision for removal of dog faeces and the implementation of curfews.

Element 11 – **Feral Animal Control**

Rabbits are present in large numbers at the Golden Beach (Torquay Sands) site. Measures including fencing, poisoning, fumigation and warren ripping are outlined for rabbit control. Foxes are mentioned, but specific measures addressing their control are not given because of the need for broad-scale control involving the wider community.

Element 12 – **Mosquitoes**

The presence of constructed wetlands may cause a problem with mosquitoes. Design measures, such as water management and vegetation issues are summarised, as well as the use of native predatory fish as a means of control.

Element 13 – **Fire**

Activities designed to minimise the risk of fire are outlined. The development and implementation of a Fire Management Plan and consultation with the Country Fire Authority and Surf Coast Shire is required.

Element 14 – **Construction Activities**

Measures and controls to be implemented during all construction phases of the development to manage and protect soils, hydrological values, water quality and flora and fauna are outlined.

Element 15 – **Smoky Mouse**

Requirement to confirm the presence of the nationally significant Smoky Mouse, and to prepare an appropriate Management Plan if the species is detected.

7.2.1 ENVIRONMENTAL MANAGAGEMENT PLAN ELEMENT 1: MANAGEMENT OF COUNCIL CONSERVATION ZONES

Introduction

Two Conservation Zones are indicated on the Comprehensive Development Plan (Figure 1). They are intended to preserve the remnant Dune Complex vegetation, the large block of Moonah – Coast Wirilda Shrubland to the west and the much smaller remnant of this to the east, where the largest Moonah stands are concentrated.

The vegetation has been considerably degraded (Section 5.1) but is still highly significant (Section 6.1). These remnants have several major management requirements to maintain and upgrade vegetation and fauna habitat values which are being eroded, particularly by weed invasion and rabbit grazing. The principal management issues are:

- Weed control
- Revegetation
- Rabbit control
- Fauna habitat and user-related issues
- Fire

These issues are addressed separately the table below. , Prior to the transfer of the Conservation Zones to the Council, the Developer must control, revegetation, rabbit control, fauna habitat protection / rehabilitation, user-related issues and fire management. Foxes may have a deleterious impact on fauna. Their control however, discussed in EMP Element 11 (Feral Animal Control) is only relevant in the context of the whole development area and it would be futile unless all surrounding land managers also took similar action in a community – based scheme over a wide area. The table below aims to identify management issues and the strategies required to achieve the specified objectives. Staging of the MWMP will be subject to Council budgetary undertakings and priorities.

PLAN SUB-ELEMENT 1.1	Preparation of Moonah Woodland Management Plan	Responsible Parties	Timing or Frequency
Objective	To protect and enhance the environmental assets within the Council Conservation Zones (CCZs)		
Implementation Actions	• Engage a qualified environmental consultant to prepare a Moonah Woodland Management Plan (MWMP) for both Council Conservation Zones before hand-over to Council. The Plan will: • document flora and fauna management requirements (field survey); • address weed control, revegetation, rabbit control, fauna habitat protection and rehabilitation, fire prevention and user-related issues; • include an implementation program (an action plan based on continual improvement) outlining responsible parties, actions, time-lines monitoring requirements and estimate of costings. The Management Plan is to be prepared in consultation with Council and be approved by Council. • Fence the boundaries of the CCZs before commencement of development construction	• Developer • Developer	• June 2001 ✓ • 2001
Follow-up or Ongoing Actions	• Periodic review of MWMP as indicated in the document *	• Environmental Management Trust	• 5-yearly
Performance Measures and Monitoring	• Individual MWMP sub-elements or issues (including those below) will have performance measures and monitoring requirements identified and detailed in the Management Plan	• Developer	• June 2001

* Insert additional Follow-up Action as per letter of approval of EMP.
  - Fence around CCZ shall be increased in height if required to prevent trespass of golfers
    - Developer/Golf Course Manager
    - within 5 years of commencement of use of this part of golf course.

PLAN SUB-ELEMENT 1.2	Weed Control	Responsible Parties	Timing or Frequency
Objectives	To prevent degradation of the State-significant remnant Moonah – Coast Wirilda Shrubland by weed invasions. Weed species targeted for elimination (Appendix 8) will not occur within the Council Conservation Zones after five years from the implementation of management activities.		
Implementation Actions	To achieve these objectives the following activities will be undertaken (as detailed in the MWMP): • The MWMP shall include a detailed field assessment (survey) of weed invasions and their impacts, and mapping of population size and density as appropriate to their management. The assessment must also detail the control methods and timing as appropriate to the particular weed species, and their distribution or population size. • Eliminate weed species (as listed in Appendix 8) if and when they recolonise from off-site. • Maintain low population levels for selected weed species (Appendix 8) for which elimination is not feasible. • Implement the control activities outlined in Appendix 8.	• Developer • Surf Coast Shire • Surf Coast Shire • Developer / Surf Coast Shire as stated in MWMP.	• June 2001 • Regular and frequent inspections • Regular and frequent inspections • 2001 / 2002
Follow-up or Ongoing Actions	• Periodic review of MWMP as it relates to weed management • Maintain fencing in good condition • Ongoing weed monitoring and management activities (control or elimination) as detailed in MWMP	• Environmental Management Trust • Golf Course Manager / Surf Coast Shire • Surf Coast Shire	• 5-yearly • Regular and frequent inspections • As detailed in MWMP

PLAN SUB-ELEMENT 1.2	Weed Control	Responsible Parties	Timing or Frequency
Performance Measures and Monitoring	• To be determined in MWMP but should generally aim for: • Elimination of target species from the sites. • Effective control (cf. elimination) of selected weed species within a similar time frame. • Monitoring and ongoing revegetation as required as part of a 5-year (at minimum) program	• Surf Coast Shire • Surf Coast Shire • Surf Coast Shire	• Within 5 years • Within 5 years • As detailed in MWMP

PLAN SUB-ELEMENT 1.3	Revegetation	Responsible Parties	Timing or Frequency
Objective	To restore the broad pre-European structure of the Moonah – Coast Wirilda Shrubland and upgrade the currently depleted floristic (species) composition of this remnant vegetation. To improve the conservation value of the CCZs, both vegetation and fauna habitat.		

PLAN SUB-ELEMENT 1.3	Revegetation	Responsible Parties	Timing or Frequency
Implementation Actions	The following activities will be undertaken to achieve the above objective (as detailed in the MWMP):		
	• Engage a qualified environmental consultant to survey the remnants to determine where revegetation is required, and what species, species-mixes and densities are appropriate. Appropriate species selected, by reconstruction of the original vegetation floristic composition, are given in Appendix 7.	• Developer	• June 2001
	• Engage a qualified environmental consultant to devise a 5-year planting program including site preparation (e.g. weed control), post-planting maintenance and timing.	• Developer	• June 2001
	• Engage an indigenous nursery contractor to grow and supply the first stage of revegetation program.	• Developer	• Spring 2001
Follow-up or Ongoing Actions	• Undertake an ongoing and staged replanting program (using tubestock, cell stock or seedlings or direct seeding) of robust herbs, shrubs, trees and vines (deemed to be members of the original flora) to produce a structurally and floristically diverse vegetation more closely resembling the pre-European vegetation.	• Surf Coast Shire	• As detailed in MWMP
	• Weed control as appropriate to ensure success of revegetation	• Surf Coast Shire	• As detailed in MWMP
Performance Measures and Monitoring	The following performance measures are appropriate but may be revised after more detailed investigations (documented in MWMP).		
	• The areas will have a structurally intact cover of appropriate trees, shrubs and robust herbs throughout within 5 – 10 years.	• Surf Coast Shire	• As detailed in MWMP
	• Vegetation cover will be maintained by natural recruitment/regeneration, or by planting of tubestock.	• Surf Coast Shire	• As detailed in MWMP

PLAN SUB-ELEMENT 1.4	Rabbit control	Responsible Parties	Timing or Frequency
Objectives	To protect vegetation and soils within the Council Conservation Zones from the depredations of rabbits. Elimination of rabbits from the Council Conservation Zones, or Maintenance of rabbits at very low numbers through active control.		
Implementation Actions	The objectives of this plan sub-element will be achieved through the following activities: • Fencing along The Esplanade (the southern perimeter of the development area) to exclude rabbits and to ensure that rabbits within the Council Conservation Zones (as well as the development area) are eliminated or controlled. Farm fence will be used with appropriate rabbit-proofing (see EMP Element 7.2.12 and Map 2). • Control of rabbits by appropriate methods as set out in the MWMP (see EMP Element 7.2.12).	• Developer • Surf Coast Shire	• At commencement of development construction • As required (determined by monitoring rabbit numbers)
Follow-up or Ongoing Actions	• Rabbit control activities as documented in MWMP.	• Golf Course Management / Surf Coast Shire	• As required (determined by monitoring rabbit numbers)
Performance Measures and Monitoring	• Rabbits will not be present or will be maintained at low numbers (as assessed by standard monitoring procedures).	• Golf Course Management / Surf Coast Shire	• As required (determined by monitoring rabbit numbers)

PLAN SUB-ELEMENT 1.5	Fauna habitat and User Related Issues	Responsible Parties	Timing or Frequency
Objectives	To retain, manage and upgrade remnant vegetation in the Council Conservation Zones (CCZs) as valuable fauna habitat. To maintain habitat links to the south of The Esplanade. To publicise the biological values of the CCZs and educate residents and visitors as to how they can assist in the protection of valuable fauna habitat.		
Implementation Actions	The objectives will be achieved by implementing the following programs and activities		
	• Implement the weed control program outlined in the MWMP (see above and Section 7.2.5).	• Developer / Golf Course Manager / Surf Coast Shire	• In accordance with the MWMP.
	• Implement the rabbit control program outlined in the MWMP (see above and Section 7.2.12).	• Developer / Surf Coast Shire	• In accordance with the MWMP.
	• Erect a farm fence (see above and Section 7.2.12) that will also function to exclude dogs, and restrict human access to defined points.	• Developer	• At commencement of development construction.
	• Define paths in accord with the MWMP to help control visitor impacts on vegetation and fauna habitat through the CCZs.	• Developer	• Prior to the transfer of the CCZs to Council.
	• As part of the revegetation program outlined in the MWMP, provide for the retention of native vegetation outside the CCZs that will assist in linking the CCZs with other remnant vegetation.	• Developer	• Ongoing
	• As part of the revegetation program outlined in the MWMP, provide for the revegetation of Moonah Woodland in area surrounding eastern CCZ bulldozed in 1998.	• Developer	• In accordance with the MWMP.

PLAN SUB-ELEMENT 1.5	Fauna habitat and User Related Issues	Responsible Parties	Timing or Frequency
	• Raise public awareness regarding the environmental values of the CCZ sites and surrounds including the woodlands, coastal and marine area, saltmarsh and estuary. –This should include interpretive signage and information sheets provided to each owner/tenant on purchase, which contains information on the natural and cultural values, plant lists, dog control etc.	• Surf Coast Shire/ Wathaurong Community/ Torquay Public Reserves/ Trust for Nature/ Environmental Management Trust.	• Immediately on transfer of CCZ and on the sale of any lot.
	• Encourage the establishment of a "Friends" group to work co-operatively with Surf Coast Shire to maintain and monitor the CCZs or involve groups and volunteer organisations already formed (e.g. Thompson Creek Catchment Committee, Torquay Coast Action Group).	• As above	• Immediately on transfer of the CCZs to Council.
Follow-up or Ongoing Actions	• As detailed in MWMP.	• Surf Coast Shire	• As detailed in MWMP.
Performance Measures and Monitoring	• Elimination or reduction of rabbits to low numbers and elimination and effective control of target weed species.	• Surf Coast Shire	• As detailed in MWMP.
	• Increased public awareness concerning the Reserves, their values and functions.	• Developer	• As part of the sale of each allotment.
	• Flora and fauna surveys conducted by "Friends" groups to observe changes in biological diversity (e.g. compilation of database of fauna observations, plant species list).	• Surf Coast Shire (as CCZ manager)	• Annual surveys.
PLAN SUB-ELEMENT 1.6	**Fire – see EMP Element 13 (Section 7.2.13).**		

7.2.2 ENVIRONMENTAL MANAGAGEMENT PLAN ELEMENT 2: SALTMARSH COMPLEX MANAGEMENT

Introduction

The saltmarsh is of State or National significance for its vegetation communities and sub-communities. The saltmarsh provides habitat for the Orange-bellied Parrot and therefore is considered to have potential National significance. It also provides habitat for numerous waders or shorebirds, some of which are listed on the Japanese Australian Migratory Bird Agreement (JAMBA) and Chinese Australian Migratory Bird Agreement (CAMBA) international treaties. The environmental value of the saltmarsh has been recognised by local residents and environment groups for many years, culminating in a conservation covenant being applied to the area in 1995 (Trust For Nature 1995). Several previous studies and reports have raised the issue of altered tidal inundation and its effects on the ecology of the saltmarsh (Walters 1999, Thompson Creek Catchment Committee 1998, Bird 1998). There are current plans to finance works to improve tidal flows to the area (A. Boyle, Thompson Creek Catchment Project, pers. comm.; J. Spittle, Surf Coast Shire, pers. comm.)

The 173 Agreement specifically addresses a range of issues relating to the Golden Beach (Torquay Sands) Development and its implementation and operation which are intended to protect the saltmarsh from direct and indirect impacts. Protection of the saltmarsh and its significant flora and fauna relies upon the involvement and co-operative management between the Developer, the Trust for Nature and the Surf Coast Shire, together constituting the Karaff Wetland Environmental Management Trust.

Several major issues are relevant to the management of the saltmarsh and more detailed investigation is required to address these issues. These issues include:

- restoration of the saltmarsh hydrological regime (see below);
- an appropriate management structure;
- preparation of a detailed Saltmarsh Management Plan; and
- providing buffers between the development and saltmarsh.

Restoration of saltmarsh hydrology

There have been massive alterations to the pre-European hydrological regime of the Saltmarsh Complex which have set in train serious degradation processes. If these are not reversed or appropriately addressed they will cause the long-term destruction of the flora and fauna values of national significance with or without development (residential or otherwise) of the hinterland. These changes are:

- construction of Point Impossible Road on the west side of Thompson Creek which has, except for a small culvert with a pipe (Plate 16), closed off the tidal Mullet Creek which allows the flooding of the Saltmarsh Complex (Bird 1998); and
- clearing of most native vegetation in the catchment to the west of the saltmarsh, resulting in greatly increased runoff into the saltmarsh. Craigie and Condina (1999) estimated that under existing conditions there is an average annual 60 ML input of freshwater into the saltmarsh from the catchment draining through the development site.

These changes have resulted in increased freshwater input into the saltmarsh (via catchment runoff) and greatly reduced tidal penetration (frequency, duration and amplitude) resulting in a lowering of the salinity. Serious degradation of the saltmarsh is predictable on theoretical grounds (i.e. maintenance of the dominant, obligate, salt-loving plants – halophytes) and this degradation is probably now evident in the vegetation, with widespread decline and death of the most important saltmarsh dominant, Shrubby Glasswort (*Sclerostegia arbuscula*) (Plate 6). This may be related to reduced salinity, as well as invasion of the saltmarsh by weeds, especially annual grasses (see Section 5.1.2). Invasion of the Blue Tussock-grass – Sea Rush Grassland/Sedgeland in the upper saltmarsh by Coast Beard-heath (*Leucopogon parviflorus*) is also evident. Invasion by the bird-dispersed Beard-heath from the adjoining dune system would not occur if normal waterlogging and salinity levels prevailed in the upper saltmarsh.

It is essential to reinstate normal tidal flooding of the saltmarsh if it is to survive in the long-term in its current form and retain its present biological values. Reinstating the tidal regime will also assist in mitigating the impacts of freshwater input to the saltmarsh from the cleared catchment. It will also be important to ensure that surface runoff regimes associated with proposed urban developments in the catchment (including Golden Beach (Torquay Sands)) are maintained as close as possible to existing rural runoff levels and, wherever practical, that opportunities to reduce runoff volumes are grasped. In regard to the Golden Beach (Torquay Sands) development, Craigie and Condina (1999) estimated that a variation of +/-15-20% from "natural" conditions would be a practical expectation in respect of post-development runoff volumes.

Urgent investigation of these crucial hydrological issues must be carried out by Surf Coast Shire, as agreed at the Council Meeting of 11 April 2000 to restore tidal flow. The investigations should determine:

(i) hydrological modelling and assessment of potential impacts of reinstatement of the former hydrological regime by reopening the saltmarsh to tidal inundation (e.g. flooding of neighbouring properties);

(ii) acceptable risks or disbenefits (if applicable) resulting from a fully or partially reinstated tidal regime;

(iii) type of works and costs required to reinstate tidal flooding regime; and

(iv) appropriate monitoring of results or impacts on the environment (particularly vegetation) from reinstatement of tidal flooding.

Management Structure

An appropriate management structure is essential to:

(i) access technical expertise required for managing flora and fauna;

(ii) ensure adequate funding;

(iii) mobilise personnel to implement management actions; and

(iv) report on and monitor the saltmarsh, management actions and outcomes. This is required before the Golden Beach (Torquay Sands) development is completed.

Management Plan

A detailed Saltmarsh Management Plan must be prepared for the whole saltmarsh.

Management issues that will need to be addressed, apart from the major hydrological issues, include weed management and revegetation. Trengove (1998, 1999) investigated and implemented a rehabilitation plan for vegetation bulldozed in the saltmarsh in 1998. Unassisted recovery of saltmarsh vegetation is well advanced with vigorous recruitment of former saltmarsh dominants. This needs to be monitored for weeds and control implemented as necessary.

Revegetation will be provided in the saltmarsh remnant (contiguous with the adjoining saltmarsh) at the eastern end of the development adjoining the 5th, 12th,13th, 15th and 16th Holes of the Golf Course and indicated on the Comprehensive Development Plan (Figure 1) as Saltmarsh – Environmental Rural Zone. This area only requires limited revegetation on its margins at the interface with the golf course and buffer zones.

It is noted that the 173 Agreement requires the establishment of an Environmental Management Trust, sometimes referred to in this report as the Saltmarsh Trustees. The 173 Agreement sets out a number of responsibilities for the Environmental Management Trust including being responsible for funding the preparation and development of the Saltmarsh Management Plan.

PLAN ELEMENT 2	Saltmarsh Complex Management	Responsible Parties	Timing or Frequency
Objectives	To protect the saltmarsh and its ecology from any adverse impacts arising from the proposed development. To reinstate the former hydrological regime (tidal inundation) in the saltmarsh. To enhance the quality and condition of the saltmarsh vegetation. To ensure protection of Orange-bellied Parrot habitat and habitat of other significant fauna species. To maintain mean annual surface runoff from development sites to within +/- 15-20% of existing conditions. To increase public awareness and knowledge about the biological values of the saltmarsh. To minimise disturbance to the saltmarsh and its fauna, by excluding humans and domestic pets and pest animals from the saltmarsh and disturbance from the development (e.g. noise, artificial lighting, retrieval of golf balls).		
Implementation Actions	• Prepare and implement a detailed Saltmarsh Management Plan (SMP) for the whole Saltmarsh Complex. The type of management activities required will be determined by an appropriate study, but will include weed control, revegetation, user-related impacts, hydrological issues and monitoring requirements.	• Environmental Management Trust	• 2001
	• Remove obstructions to tidal movement on Point Impossible Road to restore saltmarsh tidal regime.	• Surf Coast Shire	• Subject to funding
	• Erect a 1.5 m high, black PVC coated chain-mesh fence along the western boundary of the saltmarsh adjacent to golf course Hole 5 to prevent access by golfers and other people.	• Developer	• Upon commencement of development construction
	• Erect a 1.8 m high, black PVC coated chain-mesh fence along the southern boundary of the saltmarsh (boundary of former tip site) adjacent to golf	• Developer / Environmental	• Upon commencement of development construction

PLAN ELEMENT 2	Saltmarsh Complex Management	Responsible Parties	Timing or Frequency
	course Hole 15 to prevent access by golfers and other people. The Environmental Management Trust will be responsible for fencing boundaries of the saltmarsh not abutting the development; the Developer will be responsible for fencing common boundaries between the saltmarsh and the development.	Management Trust	
	• Create a vegetated buffer to protect and screen the saltmarsh from the development at the interface of the 5th, 12th,13th, 15th and 16th Fairways and the western end of the saltmarsh (see EMP Elements 7.2.7, 7.2.11 and Figures 2-5).	• Developer / Golf Course Manager	• 2001 - 2002
	• Supplement saltmarsh vegetation within the development area (Saltmarsh Environmental Rural Zone – Figure 1) with plantings of appropriate species at the interface with the golf course and adjoining buffer zones.		
Follow-up or Ongoing Actions	• Monitor function of reopened tidal inlet	• Environmental Management Trust	• In accordance with the Saltmarsh Management Plan (SMP).
	• Ensure maintenance of structures (i.e. fencing)	• Golf Course Manager / Environmental Management Trust	• In accordance with the Saltmarsh Management Plan (SMP).
	• Review Saltmarsh Management Plan at appropriate intervals	• Environmental Management Trust	• To be determined (but not less than 5 years)
	• Monitoring effectiveness of management structure	• Environmental Management Trust	• To be determined (but not less than 5 years)
Performance Measures and Monitoring	• No increase in deleterious user-related impacts (e.g. vegetation damage, disturbance to fauna).	• Environmental Management Trust	• Bi-annual comparisons with previously documented condition.

PLAN ELEMENT 2	Saltmarsh Complex Management	Responsible Parties	Timing or Frequency
	• Increased quality and health of saltmarsh vegetation.	• Environmental Management Trust	• Bi-annual comparisons with previously documented condition.
	• Restoration of tidal inundation in saltmarsh. • Monitoring needs must be determined as part of the saltmarsh Management Plan which must be completed as a matter of priority. The Developer will engage an independent environmental consultant to monitor water quality before discharge from the development area to the saltmarsh (at an adequate frequency to be determined).	• Surf Coast Shire • Environmental Management Trust	• 2002 • In accordance with the Saltmarsh Management Plan (SMP).

7.2.3 *ENVIRONMENTAL MANAGAGEMENT PLAN ELEMENT 3: REVEGETATION (OUTSIDE COUNCIL CONSERVATION ZONES AND RETENTION OF NATIVE VEGETATION AND FAUNAL HABITAT*

Introduction

Revegetation of Moonah-Coast Wirilda Shrubland is proposed for areas east of the golf course maintenance facility on the south side of the former tip (Plate 17) and to reinstate saltmarsh (at its extreme western end) that has been modified by sheep grazing (Section 5.1.2, Plate 11). The extent of revegetation proposed has not been finalised but guiding principles are given here. Trengove (1998, 1999) assessed vegetation requirements for reinstating the Moonah – Coast Wirilda Shrubland and revegetation works were implemented in some areas formerly carrying Moonah – Coast Wirilda Shrubland, as well as saltmarsh to the north-east and east. Recent inspection has shown considerable natural regeneration and this saltmarsh will probably recover adequately without further intervention. The former Shrubland areas require some site remediation (e.g. levelling of soil and removal of some woody debris), and an assessment of the extent of tubestock planting is required. This will supplement natural regeneration. Attention to weed invasions which will inhibit regeneration, and to rabbit control, is also required.

It is not considered necessary to provide special protection to remnant Moonah stands in the vicinity of the 4th and 5th Holes of the Golf Course or to provide a boardwalk to protect soils because this area has been highly disturbed by bulldozing. Rather, vehicle tracks and walking paths should skirt remnant Moonah on its northern side and be suitably designed, surfaced and maintained to protect Moonah roots.

Retention of native vegetation and faunal habitat will be achieved through appropriate designing of the golf course and other parts of the development. Design elements will include avoiding indigenous vegetation, minimising vegetation clearance, locating and documenting significant ecological attributes, protecting these during construction and continuing to protect these after the completion of development (i.e. during the operational phase).

PLAN ELEMENT 3	**Revegetation (outside Council-managed conservation zones and retention of native vegetation and faunal habitat)**	**Responsible Parties**	**Timing or Frequency**
Objectives	To protect existing vegetation including saltmarsh and stands of remnant woody vegetation Moonah – Coast Wirilda Shrubland from development. To integrate re-established indigenous vegetation with existing indigenous vegetation and thereby enhance the landscape values of the golf course and residential development.		

PLAN ELEMENT 3	Revegetation (outside Council-managed conservation zones and retention of native vegetation and faunal habitat)	Responsible Parties	Timing or Frequency
	To provide buffers to protect environmentally sensitive areas (e.g. between the 5th and 15th golf course holes and the southern and western edge of the adjoining saltmarsh). To extend the boundaries of the extant Moonah – Coast Wirilda Shrubland (eastern Council Conservation Zone) to help make this small remnant more viable for flora and fauna. To reinstate the saltmarsh at its extreme western end. To protect soils from erosion. To minimise the impact on significant natural features (i.e. plant communities and sub-communities, significant plant and animal species and habitats) during construction and operation of the residential and golf course development. To ensure that vegetation and faunal habitat is protected by clearing only the minimum area of vegetation necessary for residential and golf course development.		

PLAN ELEMENT 3	Revegetation (outside Council-managed conservation zones and retention of native vegetation and faunal habitat)	Responsible Parties	Timing or Frequency
Implementation Actions	• Engage a qualified environmental consultant / landscape architect to prepare a Moonah and Saltmarsh Revegetation Plan (MSRP). Preparation of the plan will involve assessing the success of any existing revegetation undertaken to date to inform ongoing revegetation design and implementation. The plan will cover all aspects of revegetation outside the Council Conservation Zones. The revegetation will be implemented as part of the overall landscape development. The following activities must form part of the MSRP: · Revegetate with indigenous species to compensate for clearing losses, to enhance landscape, protect soils and assist in buffering role adjacent to saltmarsh and Council Conservation Zones. · Use the 5th and 15th Fairways as a transition zone from the natural to the built environment. · Extend the vegetation, from existing remnant vegetation, by planting tubestock or cellstock and creating conditions conducive to unassisted regeneration/recruitment of plant species. Replanted vegetation will conform with existing Moonah – Coast Wirilda dominated shrubland, saltmarsh vegetation, or other models deemed to be appropriate in structure and floristic composition. · Salvage of all possible indigenous plant material (i.e. seed, cuttings, divisions, salvaged plants) that may be lost in the development area during construction.	• Developer	• July 2001

PLAN ELEMENT 3	Revegetation (outside Council-managed conservation zones and retention of native vegetation and faunal habitat)	Responsible Parties	Timing or Frequency
	· Tubestock and/or cellstock will be contract-grown from propagating material (seeds, divisions, etc.) sourced locally or as near to the site as possible. Sufficient lead-times to collect material and produce stock will be allowed (6-12 months depending upon plant species and quantities). Planting will ideally occur in autumn. · Site preparation will include weed control (with sufficient lead times) and stabilisation of the mobile sandy soil, as well as rabbit control. · Fencing of saltmarsh at its western and southern end (adjacent to golf course Holes 4, 5 & 15) to allow unassisted rehabilitation (natural plant recruitment)and revegetation (see Implementation Actions of Element 2: Saltmarsh Complex Management). · Ongoing management, mostly to control weeds, is required.		
	• Engage a qualified indigenous contract grower and landscape gardener to supply stock, implement and manage the revegetation program (MSRP).	• Developer	• Upon completion of the MSRP.
	• A post-planting maintenance contract will extend for two years from commencement of each phase of the revegetation program to ensure weed control, replacement of plant losses, rabbit control, etc.	• Developer	• As detailed in the MSRP.
	• Prepare an Existing Vegetation Plan which identifies all vegetation that must be protected at all stages of the development, notably saltmarsh vegetation, Moonah-Coast Wirilda Shrubland remnants adjoining the 14th Green of the Golf Course and Poa grasslands located along the southern boundary adjacent the CCZ. All indigenous and exotic woody vegetation (trees and shrubs) that will be removed in the development area are detailed in the Schedule given here as Appendix 12. All other remnant indigenous vegetation will be protected and managed accordingly.	• Developer	• July 2001
	• Clearly mark in the field, by appropriate temporary means, all vegetation that must be protected at all stages of the development, notably saltmarsh vegetation and Moonah-Coast Wirilda Shrubland remnants adjoining the 14th Green of the Golf Course.	• Developer	• July 2001

PLAN ELEMENT 3	Revegetation (outside Council-managed conservation zones and retention of native vegetation and faunal habitat)	Responsible Parties	Timing or Frequency
	• Fence Council Conservation Zones and Saltmarsh (refer to EMP Elements 7.2.1 and 7.2.2).	• Developer	• Upon commencement of development construction.
	• Implement high-quality site and vegetation rehabilitation (refer to EMP Element 7.2.3).	• Golf Course Manager	• As detailed in the MSRP
Follow-up and Ongoing Activities	• Implement a revegetation monitoring program aimed to identify management and maintenance needs (e.g. weed control, supplementary planting) as outlined in the MSRP.	• Developer / Golf Course Manager	• As detailed in the MSRP
	• Monitor and maintain vegetated buffer (to ensure proper function as required).	• Developer / Golf Course Manager	• As detailed in the MSRP
	• Protection of all vegetation to be retained in development area	• Developer / Golf Course Manager	• As required
	• Monitor the impacts of the residential and golf course development on the remnant vegetation and respond as appropriate to ameliorate any adverse effects detected.	• Golf Course Manager	• As detailed in the MSRP
	• Maintain fences to a high quality.	• Golf Course Manager Surf Coast Shire	• As needed
Performance Measures and Monitoring	• Establishment of a vigorous stand of vegetation within two years of implementation.	• Developer / Golf Course Manager	• July 2003
	• Revegetation areas free of serious weed invasions (notably species identified for elimination in Appendix 8).	• Developer / Golf Course Manager	• July 2003
	• Ongoing monitoring of the performance of the vegetation and weed populations and other management issues, with actions as required;	• Developer / Golf Course Manager	• As detailed in the MSRP
	• Regular inspection will be carried out for approximately 5 years to determine revegetation management needs and appropriate actions following the termination of the post-planting maintenance contract.	• Developer / Golf Course Manager	• 6-12 monthly intervals as detailed in the MSRP

PLAN ELEMENT 3	Revegetation (outside Council-managed conservation zones and retention of native vegetation and faunal habitat)	Responsible Parties	Timing or Frequency
	• No loss of vegetation/habitat identified for protection.	• Developer	• Ongoing protection
	• Free availability to all appropriate personnel of map(s) showing the location of ecologically significant areas which must be protected;	• Developer	• Maps available immediately upon commencement of any works on site.
	• Implementation of appropriate workplace procedures to ensure that significant features are protected during construction.	• Developer	• Procedures put into place immediately upon commencement of any works on site.
	• Monitor vegetation to ensure adequate protection and implement additional measures as appropriate during operations phase	• Golf Course Manager	• As detailed in the MSRP

7.2.4 ENVIRONMENTAL MANAGAGEMENT PLAN ELEMENT 4: WEED MANAGEMENT

Sub-element 4.1: General Weed Flora

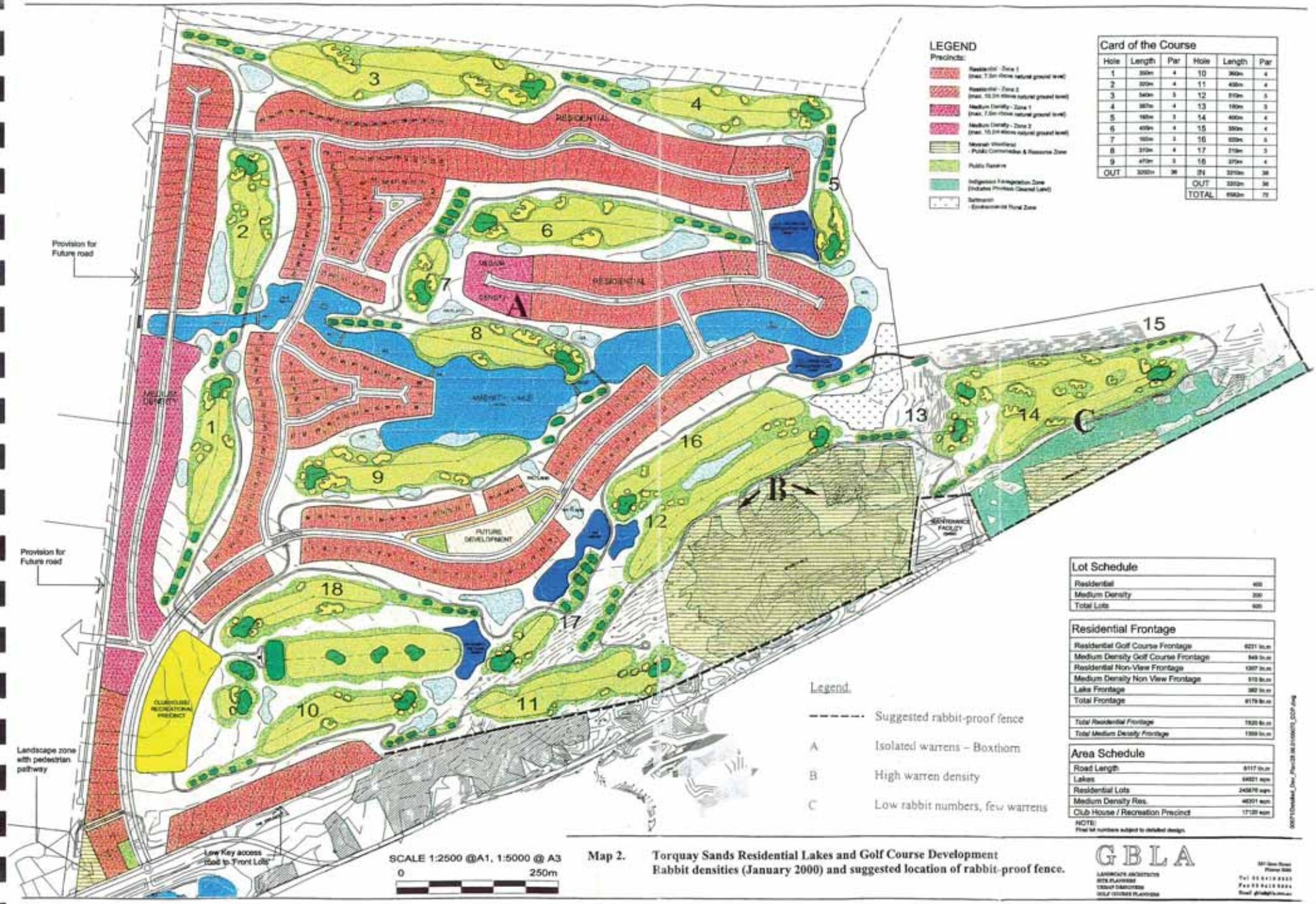
Introduction

Weed management as outlined here relates to the current weed flora of the site (see for example Plates 5, 13 and 18) and especially the weed flora of the Council Conservation Zones. There are very important weed management issues for the golf course, wetlands and other areas within the proposed development area and some of these are discussed under separate EMP elements. Much of the current weed flora of the site will be destroyed during the construction period, thus weed control is generally not advocated before development commences, except for (i) areas that will be retained (notably the Council Conservation Zones), (ii) for some particularly serious weed species, and (iii) as part of site preparation (for revegetation). A Weed Management Plan (WMP) will be prepared to guide weed management.

The Advisory Committee (McKenzie and Westwood 2000, p. 33) appointed to hear and consider submissions to Amendment R60 of the Surf Coast Planning Scheme in relation to the proposed Golden Beach (Torquay Sands) development, recommended provision of a washing-down bay for vehicles to help in weed control. At its meeting on 12 December 2000, Surf Coast Shire also required that earthmoving and grass maintenance vehicles entering and leaving the site be washed to remove contaminating weed seed that may 'escape' to establish new weed populations, that materials be sourced from non-infected areas (including details of where imported fill will be sourced), and that a quality control certification process be used.

SUB-ELEMENT 4.1	General Weed Flora	Responsible Parties	Timing or Frequency
Objectives	To eliminate some weed species (mostly woody weeds) from the entire property, to manage others to an acceptable level and minimise dispersal of weeds within, and to and from the site. To eliminate Regionally Prohibited weed species listed under the *Catchment and Land Protection Act* 1994 (Appendix 8) within two years. To eliminate Regionally Controlled weed species listed under the *Catchment and Land Protection Act 1994* (Appendix 8) or control populations at a low level within two years. To eliminate additional weed species (listed in Appendix 8) or to control these weeds in designated areas on an ongoing basis.		

SUB-ELEMENT 4.1	General Weed Flora	Responsible Parties	Timing or Frequency
Implementation Actions	• Engage a qualified environmental consultant to prepare a Weed Management Plan (WMP) documenting objectives, timing or seasonality considerations, and appropriate control/elimination methods (e.g. physical removal, herbicide application and monitoring requirements). Appendix 8 gives generic control methods for each species. The WMP must be submitted for approved by Council. The WMP must address the following issues: · Include a survey of areas outside the Council Conservation Zones to document the distribution and population size of the target weed species (carried out in late spring 2000 and May 2001) to provide the background information for the preparation of the Weed Management Plan. · Weed management in the development area will be integrated with that proposed for the coast and foreshore in accordance with the 1998 Torquay Foreshore Masterplan and Management Plan. · Detection and control of additional weed species on the site will be a priority. · Appropriate design of wetland edge zones and hydrologic regimes to minimise conditions favourable to the spread of weed species. · Ensure that 'clean' fill and other materials are sourced and recorded for use in the development area and are not infected. · Control of weed movement (e.g. Terracina Spurge) within the site to prevent spread. · Wash-down of earthmoving and grass maintenance vehicles entering and leaving the site as a routine hygiene measure. · Design and implement initial wetland plantings and all amenity vegetation and indigenous revegetation to help outcompete weed species.	• Developer	• Prior to commencement of any subdivision or land formation works



Map 2. **Torquay Sands Residential Lakes and Golf Course Development**
Rabbit densities (January 2000) and suggested location of rabbit-proof fence.

SUB-ELEMENT 4.1	General Weed Flora	Responsible Parties	Timing or Frequency
	• Commence weed management activities identified in the WMP.	• Developer / Golf Course Manager	• Upon approval of the WMP by Council.
Follow-up and Ongoing Actions	• Review Weed Management Plan at appropriate intervals	• Environmental Management Trust	• Annually, as detailed in the WMP
	• Ongoing weed management as documented in the WMP and any other weed management activities identified through the monitoring process.	• Body Corporate, Golf Course Manager	• As detailed in WMP
	• Implement regular monitoring of weeds to determine outcomes of treatments or management actions as well as identify 'new' weed species that may appear on the site.	• Golf Course Manager	• As detailed in WMP
Performance Measures and Monitoring	• Current populations of species targeted for elimination will be removed within two years, or, as an interim measure, they will be prevented from seeding.	• Golf Course Manager	• July 2003
	• Populations of species targeted for control in designated locations will be kept to a minimum.	• Golf Course Manager	• July 2003
	• No additional, seriously-invasive weed species will persist on the site six months to two years after detection (depending on weed species and its management requirement).	• Golf Course Manager	• Six monthly monitoring of any additional, seriously invasive weed species.
	• Monitoring of cultivated plants (with follow-up actions as deemed appropriate when rules breached).	• Body Corporate	• As detailed in WMP

ENVIRONMENTAL MANAGAGEMENT PLAN ELEMENT 4: WEED MANAGEMENT

Sub-element 4.2: Potential Horticultural Escapees

Introduction

A large proportion (some 70%) of the Victorian weed flora has 'escaped' from cultivation (Carr 1993) including some of the most important weed species recorded in the study area (as indicated in Appendix 8). There is a high potential for weed species to 'escape' from cultivation in the development area – either as cultivated garden plants in residential areas or amenity garden and landscape plantings in public open-space areas. Such potential problems can be avoided by adopting a policy for the development which recognises the weed potential of some horticultural species and avoids their use in the development area and discourages or forbids residents from planting such species.

The Advisory Committee (McKenzie and Westwood 2000, p. 11) notes that Council had accepted changes to Part 9 of the EMP relating to the weediness of cultivated plants. Under this agreement the Developer (proponent) will prepare a list of preferred species for planting in private gardens to be approved by Council and distributed to all new landowners. An enormous range of plant species and cultivars is available in horticultural and in the horticulture trade, the great majority of which are not weedy. Appendix 10 provides a list of cultivated species which are weedy and should not be planted.

SUB-ELEMENT 4.2	**Potential Horticultural Escapees**	**Responsible Parties**	**Timing or Frequency**
Objective	To prevent the cultivation of species in the development area which have invasive potential as environmental weeds on adjoining or local lands (e.g. Council Conservation Zones and the coastal reserve). To prepare a list of plant species which must not be planted, and publish and distribute a list of preferred species that residents are encouraged to cultivate in private gardens.		
Implementation Actions	• Engage a qualified environmental consultant to prepare a list of plant species that must not be cultivated including weeds listed in the publication *Environmental Weeds. Invaders of our Surf Coast* (Surf Coast Shire and Angair 1998) (Appendix 10). • Distribute the weeds list and supporting information in Residents' Information Kits.	• Developer • Developer	• Forms part of this EMP • As part of the sale of each allotment

SUB-ELEMENT 4.2	Potential Horticultural Escapees	Responsible Parties	Timing or Frequency
Follow-up or Ongoing Actions	• Periodically update information to residents to ensure that it remains current.	• Body Corporate	• Every three years
Performance measures and Monitoring	• No species appearing on the list of undesirable plants will be cultivated.	• Body Corporate	• Constant monitoring. Immediate notification to land owner should this situation be identified.
	• Residents will be aware of the need for responsible horticulture and will willingly comply with guidelines or restrictions.	• Developer	• As part of the sale of each allotment.

7.2.5 ENVIRONMENTAL MANAGAGEMENT PLAN ELEMENT 5: WATER QUALITY MANAGEMENT PROCEDURES

Introduction

The following is a summary of procedures, guidelines and practices to protect runoff water quality both within and from the Golden Beach (Torquay Sands) development site. They cover procedures both during and after the development phase.

There are a number of factors which will influence the water quality conditions achieved on the site and downstream of the development area. These include:

- the quality of the wastewater used for irrigation of the golf course
- the amount of wastewater used, and how and when it is applied
- the degree of capture of excess irrigation and golf course runoff by storages and wetlands
- the area of treatment wetlands in relation to the area of proposed urban and golf course development
- the extent of reuse of water captured in wetland storages
- provision of passage of flood waters around wetlands and storages
- golf course fertilisation practices and pesticide management
- the nature of the site soils
- effectiveness of clay liners on wetlands and storages
- runoff from constructed and unmade roads
- the staging of construction and best management practices and safeguards adopted during construction

The above factors can be grouped into three major site issues to be managed through the EMP.

(i) Wastewater irrigation practices

(ii) Sediment and nutrient generation and mitigation

(iii) Site maintenance practices

The following EMP sub-elements consider in detail feasible procedures and management responses to these issues. Management of potential eutrophication or other forms of pollution of waterways as a result of turf management practices requires further resolution which will be detailed in a Turf Management Plan. The Golf Course Manager will comprehensively document proposed management practices in line with the Turf Management Plan, to the satisfaction of Council. The Owner is obliged, under the 173 Agreement, to manage turf in accordance with the Turf Management Plan.

EMP Element 14: Construction Activities has been formulated to protect wetlands and other areas from adverse impacts during the construction phase of the development. Many issues and measures relevant to the construction phase overlap with issues covered here in Element 5 and in Element 6: Hydrology, Drainage and Constructed Wetlands.

SUB-ELEMENT 5.1	**Wastewater Irrigation Practices**	**Responsible Parties**	**Timing or Frequency**
Objective	To ensure that the use of wastewater as a makeup water supply for golf course irrigation does not result in pollution of site or downstream soils, groundwater or surface waters.		
Implementation Actions	• Engage a qualified consultant to prepare a Surface Water Management Strategy incorporating a Wastewater Management Plan (WWMP) which will include the following elements: · Ensure that treated wastewater quality satisfies criteria for the use of reclaimed water, in particular ANZECC Guidelines for the use of Reclaimed Water (NHMRC 1996) and Guidelines for Wastewater Reuse (EPA 1996). Performance standards specified for the use of treated wastewater should be subject to approval by the EPA. · Apply treated wastewater according to Guidelines for Wastewater Irrigation (EPA Publication 168, 1991). Testing of the soil hydraulic conductivity and permeability will be required as a basis for determination of application rates such that surface runoff or input to the regional groundwater would not normally occur. · Apply treated wastewater as a mixture with treated stormwater	• Developer	• SWMS to be completed by Aug 2001

SUB-ELEMENT 5.1	Wastewater Irrigation Practices	Responsible Parties	Timing or Frequency
	· Apply treated wastewater/stormwater mix directly to the golf course areas only - no injection of treated wastewater to occur to any irrigation storage, amenity lake or wetland. · Apply treated wastewater/stormwater mix at a rate which satisfies plant needs but does not result in any surface runoff in dry weather conditions. In wet weather, or when wet weather is forecast within 2 days, irrigation will be discontinued. This will ensure that any golf course runoff will not contain significant loads of wastewater pollutants. The further protection measures described below are simply secondary backup mechanisms, which provide another degree of protection. · Separate all runoff from areas irrigated with the treated wastewater/stormwater mix, from runoff from other irrigated and non-irrigated areas. · Collect and convey runoff from the separate drainage systems to separate treatment wetlands on the site. Wetland areas receiving drainage from areas irrigated with the treated wastewater/stormwater mixture will have surface area of at least 2.5% of catchment area. Wetland areas receiving drainage from other areas will have surface area of at least 1.2% catchment area. · Convey overflows from the treatment wetlands which receive drainage from areas irrigated with the treated wastewater/stormwater mix only to irrigation lakes and thence store and recycle for golf course irrigation. · Prevent spill occurring from the main irrigation lake system to the saltmarsh at all times · Prevent spill occurring from the minor irrigation lakes on the Back		

SUB-ELEMENT 5.1	Wastewater Irrigation Practices	Responsible Parties	Timing or Frequency
	Nine holes at all times except when irrigation storage system is full to capacity and further rain occurs (thus any spill is further highly diluted with freshwater) The WWMP shall be prepared and implemented as an Environmental Management System based on the appropriate ISO Standard and shall be submitted for approval to Council.		
	• The Developer will install signage to Council's satisfaction to indicate that certain wetlands and irrigation lakes are subject to runoff derived from a mixture of treated wastewater/stormwater. • Engage a qualified consultant to prepare a Turf Management Plan (TMP). The plan will provide all protocols for timing, rate of application and mixture proportions of irrigation water applied to various parts of the course and arrangements for conveying of all drainage from irrigated areas to the treatment wetlands. The size, configuration and location of these wetlands will be indicated on the detailed design drawings for the development, and their function and operational guidelines will be cross-referenced in the Turf Management Plan. The TMP shall be prepared and implemented as an Environmental Management System based on the appropriate ISO Standard and shall be submitted for approval to Council.	• Developer • Developer • Golf Course Manager	• Immediately the wetlands become operational. • July 2001 • As detailed in the WWMP.

SUB-ELEMENT 5.1	Wastewater Irrigation Practices	Responsible Parties	Timing or Frequency
Performance Measures and Monitoring	• Keep records of times, flow rates and total volumes of all treated wastewater importations and weather conditions during and after application of the treated wastewater/stormwater mixture.	• Golf Course Manager	• As detailed in the WWMP
	• Request that the treated wastewater supplier provides details of the quality of water supplied at least on a monthly basis during the irrigation season. This should include levels of *E. coli*, total P and total N, 5-day BOD, total dissolved salts, oil and grease and suspended solids.	• Golf Course Manager	• Monthly, as detailed in the WWMP
	• Sample wetlands for levels of total P and N and conductivity.	• Golf Course Manager	• Three times per year, as detailed in the WWMP
	• Inspect wetlands frequently for condition of aquatic vegetation and occurrence of algal blooms.	• Golf Course Manager	• Minimum monthly, as detailed in the WWMP
	• Monitor water quality parameters before water leaves the development area and discharges into the saltmarsh.	• Golf Course Manager	• As detailed in WWMP
	• Record any discharges from the wetlands to the drainage system and the saltmarsh.	• Golf Course Manager	• On occurrence.

SUB-ELEMENT 5.2	Sediment and Nutrient Generation and Mitigation	Responsible Parties	Timing or Frequency
Objectives	To ensure that the development of the site (including building construction) does not result in excessive sediment and nutrient input, either to the lake and wetlands constructed on the site, or downstream receiving waters. To provide on-site treatment for future runoff from the development area such that nutrient and sediment loads are not measurably increased over current rural conditions.		
Implementation Actions	• The following actions are to be provided for in the WWMP:	• Developer / Golf Course Manager	• Design, implementation and operational phases
	· Separate wastewater reuse irrigation drainage from the remainder of the site surface drainage system.		• Design
	· Employ best management practice in the application of wastewater reuse for irrigation to minimise volumes applied and amounts potentially transferred to the surface water and groundwater environment.		• Ongoing operations as per TMP
	· Construct treatment wetlands for urban runoff treatment generally in accordance with "Urban Stormwater Best Practice Environmental Management Guidelines". In particular size wetlands to achieve 90% hydrologic effectiveness (approximately 1.2% of contributing catchment area).	· Developer	• Design and implementation
	· Design of the inlet zone of the wetlands to preferentially trap coarser sediments to facilitate maintenance removal. These sediment ponds are indicated on the detailed design drawings for the development submitted for Council endorsement.	· Developer	· Design
	· Ensure that velocities in the wetlands are no higher than 0.4 m/s in storm events to minimise re-suspension of sediments and damage to aquatic vegetation.	· Developer	· Design

SUB-ELEMENT 5.2	Sediment and Nutrient Generation and Mitigation	Responsible Parties	Timing or Frequency
	· Plant wetlands with emergent macrophyte species over 60-80% of their area (see Appendix 6 for a list of plant species suitable for use in constructed wetlands).	· Developer	· Design and implementation
	· Maintain the appropriate coverage and density of macrophyte species within the wetlands. Undertake removal or replacement of plants as appropriate.	· Developer/golf course manager	Maintenance task as required
	· Protect wetlands from damage by flood flows greater than 1 in 1 year Average Recurrence Interval (ARI)	· Developer	· Design
	· In the event of a blue-green algal bloom initiate response procedures and install warning signs.	· Golf course manager	
	· The treatment wetlands should be designed to remove up to 80% of incoming sediment and 50% of the input nitrogen and phosphorus from up to the 1 in 1 year ARI flow.		
	• Investigate provision of re-circulation mechanisms on the amenity lakes and wetlands.	• Developer	• Design
Performance Measures and Monitoring	•	•	•
	• Inspect wetlands and lakes frequently (minimum monthly) for condition of aquatic vegetation and occurrence of algal blooms. Observations of excessive concentrations of algae should be followed up by species identification and algal counts.	• Golf Course Manager	• Minimum monthly
	• Sample the lakes six times per year for levels of dissolved oxygen, suspended solids, conductivity, pH, total P and N, and *E. coli*.	• Golf Course Manager	• 6 times per year
	• Sample urban runoff water before it enters the wetland three times per year for levels of total P and N.	• Golf Course Manager	• 3 times per year

SUB-ELEMENT 5.2	Sediment and Nutrient Generation and Mitigation	Responsible Parties	Timing or Frequency
	• Testing and auditing of water discharged into the saltmarsh will be undertaken at the Developer's / Golf Course Manager's expense by independent consultants to the satisfaction of Council. Water leaving the site should where possible meet receiving water quality objectives as detailed in SEPP "Waters of Victoria". As these objectives often exceed the quality of background rural runoff they are rarely all attained in Victorian catchments	• Environmental Management Trust	• As detailed in WWMP

SUB-ELEMENT 5.3	Site Maintenance Practices	Responsible Party	Timing or Frequency
Objectives	To minimise the generation and export of waterborne pollutants from the site. To develop and implement an emergency response plan to cope with possible spills to protect site waterbodies and downstream receiving waters.		
Implementation Actions	• Prepare and implement a best management practice site maintenance plan which will minimise the generation and export of waterborne pollutants from the site. This site maintenance plan will form part of the WWMP. The plan will include the following actions: · Encourage minimal use of fertilisers (part of TMP). · Remove litter from temporary traps after each runoff event. · De-silt sediment ponds as necessary. · Maintain all weirs, pipes, pumps and structures as necessary. · Remove undesirable aquatic weed species from lake and wetland areas and replace any aquatic plants that have been lost. · Repair lake or wetland edges in case of storm damage.	• Developer / Golf Course Manager	• July 2001
	• Engage a qualified environmental consultant to prepare a Chemical Spill Emergency Plan (SCEP). ~~SCEP~~ CSEP	• Developer	• September 2001
	• Provide adequate training to construction and operations staff and contractors on chemical use and storage, spill containment, and emergency response procedures.	• Developer	• Prior to commencement of development
	• Provide training and guidelines for extent and timing of fertiliser and pesticide applications to golf course and grassed open-space areas. There should be no fertiliser or pesticide applications within 20 m of the lake edges. Encourage minimal use of fertilisers.	• Golf Course Manager	• As part of each employment contract.

SUB-ELEMENT 5.3	Site Maintenance Practices	Responsible Party	Timing or Frequency
Performance Measures and Monitoring	• Inspect all drains, diversion channels, traps and structures for condition and correct operation following all significant storm events. For the purposes of this plan a significant storm event is defined as one in which more than 25 mm of rain was recorded in one hour or less.	• Golf Course Manager	• As needed
	• Undertake and keep records of monthly and post-storm inspections on all site infrastructure and repair as required.	• Golf Course Manager	• Monthly or as needed
	• Record any spills or cases of water pollution resulting from site maintenance practices, and report significant spills to EPA for evaluation and advice.	• Golf Course Manager	• As needed
	• Keep up-to-date records of all chemical use on the site	• Golf Course Manager	• Records will be up to date at all times.
	• Review maintenance and monitoring after 2 years, and then 5-yearly thereafter.	• Environmental Management Trust	• After 2 years, 5-yearly thereafter

7.2.6 *ENVIRONMENTAL MANAGAGEMENT PLAN ELEMENT 6: HYDROLOGY, DRAINAGE AND CONSTRUCTED WETLANDS*

Introduction

Hydrological, drainage and related issues are of over-riding importance in the design, operation and management of the proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course development. Apart from serving crucial functional and landscape objectives in the context of the development, as indicated on the Comprehensive Development Plan (Figure 1) and in the report on hydrology and drainage by Craigie and Condina (1999), the protection of the downstream saltmarsh wetland is paramount. With excessive freshwater inputs the saltmarsh will degrade irreparably because of lowered salinity, as discussed in the EMP Element 7.2.1.

Craigie and Condina (July 1999) outlined the concept for management of the quality and quantity of surface water including a feature lake system and constructed wetlands. This was supplemented by further comment in response to questions raised by an objector to the development. A brief outline of the work of Craigie and Condina (1999) is given here. They identified what is proposed in new drainage systems on the site, potential off-site impacts and the measures that will be employed to address such impacts. A summary of their report follows.

Two premises are of particular significance in the concepts outlined by Craigie and Condina (1999) and Craigie (1999): (i) Runoff from upstream (presently rural) catchments will be managed by the responsible body – Surf Coast Shire Council, (ii) The proponent, MHY Handbury Joint Venture Pty Ltd, would strongly support Council implementing a policy which maintains existing rural runoff quality and quantity conditions from the upstream catchments after these are developed for urban purposes.

A key component of the development will be the provision of substantial feature amenity lakes along the drainage line. The lakes will provide a focus of the development village and residential areas. Also there will be a series of interconnected smaller lakes and wetlands, the latter designed for water quality treatment as well as aesthetic values. The main amenity lakes should maintain an aesthetically pleasing aspect, and not suffer from water quality and related problems. Water quality conditions will also be a primary design consideration in the other irrigation lakes and open-water segments of the wetlands.

Existing hydrological features of the site are:

Thompson Creek floodplain (Saltmarsh Complex) with Rural Floodplain Zoning under the Planning Scheme with an upper bound estimate of 2.2 m AHD assumed as the 100 year Average Recurrence Interval (ARI) flood level at the east boundary of the development area†.

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† The 2.2 m ARI flood level (provided by T. Jones, Floodplain Manger, Corangamite Catchment Management Authority, 21 October 1999) is based on the expected tide storm surge from Thompson Creek estuary. All development floors will be set 300 mm above this level. 2.5 m.

31/7/01. Andrew McLowans' work on the [illegible] culvert indicates a max level of 1.4 m AHD at this point under [illegible] conditions

Western Catchment (including the bulk of the subject land) with a rural catchment of c. 520 ha (ultimately to be mostly urbanised).

Southern Catchment draining the existing residential Golden Beach (Torquay Sands) and South Beach Estates (c. 20 ha) and rural land (c. 75 ha), totalling 140 ha. This currently drains to a constructed pondage/retarding basin, The Esplanade wetland (Plate 15, Map 1). Water is directed by pump and rising main from the pondage to Deep Creek. During high flow the pondage overflows to the ocean via Whites Cut. Key deficiencies in this system include erosion of the primary sand dunes, safety threats (steep banks), poor water quality treatment, flood threat to existing housing, poor aesthetics and environmental values, and ongoing costs of pump diversion operations.

The c. 6 ha freshwater *Amenity Lakes* will be aligned along the existing watercourse with small flanking wetland areas to treat runoff from the abutting development and an upgraded Esplanade Wetland to treat and redirect runoff from the existing Golden Beach (Torquay Sands) and South Beach Estates.

Management of potential hydrological impacts

- The Golden Beach (Torquay Sands) development is obligated to:
  - control discharges emanating from within its boundaries so that no detrimental impact accrues to properties downstream;
  - provide for passage of all waters from upstream catchments so that no detrimental impact accrues to properties upstream;
  - ensure internal development levels and drainage systems adequately protect the development itself from flooding; and
  - ensure major floods are passed through the site in a safe manner.
- To mitigate offsite impacts of increased stormwater runoff from the Golden Beach (Torquay Sands) site, the drainage systems within the site will provide for flood retardation storage in the airspace above the amenity lakes and the other minor lakes and wetlands
- Excess surface runoff water will be stored on site and consumed directly (e.g. by irrigation) or indirectly (e.g. evaporation). All lakes and wetlands will be fully lined and sealed against leakage to protect against saline groundwater intrusion. See Coffey's Hydrogeology report.
- Water supply to maintain water quality standards and limit drawdowns in lakes will be an issue of major importance.
- With the amenity, minor lakes and wetlands, a total of c. 8 ha of surface water will result, with stored volume at NTWL of c. 140 ML.
- The Golden Beach (Torquay Sands) development will ensure that no significant change occurs to quantity, quality or seasonality of stormwater runoff discharged from within its boundaries as a consequence of its own development. A variation of +/- 15-20% from "natural" conditions would be considered as being within the bounds of practicality. It is a practical impossibility to ensure zero change occurs.

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- Golden Beach (Torquay Sands) will use much of the water from The Esplanade (Southern Catchment) for golf course irrigation and lake supply, especially in the summer period when no drainage water would naturally flow to the saltmarsh. The balance of all overflows are intended to be passed through the lake and wetland system and then on to the saltmarsh, but only after satisfaction of irrigation diversion and storage requirements. This will necessitate the building of a pipeline between the Esplanade wetland and the main lake in Golden Beach (Torquay Sands). The system is to ensure there is no occurrence of stormwater overflow through the Whites Cut sand dune system.

Wetland treatment to ameliorate water quality

- No free discharge of surface water will occur from any part of the development, without such water firstly being processed through grass filtration and/or wetland treatment and lake storage systems. All stormwater generated from development areas (roads, condominiums, houses, hotel) will be stored on site, treated in wetland systems and diverted to supply the main amenity lakes and other minor feature lakes and golf course irrigation systems.
- The water treatment wetlands will be sized to treat all flows from the residential and commercial areas of the development and from non-irrigated golf areas, to achieve approximately 80% suspended solids removal and removal of 50% of the incoming total phosphorus and total nitrogen, as recommended in the Best Practice Environmental Management Guidelines for Urban Stormwater (EPA 1999).
- The total area of "treatment" wetlands will be at least 1.2% of the contributing developed catchment area. This will also satisfy related criteria that the wetlands achieve a 90% hydrologic effectiveness and detain pollutants for a sufficient period to provide the required treatment.
- The inlet portions of each wetland serving urban areas will incorporate a zone of coarse particle sedimentation and litter trapping. Up to 80% of the surface area of the wetlands will be composed of a mix of ephemeral area and shallow marsh areas up to 0.6 m deep, which will feature emergent aquatic vegetation. Open water zones (free of significant stands of emergent vegetation) within the wetland will be limited to about 20% of the surface area.
- The lakes are primarily open water bodies with gently sloped verges and shallows to suit establishment of a diverse community of fringing aquatic vegetation. Up to 80% of the surface area of the lakes is intended to be open water, free of significant stands of emergent aquatic vegetation. The lakes form an important component of the water quality treatment train, with long-term settlement of fine particulates and ultraviolet disinfection being the primary processes.

- Shoreline treatments, e.g. rock boulders, retaining walls, boardwalks, jetties and sand or gravel beaches, can be incorporated to suit a variety of landscape and recreational objectives; suppress wind-driven wave action; prevent uptake of fine particulates and clays through dispersion processes; and mitigate turbulent resuspension of settled materials.
- The design of edge treatment, choice of wetland plantings and recirculation measures will aim to mitigate the risk of nuisance conditions, such as mosquitoes or algal blooms.

Golf course runoff (irrigated areas)

- A mix of treated wastewater (from Black Rock Sewerage Treatment Plant) and treated stormwater is proposed for most golf course irrigation. The treated wastewater will only be added as necessary to make up for deficiencies in supply of treated stormwater from the irrigation storage system. Treated stormwater will be the prime ongoing irrigation supply. With expected higher nutrient loadings by comparison with urban stormwater runoff, all rainfall runoff from the areas of the golf course irrigated with the mixed water will be kept separated from that arising from the non-irrigated areas (and areas irrigated with stormwater only) and the urban stormwaters.
- Maximum opportunity for mechanical filtration and biological uptake through extended detention is a key to effective treatment of the runoff from irrigated areas of the golf course. All such rainfall runoff is to be contained on site in a series of depressions draining to terminal storage systems.
- As far as practicable, these systems will be protected from entry of runoff from both non-irrigated areas on the course and external catchments. They will be designed as ephemeral wetlands with small open water areas acting as landscape features and evaporation surfaces. In times of significant runoff the open water areas will increase until such time as preset overflow levels are exceeded and discharge will occur to terminal irrigation dams from whence recycling of water will occur to the main irrigation storage.
- The design of the ephemeral wetlands will aim for removal of up to 60% of total nitrogen and total phosphorus. To achieve these performance criteria, the total area of "treatment" wetlands provided will be at least 2.5% of the contributing irrigated catchment area in the golf course.

From their investigations Craigie and Condina (1999) conclude that:

- major benefits will accrue for Whites Cut and the existing pondage area at the end of The Esplanade as a planned outcome of the proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course development;

- there is ample scope to store the necessary volumes of floodwater within the site to ensure that offsite discharges from the Golden Beach (Torquay Sands) Residential Lakes and Golf Course development are maintained to present conditions;
- the water storage and water quality treatment systems within the development boundaries can be designed to effectively mimic the existing seasonal regime of surface water discharged from the site area to the saltmarsh wetlands in Thompson Creek estuary/floodplain;
- all external catchment floodwaters will be passed through development areas along designated paths (primarily through the amenity lake system). Velocity and depth of floodwaters in all floodways will conform to contemporary standards for safety as set out in Melbourne Water Corporations' *Floodway Safety* Guidelines;
- an upper bound estimate of 2.2 m AHD has been assumed as the 100 year ARI flood level at the east boundary of the site;
- all stormwater generated from development areas (roads, condominiums, houses, hotel) will be stored on site, treated in wetland systems and diverted to supply the main amenity lakes and other minor feature lakes and the golf course irrigation system. The water treatment wetlands will be designed and sized to treat all flows from the residential and commercial areas of the development and from the non-irrigated golf course areas, in accordance with recommendations in the Best Practice Environmental Management Guidelines for Urban Stormwater (EPA 1999);
- there is no evidence of acid-sulphate soils being present on the site in significant quantities;
- leakage of surface water to groundwater from proposed waterbodies will be minimal owing to very low clay soil permeabilities and proposed use of synthetic liners.;
- the clay soils are slightly to moderately dispersive and will require protection from water action on the edges of all waterbodies;
- treated wastewater from Black Rock STP is proposed to be imported for golf course irrigation. Due to expected higher nutrient loadings by comparison with treated urban stormwater runoff, all rainfall runoff from areas of the golf course that are irrigated with water mixed with treated water from Black Rock STP will be kept separated from that arising from the non-irrigated areas and the urban stormwaters; and

- all rainfall runoff water from irrigated parts of the golf course will be separated from the urban stormwaters and contained on site in a combined water quality/water quantity management system. This will take the form of a series of depressions draining to terminal storage systems which will be designed as ephemeral wetlands offering maximum opportunity for mechanical filtration and biological uptake of pollutants through extended detention. Overflows from these wetlands will be captured and recycled in the irrigation sytem. The design objective for the system will be to harness all golf course drainage water for recycling in irrigation and toremove up to 60% of total nitrogen and total phosphorus.

Further studies are required to:

- detail requirements and operating characteristics of all flood storages utilising the RORB hydrologic model;
- confirm operational requirements to achieve the design objectives for offsite discharge, irrigation supply and makeup supply needs for both irrigation and the main amenity lakes; and
- refine the design of edge treatments, wetland plantings and recirculation measures and to ameliorate potential nuisance conditions (e.g. mosquitoes and algal blooms).

The following EMP element broadly addresses the means of achieving the stated objectives; it is to be considered in conjunction with the water quality component of the EMP (Element 7.2.5).

PLAN ELEMENT 6	**Hydrology, Drainage and Constructed Wetlands**	**Responsible Parties**	**Timing or Frequency**
Objectives	To ensure effective drainage and disposal of stormwater runoff from the development area and catchments to the west and south-west. To protect the downstream saltmarsh from excessive freshwater inputs i.e. to maintain inputs at or near current levels with similar seasonality of flows. To protect the downstream saltmarsh from silt and accidental spills, particularly during construction. (Refer Element 15)		

PLAN ELEMENT 6	Hydrology, Drainage and Constructed Wetlands	Responsible Parties	Timing or Frequency
	To enhance landscape values in a residential and golf course context with a feature lake system and associated wetlands, which allows for passive recreation. To achieve a design for the drainage and wetlands systems that will be operationally sound, cost effective, and result in no adverse impact on the saltmarsh, by thorough investigation and testing of options. To employ water quality amelioration (stormwater) in wetland treatment systems and separation of treated effluent from stormwater and protect the quality of water entering saltmarsh; To ensure that no adverse impacts arise during construction		
Implementation Actions	• Pending further investigations to finalise the Surface Water Management Strategy (SWMS), Implementation Actions are not detailed here. Further studies (e.g. hydrological modelling) undertaken by specialist consultant appointed by the Owner will resolve design and function issues for the system. The Section 173 Agreement specifically addresses (points 8.6 – 8.9, 8.12 and 8.13) obligations of the Developer and the Golf Course Manager in respect of hydrology, drainage and maintenance of water quality. Satisfactory resolution of all these matters will be required prior to Council issuing stage approvals for the systems and the numerous details that follow.	• Developer / Golf Course Manager	• SWMS to be completed by Aug 2001
Follow-up and Ongoing Actions	• As detailed in design and surface water management strategy documentation.	• Developer / Golf Course Manager	• As detailed in design and surface water management strategy documentation
Performance Measures and Monitoring	Additional performance measures need to be developed after design of the systems has been finalised. These will be addressed in the Surface	• Developer/Golf course manager	• SWMS to be completed by Aug

PLAN ELEMENT 6	Hydrology, Drainage and Constructed Wetlands	Responsible Parties	Timing or Frequency
	Water Management Strategy. Performance standards for all wetlands should include: • 80% suspended solids removed • 50% TN, TP removal (urban drainage areas) • 60% TN, TP removal (mixed treated wastewater/stormwater reuse irrigation areas) • mean annual surface runoff from Golden Beach (Torquay Sands) to be within +/- 15-20% of existing conditions.		2001

7.2.7 ENVIRONMENTAL MANAGAGEMENT PLAN ELEMENT 7: BUFFER AND INTERFACE ZONES

Introduction

A range of 'edge effects' can result following disturbance, for example clearing vegetation for the development of infrastructure such as roads, power-line easements, buildings and residential lots. Edge effects may be direct or indirect. Examples of edge effects include increased disturbance of fauna by noise, activity (people and vehicles) and light; increased rubbish; introduction of weed species (e.g. garden escapees), and prevalence of aggressive 'edge' animal species (e.g. Noisy Miner, Australian Magpie). More subtle edge effects may include a change in drainage and hydrology, water quality and changes in micro-climate and soil nutrient composition.

Edge effects may be ameliorated to varying extents by buffer zones. Buffer zones aim to shield natural habitats from adjacent developments by removing defined interfaces and introducing a gradient of land-use changes. Effective widths are site specific and may vary in response to topography, quality of adjacent habitat, degree of disturbance or type of development. Buffer zones are particularly important to ameliorate edge effects on the eastern boundary of the development and the saltmarsh, potential Orange-bellied Parrot habitat.

Formal buffers are not considered necessary on the north and west sides of the larger western Council Conservation Zone (Figure 1) because of the favourable topography (slopes away from the reserve), the presence of very well-drained soils and the quality of the remnant vegetation. It is already highly degraded in the understorey. Limited revegetation will be implemented along the north and western boundaries of this Council Conservation Zone.

The eastern Council Conservation Zone will be afforded considerable protection from edge effects by extensive revegetation of Moonah Woodland on its northern, western and eastern boundaries (Figure 1). A pathway, originally proposed to be located between the 14th Golf Course and the 15th tee (specific environmental issue 8.3 in Section 7.1) will now be located along the interface of Golf Course Hole 14 and the remnant Moonah stands, downslope from the Moonah trees. It will not impinge on the Moonah trees or revegetation proposed for this area.

PLAN ELEMENT 7	Buffer and Interface Zones	Responsible Parties	Timing or Frequency
Objectives	To minimise impacts and edge effects from the proposed development on adjacent vegetation and habitat, particularly the saltmarsh. To avoid direct interfaces between development buildings, golf course holes and existing vegetation communities (e.g. Moonah – Coast Wirilda Shrubland and saltmarsh).		

PLAN ELEMENT 7	Buffer and Interface Zones	Responsible Parties	Timing or Frequency
	To provide buffer zones where possible with appropriate indigenous vegetation (created by revegetation).		
Implementation Actions	The following buffer zones will help to reduce impacts from the proposed development: • At the interface between the 5th Fairway on the eastern boundary of the development and the western boundary of the saltmarsh. • At the boundary in the eastern section of the golf course, Golf Course Hole 15 and the saltmarsh. • At the interface between Golf Course Hole 14 and the Moonah – Coast Wirilda Shrubland revegetation. • Along the boundaries of the maintenance facility. • Design and implement a vegetated, mounded buffer between the 5th Fairway and the western edge of the saltmarsh to ensure that no saltmarsh vegetation is adversely impacted during construction and operation of the golf course. · A minimum buffer distance of 10 m will apply between the ridgeline of the buffer mounding and the edge of the saltmarsh, and 2m between the toe of any fill and the edge of the saltmarsh. A maximum fill height of 2.9 m at the ridgeline of the buffer mounding will apply. All drainage from the golf course will be directed to the west and detained on site (Section 7.2.6) and during construction all protocols will be implemented to prevent mechanical damage to the saltmarsh and turbid runoff into the saltmarsh (Section 7.2.5). · A buffer of indigenous vegetation (trees, shrubs, perennial herbs) to	• Developer • Developer	• 2001 • 2001

PLAN ELEMENT 7	Buffer and Interface Zones	Responsible Parties	Timing or Frequency
	screen golf play from the saltmarsh and act as a 'filter strip' at the toe of the batter (deflecting drainage westward) will be implemented from the edge of the saltmarsh and will be of appropriate width to achieve its intended functions. Design of this buffer will be integrated with the overall golf course design.		
	• A 1.5 m high black PVC coasted chain-mesh fence will be erected along the western boundary of the saltmarsh at the toe of the batter (edge of revegetated buffer). This will prevent or discourage access by 'out of play' golfers, other people, and some dogs. Figures 2-5 (following pages) show the interface zone (buffer) widths, elevations, grades, scope of revegetation works and other details (refer to EMP Element 7.2.2).	• Developer	• Upon commencement of development construction.
	• A 1.8 m black, PVC coated chain-mesh fence will be erected at the bottom of the embankment (fill at edge of former tip) to prevent retrieval of golf balls from the saltmarsh, general access and to help exclude dogs. Buffer to consist of revegetation and screen planting using indigenous species extending down the embankment to the saltmarsh. Formal buffers between Golf Course holes 2, 3, 4 and 5 and the two Moonah Woodland Conservation Zones are not proposed. The Conservation Zones will be fenced with a farm type rabbit-proof fence to confine access to defined points in the western (large) Conservation Zone and deny access (except for managers) to the smaller, more sensitive eastern Conservation Zone. In addition, extensive revegetation and landscaping utilising indigenous plant species adjacent to the above Golf Course holes will also provide buffering effects (especially visual disturbance to wildlife).	• Developer	• Upon commencement of development construction.

PLAN ELEMENT 7	Buffer and Interface Zones	Responsible Parties	Timing or Frequency
	• At least 10 m of screen planting around the perimeter of the maintenance facility to buffer Moonah – Coast Wirilda Shrubland to the east and west. Fencing is already suggested in this area (see EMP Element 7.2.1) and will also function to contain works within this area. Figures 2-5 (following pages) show the interface zone (buffer) widths, elevations, grades, scope of revegetation works and other details.	• Developer	• Upon commencement of development construction.
Follow-up or Ongoing Actions	• Routine monitoring and maintenance of buffer and interface zones as required	• Developer / Golf Course Manager	• As needed
Performance Measures and Monitoring	• Monitor function of buffer zones, including: · effectiveness in restricting access to sensitive areas; · quality and condition of saltmarsh (also see EMP Element 7.2.2); · monitoring of weed distribution and encroachment.	• Golf Course Manager	• 6-monthly
	• At a later date it may be necessary to provide more barriers or other controls on land use or access if problems with the buffer zones emerge. Identification of any further measures required will form part of the monitoring program.	• Golf Course Manager	• As indicated by monitoring
	• No significant human impacts in the saltmarsh and Moonah – Coast Wirilda Shrubland (e.g. mechanical damage to vegetation or soils) from golf ball retrieval or general recreation will be evident.	• Environmental Management Trust	• Six monthly inspections

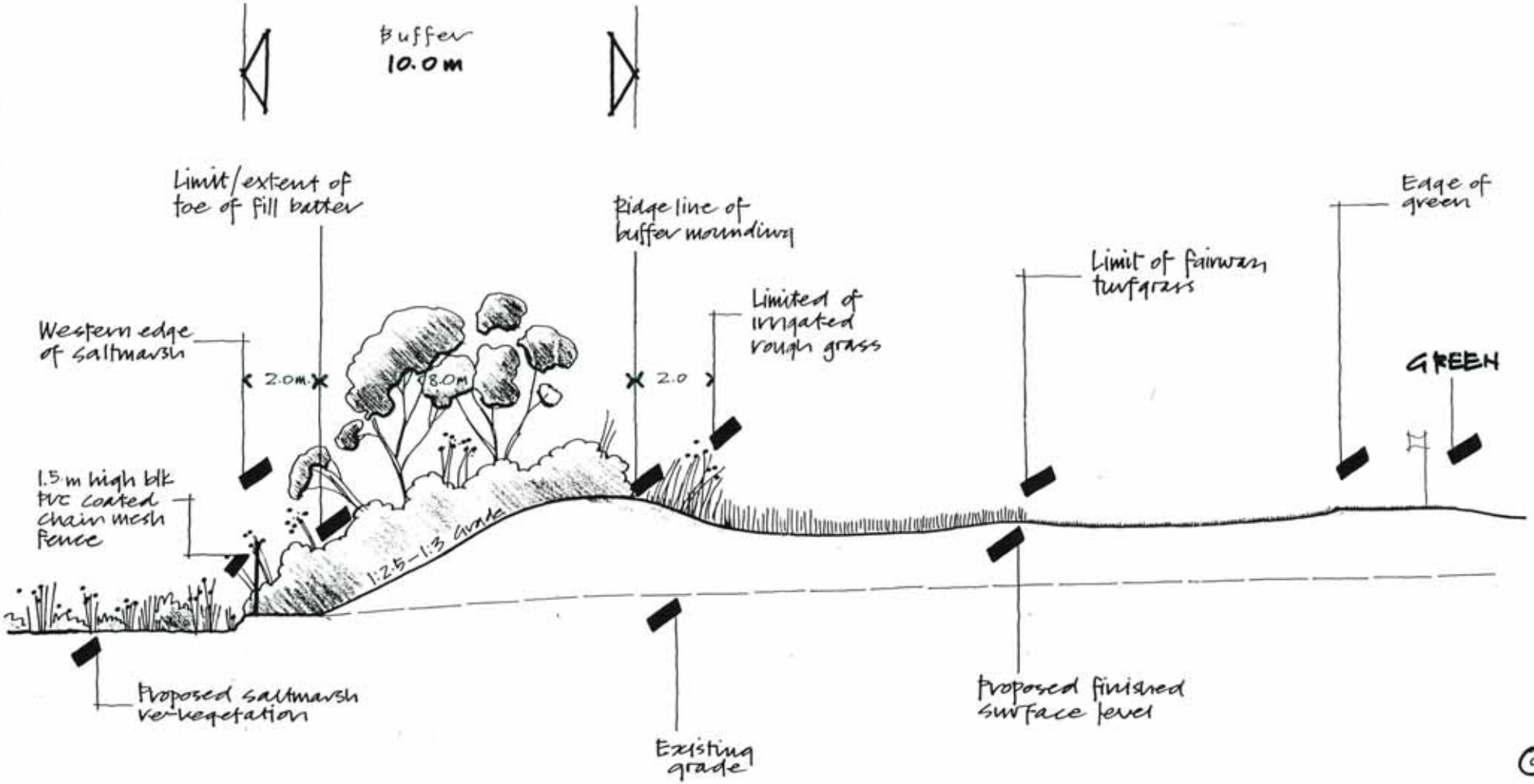


Figure 4. **Torquay Sands Residential Lakes and Golf Course Development Section A – A (see Figures 2 and 3) showing treatment of buffer zone between 15th Fairway and western edge of saltmarsh.**

1:100

Torquay Sands
5th Fairway
Section A-A
Date: 03 April 2001

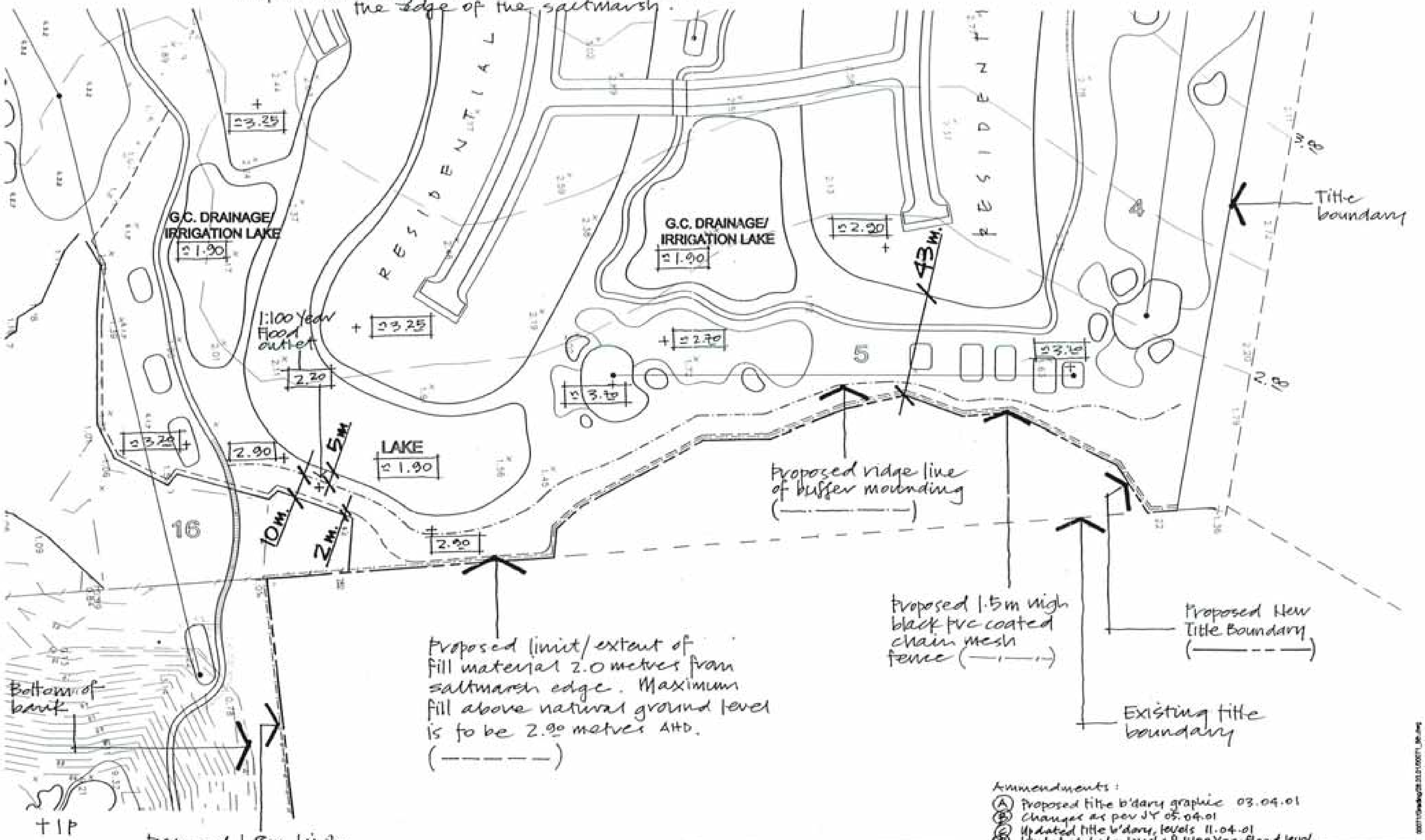
GBLA

Issue:
RL's 20.11.00
RL's 24.11.00
SCS 06.12.00
E.A 03.04.01

Amendments
(A) Fence addition 24.11.00
(B) Ridge location/fence height 06.12.00
(C) Adjustments to 5th fairway dims. 03.04.01

NOTES

- The minimum distance of toe of fill to edge of saltmarsh is to be 2.0 metres.
- The minimum distance of the ridge line of buffer mounding is to be 10.0 metres from the edge of the saltmarsh.
- The minimum distance between residential development (toe of fill) and the edge of the saltmarsh is to be 40.0 metres.



Ammendments:
(A) Proposed title b'dary graphic 03.04.01
(B) Changes as per JY 05.04.01
(C) Updated title b'dary, levels 11.04.01
(D) Updated lake levels & 1:100 Year flood level.

Issue:
EA 06.04.01
RL's 06.04.01 (B)
RL's 11.04.01 (C)
RL's 12.04.01 (D)

SCALE 1:1500 @ A3
0 30m 60m 75m

Figure 2.

Torquay Sands Residential Lakes and Golf Course Development
5th Fairway grading and drainage plan.

GBLA

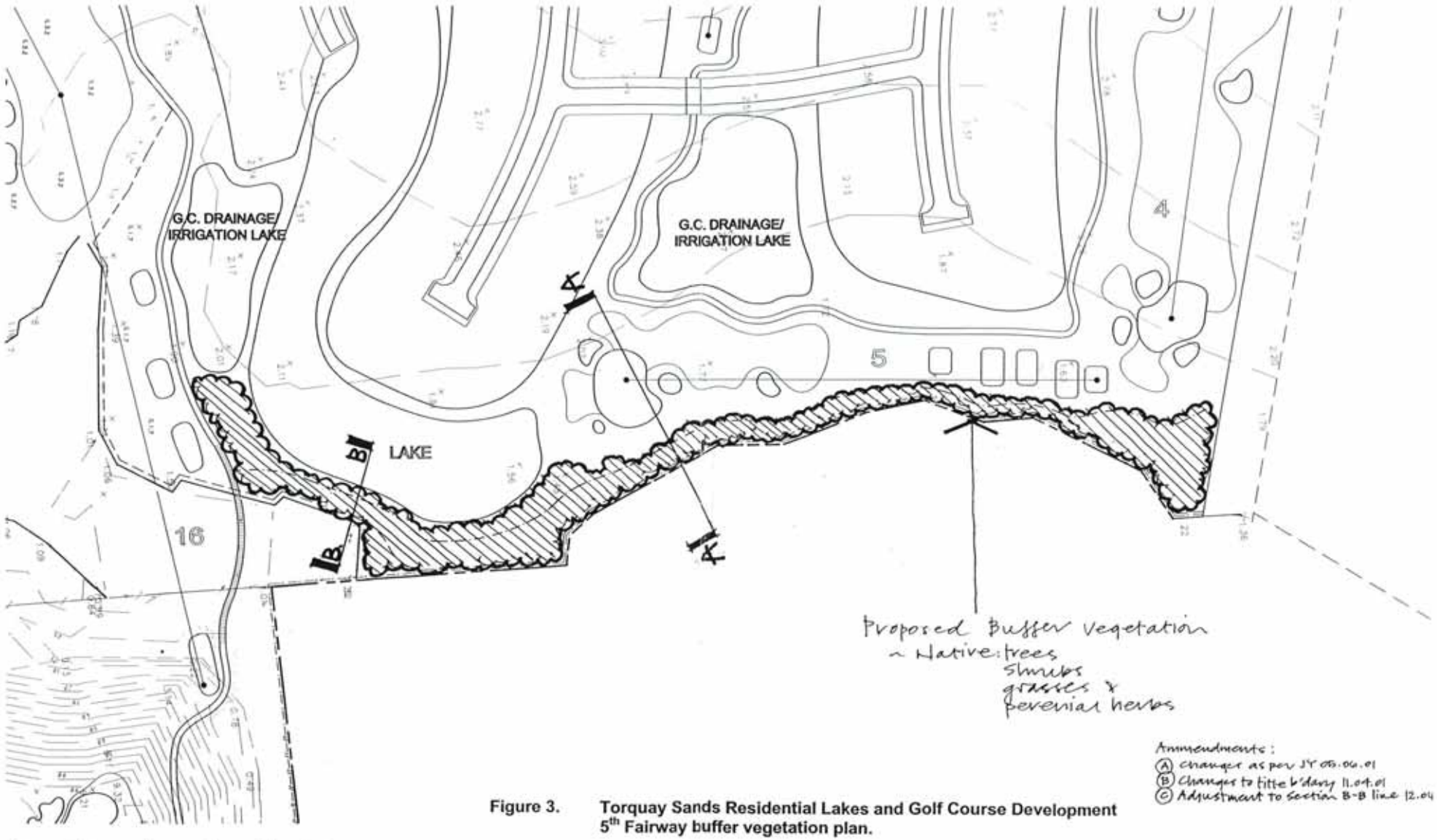


Figure 3. Torquay Sands Residential Lakes and Golf Course Development
5th Fairway buffer vegetation plan.

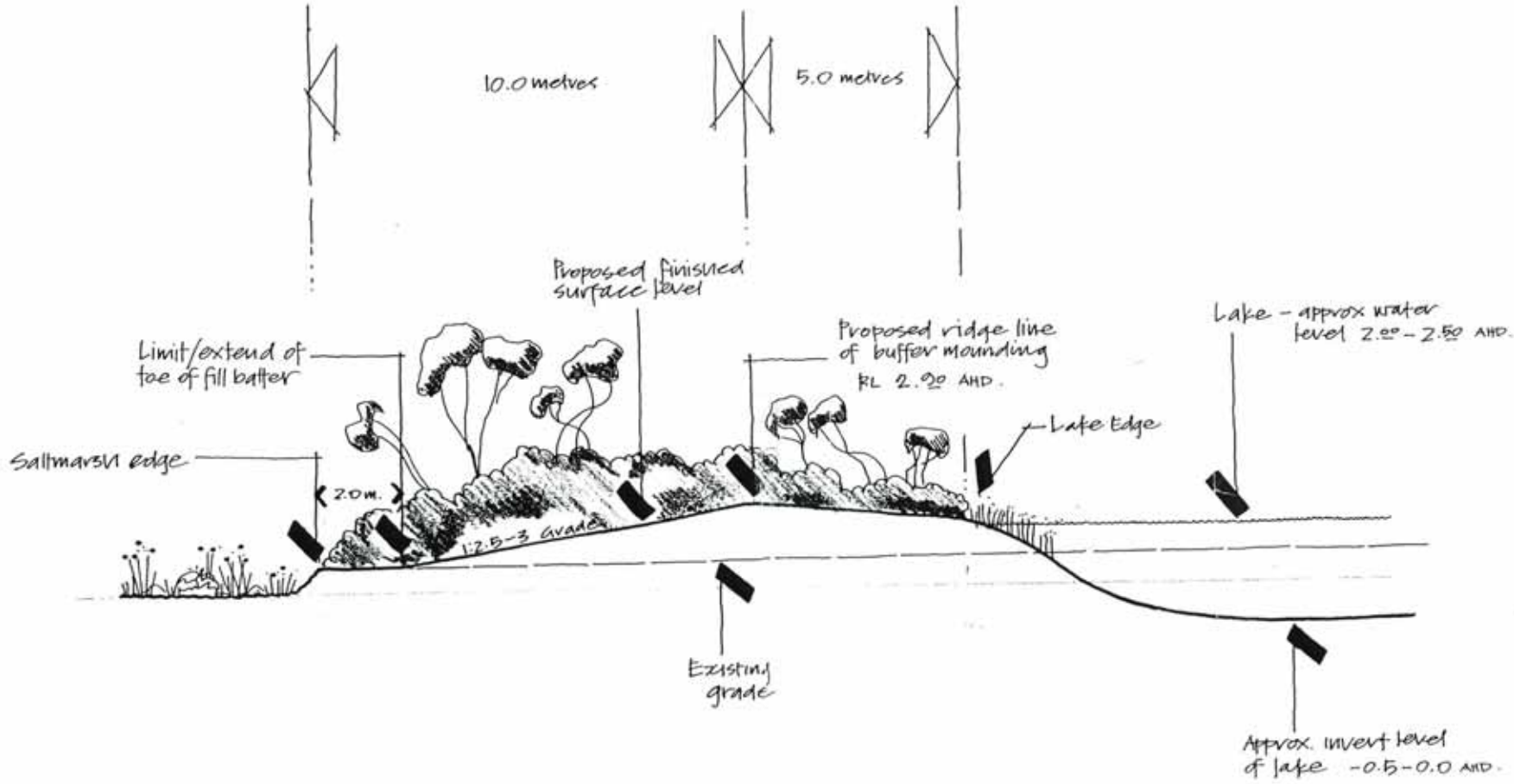
Ammendments:
(A) Changes as per JT 05.06.01
(B) Changes to title b'dary 11.04.01
(C) Adjustment to section B-B line 12.04

Issue: (A) 1 No. Ecology Australia 06.04.01
(A) 1 No. RL's 06.04.01
(B) 1 No. RL's 11.04.01
(C) 1 No. EA 12.04.01

SCALE 1:1500 @ A3
0 30m 60m 75m

TORQUAY SANDS
RESIDENTIAL LAKES & GOLF COURSE DEVELOPMENT
5th FAIRWAY
BUFFER VEGETATION PLAN (28.03.01) (C) (12.04.01)

GBLA
LANDSCAPE ARCHITECTS
SITE PLANNERS
URBAN DESIGNERS
GOLF COURSE PLANNERS



Issue:
EA: 05.04.01

Figure 5. **Torquay Sands Residential Lakes and Golf Course Development Section B –B (see Figures 2 and 3) showing treatment of buffer zone between 15th Fairway and western edge of saltmarsh.**

1:100

Torquay Sands
5th Fairway
Section B-B
Date 05.04.01

GBLA

7.2.8 ENVIRONMENTAL MANAGAGEMENT PLAN ELEMENT 8: USER-RELATED ISSUES

Introduction

The Esplanade is a popular public access route to Whites Beach. The public is accessing the beach via dunes along the length of The Esplanade, despite a car-park with amenities and beach access to the south of the study area. Numerous tracks are scattered through the unfenced dunes to the beach, causing trampling of dune vegetation and erosion. The human traffic through the dunes is impeding revegetation efforts by Torquay Public Reserves. This recreational focus is likely to increase when the development proceeds as new residents and visitors access the surf beach from the Golden Beach (Torquay Sands) Residential Lakes and Golf Course. This has been recognised by the Torquay Foreshore Committee and Surf Coast Shire Council will liaise with the Committee regarding pedestrian access across the dunes from the Golden Beach (Torquay Sands) Development.

Recreation is also centred around the Retarding Basin and the saltmarsh in or adjacent to the development area. It is assumed that such activities will increase following development if access is not managed. This is a major concern for the conservation of the saltmarsh as evidence of dogs and trail bikes was common in the saltmarsh.

Management of increased visitation to the foreshore and the immediate environs is imperative to protect the environment from increased human impacts. Torquay Public Reserves have produced a Foreshore Masterplan and Management Plan that includes foreshore relevant to the proposed development (i.e. the coast and dune system from Whites Beach to Point Impossible - Torquay Public Reserve Committee of Management 1998). Co-operative management between Torquay Public Reserves (and reference to their Foreshore Masterplan), Surf Coast Shire Council and MHY Handbury Joint Venture Pty Ltd is the key to ameliorate impacts of increased human activity in these areas. It has been previously documented in the Amendment R60 (Surf Coast Shire Council 1999b) that the Developer (MHY Handbury Joint Venture Pty Ltd) will contribute funding to the production of construction plans for the Landscape Masterplan for the foreshore area of Whites Beach.

The Torquay Foreshore Committee recently resolved the location, routes and design parameters of a car-park, fencing, boardwalk and roading in consultation with representatives of the Developer and DNRE. Detailed survey, staking-out and design of these facilities has been completed. This will involve the Landscape Architects in consultation with the referral agents (Surf Coast Shire, Torquay Foreshore Committee and DNRE).

PLAN ELEMENT 8	User-related Issues	Responsible Parties	Timing or Frequency
Objectives	To manage the increased human population and visitation and associated effects on the surrounding environment and cultural heritage values. To minimise human impact on the biological and cultural heritage values of the study area by providing controlled access to sensitive habitats. To educate residents and visitors about the biological and cultural heritage values of the study area. To facilitate co-operative planning and management between the Developer, Surf Coast Shire Council, Torquay Foreshore Committee and the associated community groups (e.g. Breamlea Coast Action and Progress Association, Torquay Coast Action Group, Thompson Creek Catchment Committee).		
Implementation Actions	• Determine the method, location, type of facilities and detailed design features needed to protect values in consultation with the Developer (and Landscape Architects), Torquay Foreshore Committee and DNRE (see note in *Introduction* to this EMP element). Matters to consider include: road design, car-park size, location of boardwalk and level of animal control on foreshore. • Implement construction of these facilities with approval from the referral bodies (SCS, DNRE, Torquay Foreshore Committee, representatives of the Wathaurong Community).	• Developer / Surf Coast Shire / Torquay Foreshore Committee • Developer / Surf Coast Shire / Torquay Foreshore Committee / Wathaurong Community	• 2001 • 2001

PLAN ELEMENT 8	User-related Issues	Responsible Parties	Timing or Frequency
	• Educate the visiting public with signage documenting the biological and other values of surrounding habitats. Extending this kind of simple but specific information to the public contributes to the success of control measures (e.g. dogs to be kept on leads) by offering explanations why these restrictions are put into place, e.g. information about specific habitats and the species they support: · Moonah – Coast Wirilda Shrubland Reserve (various birds); · Saltmarsh (Orange-bellied Parrot, water birds and waders, especially JAMBA/CAMBA species); and · Dune system and surfbeach (Pacific Gull, Great Cormorants, and ground-nesting birds such as the Hooded Plover).	• Torquay Foreshore Committee / DNRE / Surf Coast Shire	• Ongoing, however should begin immediately.
	• Creation of specific beach access route through the adjacent White's Cut dune system (access to saltmarsh will not be provided).	• Developer	• As per 173 Agreement
	• Regular consultation with the Wathaurong Community according to the Community's wishes.	• Torquay Foreshore Committee	• As indicated by agreement between parties
Performance Measures and Monitoring	• Success of revegetation program in the dune system.	• Torquay Foreshore Committee	• As indicated in Management Plan
	• Decrease of human-induced erosion processes in the dune system.	• Torquay Foreshore Committee	• As indicated in Management Plan
	• Maintenance of environmental and cultural heritage values	• Torquay Foreshore Committee	• As indicated in Management Plan
	• No increase in litter in the general area.	• Torquay Foreshore Committee	• As indicated in Management Plan
	• No reduction in bird population, especially ground nesting birds and migratory birds.	• Torquay Foreshore Committee/ DNRE	• As indicated in Management Plan

PLAN ELEMENT 8	User-related Issues	Responsible Parties	Timing or Frequency
	• Monitor use of access tracks.	• Torquay Foreshore Committee	• As indicated in Management Plan
	• Annually assess condition of dune system and key indicator biological and cultural heritage values.	• Torquay Foreshore Committee	• As indicated in Management Plan

7.2.9 ENVIRONMENTAL MANAGAGEMENT PLAN ELEMENT 9: INDIGENOUS LANDSCAPE AND AMENITY PLANTINGS

Introduction

The indigenous vegetation in the Torquay – Breamlea area confers an important landscape character in and around the proposed development area and there is considerable scope to use indigenous species from the local flora for landscape and amenity plantings associated with the golf course, residential and other public open space. Use of indigenous plant species will also enhance conservation values as it will provide resources for some fauna species (e.g. food, shelter, nesting sites). Three broad environments are present in the development area: well-drained sandy calcareous soils of the dune system (nearest the coast); well-drained sandy or loamy acidic soils away from the coast (the bulk of the property); and seasonally wet sites, with loamy or clay-loam soils, of drainage lines and low-lying areas. These broad environments would have carried a distinct vegetation and flora. For horticultural applications using the local flora, planting of species should be appropriate to the broad environments to ensure best performance, and plant associations should be designed to make the most 'ecological sense' (e.g. coastal species planted near the coast in more-or-less natural associations).

Plant species from the local flora appropriate for various horticultural applications are given in Appendix 9. These species occur or are considered to have occurred as part of the original vegetation of the property (mostly grassy/sedgy open woodland) as extrapolated from local remnant vegetation, or they occur in similar environments to the near west of Torquay.

It is recognised that many indigenous plant species are untried or little-known in horticulture but many species are highly suited to cultivation, especially if they are treated 'tough' (e.g. minimal artificial watering and avoidance of 'advanced' nursery stock). All indigenous species used in horticultural/landscape applications should be propagated from local material to ensure genetic conformity with local populations and to maximise their value as sources of known-provenance propagating material.

However these species should not be potentially weedy and should be broadly compatible with the local character. They should be capable of performing well in a fairly hostile coastal environment where salt spray and calcareous soils are potentially major limitations to plant performance.

The use of native, predominantly indigenous plant species will be provided in the planting of private gardens, and in the non-residential components of the development site unless otherwise approved in writing by Council. Planting of non-native shrubs and vegetable gardens is permitted provided that they cannot be viewed from the streetscape at mature height.

The list of indigenous plant species in Appendix 9 is confirmed as the list of recommended species for planting.

7.2.10 ENVIRONMENTAL MANAGAGEMENT PLAN ELEMENT 10: DOMESTIC ANIMALS

Introduction

There is evidence of stray or feral cats and dogs in the study area. It is likely that some cats are wandering into the study area from existing housing developments to the west of the site (one cat was seen during spotlighting – see Section 5.2.1). Cats and dogs have been a management issue in the area for some time and pets have been known to wander as far as Point Impossible from nearby residential areas (S. Cameron, Surf Coast Shire Council, pers. comm.). Currently, many local residents walk or run their dogs in the study area, the adjacent saltmarsh and Whites Beach. There are currently no restrictions on domestic pet access to Whites Beach, although a 'Dog Free Zone' exists within the Shire along the beach from Darian Road, Torquay, to the Bird Rock car-park at Jan Juc (T. Doueal, Surf Coast Shire Council, pers. comm.). The proposed development will most likely increase the density of dogs and cats within the study area. Domestic pets are an integral part of modern society, and their management needs to be approached with flexibility and appreciation for both community and environmental needs.

Cats

Impacts of the feral, stray and domestic cat (*Felis catus*) on fauna have been investigated widely in the Australian scientific literature (Bezuijen and McMahon 1999; Webb et al. 1995; Barratt 1995, 1997, 1998; Paton 1993). It is generally acknowledged that cats may prey on a range of native and exotic mammals, birds, reptiles and frogs. Impacts on native fauna by cats are thought to be most significant in undisturbed habitat adjacent to new residential developments (Barratt 1997, 1998).

Predation of native wildlife by cats is listed as a Threatening Process under Schedule 3 the *Flora and Fauna Guarantee Act 1988*. Action Statement No.80 (Seebeck and Clunie 1997) has been prepared under this Act to help ameliorate the adverse impacts of cats. Predation by cats is recognised as one of a suite of processes threatening native fauna populations. Others include habitat loss and fragmentation, edge effects and disturbance, climatic variation, competition and other predators (e.g. foxes) (Bezuijen and McMahon 1999). It is therefore difficult to quantify effects of cat predation *per se*, although several conclusions are possible:

- The introduction of domestic cats (and dogs) as a result of a new residential development can introduce or modify a range of degrading processes impacting directly or indirectly on flora and fauna, including predation;
- Domestic cats play a contributing role in the decline of many mammal, bird and reptile taxa; and
- Domestic cats appear to selectively prey upon small mammals, particularly nocturnal ground- and tree-dwelling species. After mammals, birds appear to be the most preferred prey (Bezuijen and McMahon 1999).

Dogs

Domestic dogs can also pose a threat to native wildlife, although more often via indirect processes rather than direct predation. Dogs exercised irresponsibly may cause individuals or flocks of foraging or roosting birds to take flight. They may also flush birds from nests during breeding. This is an important issue for ground-nesting birds, particularly the Hooded Plover, as well as birds that forage along beaches, mudflats and other aquatic habitats (e.g. Fairy Tern, Masked Lapwing, Red-kneed Dotterel, Red-capped Plover). Sightings of the Hooded Plover have been observed to decrease in frequency along Thompson Creek and the associated saltmarsh at Breamlea during summer when the peak of dog recreation and horse riding occurs (S. Howlles, Geelong RAMSAR Awareness Committee, pers. comm.).

This EMP recommends in the interests of bird conservation that dogs should be prohibited in the sand dunes between White Beach and Point Impossible except at approved entry and exit points.

PLAN ELEMENT 10	Domestic Animals	Responsible Parties	Timing or Frequency
Objectives	To minimise impacts of domestic animals on native flora and fauna To exclude or restrict access of domestic animals (cats and dogs) in environmentally sensitive habitats, such as the saltmarsh, Beach/Shoreline and the Moonah – Coast Wirilda Shrubland Conservation Zones (managed by Council). To provide a framework to accommodate pets in appropriate parts of the Golden Beach (Torquay Sands) development.		
Implementation Actions	• Prohibit keeping of domestic cats in all parts of the development east of a north-south line approximately 200 m from Whites Road which bounds the western edge of the development indicated by the 10th, 11th and 18th Fairways. Only residents fronting or in the vicinity of the Whites Road end of the development will be permitted to keep cats.	• Body Corporate	• At all times
	• Apply Surf Coast Shire Council's current domestic pet regulations and the *Domestic (Feral and Nuisance) Animals Act 1994*.	• Surf Coast Shire	• At all times

PLAN ELEMENT 10	Domestic Animals	Responsible Parties	Timing or Frequency
	• Promote responsible pet ownership and public education about the negative impacts of pets on wildlife and amenity values.	• Surf Coast Shire	• Ongoing • At all times
	• All dogs within the Golden Beach (Torquay Sands) Development must be restrained by leads.	• Surf Coast Shire	• Ongoing
	• Community consultation (e.g. Council questionnaire/survey) to understand and consider the needs of local pet owners. This will ensure the most appropriate management decisions with regards to potentially controversial legislation, such as night curfews and exclusion zones. Include responsible ownership information in the 'new resident kit'.	• Surf Coast Shire	
	• Restrict the keeping of domestic cats and dogs to the residential zone not more than 200m wide at the western edge of the development (along Whites Road)	• Body Corporate	• At all times
	• Only allow domestic dogs on leash in development area, and remove stray dogs and stray and feral cats from development area when (and if) they appear.	• Body Corporate / Surf Coast Shire	• At all times
	• Encourage confinement, registration of pets and de-sexing, especially of cats.	• Body Corporate	• At all times
	• Erect regulatory signage advising 'On-leash Areas' at appropriate sites and exclusion from other areas (e.g. Council Conservation Zones).	• Developer	• 2001
	• Provide and maintain specific bins, "Doggy Loos" or "Pooch Patches" (Harlock and Jackson Pty Ltd 1995) in public areas to encourage and enable responsible removal of dog faeces. This will also help avoid nutrient-enrichment problems.	• Developer / Body Corporate	• 2001
	• Enforce fines on owners of unrestrained dogs and cats.	• Surf Coast Shire	• At all times

PLAN ELEMENT 10	Domestic Animals	Responsible Parties	Timing or Frequency
	Considering feedback received from the local community: • Implement a night curfew on cats in areas where cats are permitted in accordance with the Surf Coast Shire 173 Agreement (1999a) • During the Hooded Plover nesting season, August to February (Schulz 1992), extend the existing 'Dog Free Zone' from Darian Road to Point Impossible.	• Body Corporate • Torquay Foreshore Committee	• At all times • Annually
Performance Measures and Monitoring	• A decrease in unrestrained and wandering domestic pets. • A decrease in dog faeces in public places. • Random patrolling of management measures to evaluate effectiveness.	• Body Corporate / Golf Course Manager • Body Corporate / Golf Course Manager • Environmental Management Trust	• Six monthly inspections

7.2.11 ENVIRONMENTAL MANAGAGEMENT PLAN ELEMENT 11: FERAL ANIMAL CONTROL

Introduction

Rabbits

Rabbit damage on golf courses is both a common and a costly management issue for many Victorian clubs, particularly those in the "Sand Belt". The main damage consists of "scratchings" on the greens, which then require considerable remedial work. The authors know of some clubs in Victoria where rabbit damage has caused thousands of dollars worth of damage each week. In the absence of some action on current rabbit infestations, costly damage to newly established greens at Golden Beach (Torquay Sands) is likely, if not certain.

Quite apart from damage to the Course proper, even a low population density of rabbits can seriously impede efforts to revegetate targeted sites. Rabbits selectively graze the seedlings of many native tree and shrub species. As an example Cooke (1987) has found that as few as 2-3 rabbits per hectare is sufficient to prevent regeneration of some important native species on the Coorong in South Australia – an environment not unlike that at Golden Beach (Torquay Sands).

Since some form of fencing seems to be indicated for these areas on the current Comprehensive Development Plan, the incorporation of a rabbit-proof design should not add greatly to the cost.

Foxes

Foxes do not normally cause serious problems on golf courses in Victoria, although there are exceptions. The main exception relates to excavations in the turf made by the animals (and by ravens) in search of certain species of cockchafer grubs, which sometimes infest the greens. This problem can usually be solved by judicious and carefully timed application of the correct insecticide to remove the source of food.

The significance of fox predation in the Moonah – Coast Wirilda Shrubland is unknown. In the absence of any evidence of uncommon, rare or threatened wildlife in this area, it is difficult to suppose that existing predation rates constitute a threatening process, as outlined in Mansergh and Markes (1993). In any case, because the fox is a highly mobile animal with a much larger home range than the rabbit, any control action on foxes would be futile unless surrounding land managers also took similar action in a community-based scheme over a large area.

Fox control should be considered only if significant damage is being caused on the course (digging for food) or if harmful predation of native species is suspected. Discussion of a possible poisoning campaign should then involve DNRE and local residents.

PLAN ELEMENT 11	Feral animal control	Responsible Parties	Timing or Frequency
Objectives	To minimise rabbit-induced (and possibly fox) impacts to native vegetation and the Golf Course. To minimise habitat opportunities for rabbits and foxes.		
Implementation Actions	***Rabbits*** • **Fencing** A rabbit-proof fence should be erected along the southern boundary of the development (see Map 2). This would protect the Golf Course and proposed revegetation areas from rabbits living in the adjacent Moonah – Coast Wirilda Shrubland and dune complex of the coastal reserve. Suggested specifications for a free-standing rabbit fence are given below. **Netting**: Standard 105 x 4 x 1.4. (i.e. 105 cm high, 4 cm mesh width, 1.4 mm wire). The netting should be hung to allow for a generous ground apron of 8-10 cm. This apron should be to the outside of the fence, to prevent rabbits burrowing into the protected area. For a free-standing rabbit fence, posts (5'6" star pickets or treated pine poles) should be at no more than 3.5 m centres. A minimum of two plain wires (top and bottom) is required to affix the netting to the fence. These wires should be of a heavy gauge to prevent sagging (e.g. 10G). A third "belly" wire, half way up the post will prevent the netting from bulging in the centre, but this is not mandatory. It is most important that the line of the fence is cleared of vegetation and the netting apron is smoothed to rest firmly against the soil surface. As an alternative, the "apron" can be buried vertically but this will require a continuous trench c. 10 cm deep.	• Developer / Golf Course Manager	• 2001

PLAN ELEMENT 11	Feral animal control	Responsible Parties	Timing or Frequency
	The addition of plain or barbed wires at the top of the fence (spaced at 10 cm centres above the top of the netting) may act as a deterrent for foxes but will not prevent determined individuals from climbing the fence. While such a fence, properly maintained and patrolled, will prevent entry of rabbits onto the course, rabbit proof fencing of the two Council managed Conversation Zones, will also be required and will be provided by the Developer. • **Poisoning** Because the development area is currently a popular walking spot for people with dogs, use of conventional 1080-treated carrot or oat bait is contra-indicated. There is also a high risk of secondary poisoning of pet dogs and cats (ingestion of poisoned carcasses) and other non-target species (e.g. Smoky Mouse). ~~This means that all rabbit poisoning needs to be centred on the use of pindone-treated carrot bait. Such bait should be hand broadcast over all rabbit feeding areas. Assistance can be obtained from the local DNRE office. The technique requires that rabbits be fed with the pindone-treated bait on two separate occasions, no less than three days apart and no more than five days apart.~~ Baiting rates will need to be adjusted according to indicated rabbit numbers. If rabbit numbers are high, some 20-30 kg bait/ha will be needed. In the Moonah – Coast Wirilda Shrubland, it is suggested that an initial poisoning campaign (ideally in late summer or early autumn) should be followed up with warren fumigation (see below).	• Surf Coast Shire	• As required

Amend as per letter of approval of EMP

Golden Beach (Torquay Sands) Development

PLAN ELEMENT 11	Feral animal control	Responsible Parties	Timing or Frequency
	• **Fumigation** Since the majority of warren entrances are accessible to humans, fumigation with aluminium phosphide tablets is a control option. This should be carried out in autumn, after the break but before the onset of rabbit breeding. At this time, soil moisture is sufficient to generate the toxic phosphine fumes and rabbits will be controlled before they have had the opportunity to breed up. For efficient fumigation, the use of a power fumigator is recommended. These machines, together with instructions for use, can usually be obtained from local DNRE offices. All holes, active or inactive, must be treated with tablets (1 or 2 per hole) and securely blocked with soil. Fumigation (with a proven fumigator) and the use of dogs to drive rabbits underground before fumigation is required to eliminate rabbits within the Conservation Zones after the installation of the rabbit proof fence.	• Surf Coast Shire	• As required
	• **Warren Ripping** Such a technique should certainly be used in the current pastureland areas where the removal of boxthorns and destruction of associated warrens will give permanent control of rabbits. However, most existing warrens are under or near desirable vegetation (e.g. Moonah – Coast Wirilda Shrubland), and destruction of warrens via ripping is not a viable option in these areas (refer to Fumigation above).	• Golf Course Manager / Surf Coast Shire	• As required
	Foxes The control of foxes will be quite difficult at this site and should not be considered unless a community-based scheme involving all neighbours is possible.	• Golf Course Manager / Surf	• As required

PLAN ELEMENT 11	Feral animal control	Responsible Parties	Timing or Frequency
	Hunting and shooting are unlikely to give any real level of control and this leaves only poisoning as a viable option. Again, there are problems here because of the high human traffic and presence of pet dogs and cats. **Poisoning** The only available poison is 1080. A co-ordinated poisoning program along the entire foreshore area would require the permission of DNRE, the provision of ample signs and a restriction on the entry of pets to the area while poisoning was in operation. The preferred method of baiting would be to establish bait stations (small, raised hillocks of sand in which a toxic bait – available from DNRE – is buried). Pre-feeding with unpoisoned baits would be a useful precaution since possible visitation of the sites by non-target species could then be checked.	Coast Shire	
Follow-up or Ongoing Actions	• Ongoing and regular patrolling and maintenance of rabbit-proof fences • Careful monitoring for signs of rabbit scratching, active warren entrances, etc. will give an indication as to when (and if) control works are needed. Warren fumigation to be applied routinely as soon as indications of increasing rabbit numbers are present.	• Golf Course Manager • Golf Course Manager	• As needed • As needed
Performance Measures and Monitoring	• Decrease in rabbits and rabbit-induced impacts in the development area. • Little or no rabbit damage to Golf Course greens. • Elimination of rabbits from the Council managed Conservation Zones. • Periodic review and refinement of pest animal management approach and effectiveness.	• Environmental Management Trust	• To be determined

7.2.12 ENVIRONMENTAL MANAGAGEMENT PLAN ELEMENT 12: MOSQUITOES

Mosquitoes have been raised as a potential issue of concern for constructed wetlands. Mosquitoes are considered to be an issue due to their nuisance value and their potential role as disease vectors (e.g. of Ross River Fever). The report by Craigie and Condina (1999) for the Golden Beach (Torquay Sands) development notes that the design of the wetlands and lakes will take into account mitigation of the mosquito risk. Summarised below are some design guidelines given in *The Constructed Wetlands Manual* from NSW (DLWC 1998) and Lawrence and Breen (1998). Native mosquito species are a natural part of the existing saltmarsh ecosystem and we do not advocate control in this area. The measures suggested here apply only to the constructed wetlands where there is a risk of an overabundance of introduced mosquitoes (e.g. *Aedes egypti*) (Walters 1999). The following are general notes as habitat preferences and biology vary between the different species of mosquito.

Mosquitoes are, however, only one of several considerations in the design of wetlands. The use of native fish that are mosquito predators is an additional option to reduce mosquitoes. The Southern Pygmy Perch (*Nannoperca australis*) or the Yarra Pygmy Perch (*Nannoperca obscura*) are native in the region and would be suitable for artificial wetland stocking for mosquito control (Steve Saddlier, Arthur Rylah Institute for Environmental Research, pers. comm.). The latter species is threatened in Victoria and special conditions for its use in this regard must be fulfilled. Its use would probably have conservation merit. Standard DNRE stocking protocols must be adhered to, as well as translocation regulations available from DNRE Fisheries.

Mosquito control through water body design

The potential for mosquito hazards can be minimised through adoption of appropriate design measures. It is important to ensure that the wetlands do not contain pockets isolated from predation by normal wetland biota such as fish and crustaceans. Such pockets include water trapped on poorly graded banks following elevated water levels in storm flows, or shallow water in association with debris. Design measures for minimising the possibility of mosquito nuisance include:

- grading banks to ensure free shedding of water following draw down of floodwaters
- adoption of an edge grading of slope 1 in 8 with an edge lip of 200 mm and a minimum depth of 300 mm
- shaping to provide efficient circulation of flow
- provision of sediment and trash interception at wetland entry points
- selection of aquatic plants which do not have broad leaves above the surface to minimise substrate for mosquito breeding. Floating vegetation should be discouraged as it may support a diverse mosquito fauna.

- provision of artificial recirculation mechanisms

Mosquito problems have rarely been observed in any wetlands and ponds where the above precautions have been taken, however the potential for problems should be recognised. Newly flooded vegetated habitats without predators can produce large numbers of mosquitoes whereas more permanent habitats with established and diverse fauna will generally produce fewer adult mosquitoes (Russell 1997). Mosquitoes often breed in relatively shallow water wetland edges, therefore if steeper edge gradients are untenable for safety reasons then a short vertical lip (200 mm) at the edge can provide depth for predators (Russell 1997). Fortunately, in the development area the quality of runoff will be such that the treatment wetlands will be subject to relatively low pollution loads compared with loads from many residential or commercial and industrial areas.

PLAN ELEMENT 12	Mosquitoes	Responsible Parties	Timing or Frequency
Objectives	To minimise the potential mosquito risk in the development area. To ensure there is only minimal breeding of mosquitoes in the constructed wetlands.		
Implementation Actions	• Implement wetland design and operation guidelines aimed at reducing abundance of mosquitoes in the constructed wetland where these do not conflict with operational guidelines (i.e. to ameliorate water quality). Apply suggested water body design and operational measures (as outlined above) to help in keeping mosquito numbers to a minimum: · grading banks to ensure free shedding of water; · adoption of appropriate edge gradient and configuration; · shaping for efficient circulation; · sediment and trash interception; · selection of plant species to avoid floating vegetation; and · provision of artificial circulation mechanisms.	• Developer	• 2001/2002

PLAN ELEMENT 12	Mosquitoes	Responsible Parties	Timing or Frequency
	• Stock wetlands with predatory fish and ensure populations are maintained (e.g. Southern Pygmy Perch or Yarra Pygmy Perch); contact DNRE regarding stocking protocols and translocation regulations; and	• Golf Course Manager	• When wetlands have stabilised and vegetation is well established
	• Use of 'Bacterial Larvicide' as a specific mosquito control agent is acceptable; other pesticides with non-specific activity are unacceptable.	• Golf Course Manager	• As needed
Follow-up or Ongoing Actions	• Monitor survival of fish	• Golf Course Manager	• As indicated by fish introduction protocols
Performance Measures and Monitoring	• No excessive levels of freshwater mosquitoes breeding in the constructed wetlands. • Conduct seasonal monitoring of mosquito numbers. Aspects of this (e.g. which mosquito species to monitor and frequency and timing of monitoring) need to be resolved after construction and when wetlands are operational	• Golf Course Manager	• As required

7.2.13 ENVIRONMENTAL MANAGAGEMENT PLAN ELEMENT 13: FIRE

Introduction

Fire management is an issue relevant to the management of the Council Conservation Zones from the view point of fire safety and control of unplanned fire. No prescribed ecological burning is advocated in the Conservation Zones or upper saltmarsh as this could damage the vegetation which may be unable to recover satisfactorily after fire because of insufficient soil-stored seed bank; because massive weed invasion is expected after fire, and/or because of rabbit grazing.

From the viewpoint of management of wildfires, any control measures must be implemented very carefully to prevent mechanical damage to vegetation or soils. Similarly, a careful balance is required between the need to be able to control fires by the provision of fire-breaks and the need to avoid further damage to the scarce, state-significant Moonah – Coast Wirilda vegetation by creating new fire-breaks. The vegetation in the eastern Council Conservation Zone is already highly fragmented by the clearing in 1998; provision of a fire break along its southern boundary may not be necessary and if it is, further clearing will not be required. In the western Council Conservation Zone it may be appropriate to maintain a fire break along the southern boundary or preferable utilise the road in the coastal reserve as a fire break to protect indigenous vegetation and assets.

Further resolution of the fire management issue is required by consultation with officers from the Surf Coast Shire and the Country Fire Authority to provide a local fire management plan.

PLAN ELEMENT 13	Fire risk reduction	Responsible Parties	Timing or Frequency
Objectives	To minimise the risk of fire destroying significant ecological attributes, particularly the saltmarsh and other remnant vegetation. To minimise the likelihood of unplanned fires occurring in the area that threaten significant ecological features; and To ensure, in the event of fire in the development area or offsite on other private or public land, that fire control techniques are implemented in a manner that does not have deleterious ecological impacts.		

PLAN ELEMENT 13	Fire risk reduction	Responsible Parties	Timing or Frequency
Implementation Actions	• Develop and implement a Fire Management Plan (FMP) for the whole site in consultation with Surf Coast Shire and the CFA, having regard to all other relevant management plans. The FMP will: · cover both prevention and control activities; and · incorporate fire prevention and control activities which do not deleteriously effect significant ecological features (e.g. nationally significant saltmarsh and Moonah – Coast Wirilda Shrubland).	• Developer	• 2001
Follow-up or Ongoing Actions	• Periodic review of Fire Management Plan as advised by CFA • Implement management to rehabilitate vegetation / soils in the event of damage caused by unplanned fire (this particularly applied to weed invasions and rabbit control).	• Golf Course Manager / Surf Coast Shire / Country Fire Authority • Golf Course Manager	• To be advised by CFA • As needed
Performance Measures and Monitoring	• No lasting damage to infrastructure, vegetation or soils as a result of unplanned fire or fire control activities. • In the event of fire and fire control measures (unplanned or planned fires) monitor to determine impacts of fire.	• Golf Course Manager • Golf Course Manager	• As needed • As needed

7.2.14 ENVIRONMENTAL MANAGAGEMENT PLAN ELEMENT 14: CONSTRUCTION ACTIVITIES – CONTROL OF EROSIONS, SILTATION, TURBIDITY AND POLLUTANTS

This EMP Element has been formulated to enable protection of environmental and flora and fauna values within the development area and on adjoining lands during construction. In particular it seeks to control soil erosion and sedimentation in receiving environments and protect water quality, particularly in the Saltmarsh, as well as protect remnant vegetation and faunal habitat from direct damage. Some of the issues and controls in this Element are common to Element 5: Water Quality Management and Element 6: Hydrology, Drainage and Constructed Wetlands.

PLAN ELEMENT 14	Construction Activities – Control of Erosions, Siltation, Turbidity and Pollutants	Responsible Parties	Timing or Frequency
Objectives	To ensure protection of soils from erosion during the construction phase of the development. To minimise wind-blown dust generated during construction. To ensure that potential downstream receiving environments – in particular saltmarsh and constructed wetlands – are protected from sedimentation during construction. To ensure the maintenance of runoff water quality in receiving environments (saltmarsh and constructed wetlands) notably the control of turbidity and contamination by pollutants (e.g. oil and chemical spills) during construction. To protect all remnant indigenous vegetation and faunal habitat from direct damage (e.g. from vehicles) during construction. To prevent hard rubbish littering the development area and the adjoining environments (saltmarsh, Council Conservation Zones and the public dune complex to the south of the development area) during construction. This issue is concerned with the maintenance of landscape values (i.e. visual qualities) and the potential for hard rubbish to harm fauna. To minimise noise impacts on adjoining properties.		

PLAN ELEMENT 14	Construction Activities – Control of Erosions, Siltation, Turbidity and Pollutants	Responsible Parties	Timing or Frequency
	To minimise the risk of promoting feral animal (foxes, feral cats, rodents) populations by provision of food scraps or food waste during construction.		
Implementation Actions	• Prepare a Construction Management Plan (CMP) outlining all measures to protect the environmental values of the site, including construction techniques that minimise erosion and prevent the movement of dust sediment, runoff and noise from construction areas. The CMP is to include the following measures:	• Developer	• Prior to any works commencing on site
	· Exclude all activities from sensitive areas where direct damage may occur to vegetation and faunal habitat	• Developer / Construction Manager	• Ongoing
	· Bonding arrangements will be made with Contractors to ensure implementation of the protection measures;	• Developer / Construction Manager	• As part of each contractual agreement
	· In the event of failure of any of these controls, amelioration measures will be implemented immediately to rectify the situation, potentially with Contractors forfeiting the bond(s).	• Developer / Construction Manager	• As needed
	· Arrange development staging and work schedules to limit the extent of cleared areas during development and re-grass and stabilise completed areas.	• Developer / Construction Manager	• As needed
	· Divert stormwater from active works areas.	• Developer / Construction Manager	• As needed
	· Locate soil stockpiles at least 20 metres from any drainage pit.	• Developer / Construction Manager	• As needed

PLAN ELEMENT 14	Construction Activities – Control of Erosions, Siltation, Turbidity and Pollutants	Responsible Parties	Timing or Frequency
	• Release of water (other than during a rainfall event) from the site during construction must have prior permission from the EPA and conform to their standards for release.	• Developer / Construction Manager	• In accordance with EPA standards
	• Clean earthmoving and grass maintenance vehicles entering and leaving the site and source materials (e.g. fill) from non-infected sites.	• Developer / Construction Manager	• As needed
	• Provide temporary litter traps during the construction phase at local drainage inlets to the treatment wetlands. Screening techniques, such as hay bales or silt fences will be used around drainage pits, active construction areas and along the eastern boundary of the site.	• Developer / Construction Manager	• Upon commencement of construction works
	The following activities will also form part of the Construction Management Plan and will be undertaken where erosion, siltation and turbidity are judged by the Construction Manager / Contractor to be potential problems: • at stockpile sites vehicle activity must be tightly regulated and confined to as small an area as possible; • table drains built along access tracks / haul roads will not have to carry more than 1:1 ARI peak flow. The larger the area, the harder it is to stabilise against erosion. 1:1 ARI will handle >95% of mean annual runoff; • all table drains will be stabilised to prevent erosion: grassing plus gravels in the bed should suffice, with silt fences as appropriate; • all table drains should discharge into appropriately designed sediment ponds and/or to grass spreader banks. No table drain will discharge directly to any watercourse;	• Developer / Construction Manager and delegated authorities	• Throughout construction period

PLAN ELEMENT 14	Construction Activities – Control of Erosions, Siltation, Turbidity and Pollutants	Responsible Parties	Timing or Frequency
	• for upslope areas where runoff will not be contaminated, runoff will be diverted around the construction area via a stable, shallow grassed drain and/or levee bank, so that its volume does not add to the polluted water from the works sites. Appropriate surface grassing of the drain (with sterile exotic grass) is important so that clean runoff entering the drain does not become turbid. Non-contaminated upslope runoff will not drain into sedimentation ponds, which would increase water volumes to be managed and mix clean water with contaminated water; • the location of grassed levee banks and grassed disposal areas will be illustrated in the Construction Management Plan; • all runoff from the works areas and haul roads must drain into sediment ponds and/or grassed disposal areas, to manage contaminated water. The sediment ponds could be built with 'leaky' bases (pending determination of the permeability of soils) so that water ponded to NTWL (Normal Top Water Level) may gradually seep away and add to evaporative losses. This may be achieved by having small holes in the outlet pit and surrounding these with a suitable filter layer (selected gravels, possibly including a geotextile);		

PLAN ELEMENT 14	Construction Activities – Control of Erosions, Siltation, Turbidity and Pollutants	Responsible Parties	Timing or Frequency
	• disposal of contaminated water from sediment ponds by pumping should not be necessary, or minimised as far as possible. Each pond should have a gravity outflow pipe operating from a spillway overflow pit. Any works areas which cannot be commanded by gravity flow to a sediment pond should resort to a 'silt fence with grassed buffer strip' approach; • the gravity outflow pipe from the sediment pond should discharge to a grass spreader bank system to disperse flows over a designated grassed area remote from watercourses. If a pump system is required, the pump outlet should discharge in the same way as the pipe; • all sedimentation ponds should be regularly monitored to ensure pond integrity (i.e. that sediments are not leaking into nearby watercourses); • the use of silt fences / traps will be minimised (sediment ponds are more effective). The CMP shall be prepared and implemented as an Environmental Management System based on the appropriate ISO Standard and shall be submitted for approval **Protection of on-site and adjoining remnant vegetation and fauna habitat**		
	• the two Council Conservation Zones will be fenced by the Developer (farm fence);	• Developer	• Before commencement of construction works
	• the Developer will fence the development areas – saltmarsh interface adjoining Golf Course Hole 15 (1.5 m high, PVC coated, chain-mesh fence) and Hole 5 (at toe of former tip batter) (1.8 m PVC coated, chain-mesh fence)	• Developer	• Before commencement of construction works
	Hard rubbish and food waste		
	• the Developer will be responsible for provision and maintenance of rubbish receptacles;	• Developer	• Routine and ongoing
	• fences (see above) will help prevent hard rubbish from the construction area entering the saltmarsh and Council Conservation Zones;		
	• no waste food or scraps will be left on-site by contractors at any time.	• Developer / Contractors	• Routine and ongoing

PLAN ELEMENT 14	Construction Activities – Control of Erosions, Siltation, Turbidity and Pollutants	Responsible Parties	Timing or Frequency
	• all contractors and their staff will remove all hard rubbish (including lunch rubbish) from the construction area at the end of each day;	• Developer / Contractors	• Routine and ongoing
Follow-up or Ongoing Actions	• Regular monitoring of environmental management activities and compliance by contractors • Respond where remediation action is indicated to rectify problems • Routine maintenance (rubbish removal)	• Developer / Golf Course Manager • Developer / Golf Course Manager • Developer	• Ongoing • As needed • As needed
Performance measures and Monitoring	The following performance measures will indicate successful implementation of erosion and sediment control: • sediment ponds and traps not to contain more than 50% holding capacity of sediment (total pond/trap volume calculated to NTWL); • no erosion in grass disposal areas or in table drains; • no significant deposition of sediment downstream of construction areas (i.e. outside silt barrier) due to dust dispersion or after rainfall events; • silt barriers in operational condition when checked; • no significant erosion of post-construction land surface; • no contamination of saltmarsh or wetlands by turbid water or pollutants; • no rubbish, food scraps or waste food evident on site or in adjoining lands emanating from the construction areas.	• Developer / Construction Manager to report on these issues to the Environmental Management Trust	• Six monthly

7.2.15 ENVIRONMENTAL MANAGAGEMENT PLAN ADDITIONAL SUB-ELEMENT: SMOKY MOUSE SURVEY

The record of the Nationally significant Smoky Mouse in the Dune Complex is potentially of very high conservation significance and it is vital to confirm the presence, and if present, establish the status of the Smoky Mouse in the area.

This should be done as soon as possible and a trapping survey of the Dune Complex and the remnant Moonah Woodland – Coast Wirilda Shrubland is recommended, to be carried out in autumn 2001 (when population numbers of this native rodent would be highest following recruitment of young). EMP elements that are of potential importance to the protection of this species include Elements 1, 3, 5, 8, 10 and 12. In light of a population being discovered and confirmed from a trapping survey, more intensive restrictions concerning public access and domestic pets in the Dune Complex and other suitable habitats may need to be applied. The presence of a population of Smoky Mouse may require co-operative management between MHY Handbury Joint Venture, Torquay Public Reserves and Surf Coast Shire Council to help reduce the potential indirect impact of the development on this threatened species and its habitat.

The Department of Natural Resources and Environment will conduct a survey for the Smoky Mouse.

PLAN SUB-ELEMENT	**Smoky Mouse**	**Responsible Parties**	**Timing or Frequency**
Objective	To survey for the Smoky Mouse in the coastal reserve south of The Esplanade to confirm if the species is present. If present, devise a management strategy for this significant species.		
Implementation Actions	• Conduct a trapping program to ascertain the presence, or otherwise, of the species.	• DNRE	Autumn 2001 or 2002
	• Prepare a report on the results of the trapping survey.	• DNRE	As soon as possible after the survey
	• Prepare a Smoky Mouse Management Plan if the species is detected	• DNRE	Pending results of the survey: as soon as possible after the survey
Follow-up or Ongoing Actions	• As detailed in the Smoky Mouse Management Plan	• DNRE	

Note: this is outside the scope of the EMP but is included here for completeness.

Plate 13. **A large African Boxthorn (*Lycium ferocissimum*) providing harbour for rabbits; note the warren system beneath the shrub and the lack of vegetation cover.**

Plate 14. **Intense soil disturbance and denudation by rabbits on a dune slope.**

Plate 15. **The constructed wetland associated with the current residential development. A near-total absence of wetland vegetation and intense rabbit grazing are evident.**

Plate 16. **The small culvert on Point Impossible Road, west side of Thompson Creek, restricting tidal inundation of the Saltmarsh.**

Plate 17. **Cleared site formerly carrying Moonah – Coast Wirilda Shrubland. Considerable regeneration of native vegetation is evident; active revegetation is required.**

Plate 18. **A plant of the serious environmental weed Cape Ivy (**Delairea odorata*) scrambling over Moonah debris.**

8.0 GLOSSARY

annuals: Plants completing their life cycle within a year

anthropogenic: Caused by human intervention.

buffer zone: An area (conceptually often thought of as a band) of habitat surrounding a core conservation area. The buffer zone is meant to act as a barrier to human activities (e.g. development) to the core habitat.

co-dominant (plant species): Of plant species in a particular vegetation stratum: one of several species with an important role in the structure of the vegetation.

cover/abundance: A measure of the vertically projected two-dimensional cover (or space) occupied by particular species, or the vegetation as a whole, in a defined area, *and/or* the abundance of a particular species in the defined area.

density of vegetation: Three-dimensional space occupied by vegetation in a given area – a function of its cover/abundance.

derived: Vegetation with anthropogenically modified floristic composition and/or structure; usually used for vegetation modified by stock grazing.

dieback: Death of vegetation caused by exotic pathogens (e.g. Cinnamon Fungus) or a complex of more-or-less natural factors (generally insect predations) resulting from ecological 'imbalance' or ecological perturbations.

dominant species: Of a particular vegetation stratum: species with highest cover or the greatest contribution to the vegetation structure.

ecologically 'out of balance': Indigenous plant species which behave as weeds because of anthropogenic ecological disturbance factors.

ecosystem fragmentation: Partial clearing of indigenous vegetation resulting in isolated patches of remnant vegetation distributed in the landscape.

ecotone: Narrow and fairly sharply defined transition zone between two or more different communities. Ecotones arise naturally e.g. at land-water interfaces, but elsewhere may often reflect human intervention e.g. the agricultural clearance of formerly forested areas.

environmental weed: Naturalised, exotic, or ecologically 'out-of-balance' indigenous species outside the agricultural or garden context, which invade and adversely affect the survival or regeneration of indigenous species in natural or partly-natural vegetation communities.

eutrophication: The artificial increase in nutrient levels (particularly nitrogen and phosphorus) of soil or water above natural levels. Eutrophication is typically associated with urban runoff, including that from unsewered properties and fertiliser application.

exotic species: Introduced species.

field layer: Lowest stratum of vegetation comprised of annual or perennial herbs or small shrubs.

fire-dependant species: Plant species requiring fire for regeneration or recruitment.

flora: The plant species comprising a vegetation community or the vegetation of a site or region.

floristics: Species composition of a vegetation community or site.

garden escapes: Introduced weedy species originating from cultivation in gardens, plantations etc.

geophytes: Herbaceous plant species with underground storage organs (e.g. bulbs, tubers, corms, rhizomes); they are often summer-dormant (e.g. orchids, many lilies, *Drosera* (Sundews)).

halophytes: Plant species tolerant of a highly saline growing environment; such species may have a physiological requirement for high salinities.

indigenous vegetation: Vegetation occurring naturally in a particular area. The vegetation which would have existed in the area before European settlement. The flora (plant species) characterising a locality, as opposed to introduced (exotic) plants, environmental weeds or plantings of non-indigenous Australian plants.

land capability: Ability of land to resist environmental degradation under an artificial management regime, such as clearing and grazing, e.g. soil erosion, salinisation, landslip.

layers: Strata in vegetation (in relation to vegetation structure).

minimum viable area: The smallest area that can contain a viable breeding population of a species.

native vegetation: Synonymous with indigenous vegetation; it may however be anthropogenic, though comprised of indigenous species.

non-vascular plants: Plants without specialised conducting tissue (phloem and xylem) in root stems, leaves, etc.; these includes mosses, liverworts, lichens, algae, etc.

noxious weeds: Plant species that are weeds of agricultural or other utility lands.

old-growth: Old, mature, generally pre-European forest vegetation which has not been significantly modified by timber harvesting operations.

percentage cover: In a given sample area of vegetation, the vertically projected, two-dimensional, percentage area occupied by plant species or vegetation as a whole.

physical disturbance: Generally, a direct mechanical disturbance to soils and/or reduction of vegetation biomass or cover.

quadrat: Area of specified size used for sampling vegetation in which data on floristic composition, cover/abundance etc., may be collected.

rural tree decline: Used in the same sense as dieback (q.v.).

salinised: Salt affected land caused by rising saline watertables, the result of clearing of vegetation in the catchment.

shrub layer: Vegetation stratum comprised of shrubs.

significance of vegetation: In this context, the biological conservation value(s) of vegetation for flora and/or fauna, frequently a function of rarity, degree intactness, etc.

species composition: Plant species comprising a vegetation stand.

species richness: Number of plant species (indigenous or exotic) in a defined area or unit of vegetation.

tree canopy: Upper stratum of trees or tree crowns.

vascular (plants): Plants with specialised conducting tissue in roots, stems, leaves, etc. (comprised of phloem and xylem); it includes ferns, gymnosperms (conifers etc.) and flowering plants.

vegetation stratum: One of the one to several layers in vegetation generally composed of plant species with similar life forms (e.g. herbs, trees, shrubs).

vegetation structure: The physiognomic and architectural attributes of the vegetation, a function of the life forms comprising the stand (e.g. herbs, shrubs, trees).

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Appendix 1. Vascular plant species recorded for the proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course, Torquay.

Taxonomy follows Ross (1996), Griffiths (1994), Lord and Willis (1982) and Ecology Australia Pty Ltd (unpubl.).

* denotes exotic taxa.
\+ denotes species recorded by other references but not seen during this study.

MONOCOTYLEDONS

ASPARAGACEAE		
	* *Asparagus asparagoides*	Bridal Creeper
ASPHODELACEAE		
	* *Asphodelus fistulosus*	Onion Weed
CYPERACEAE		
	Bolboschoenus caldwellii	Salt Club-sedge
	Carex breviculmis	Common Grass-sedge
	Eleocharis acuta	Common Spike-sedge
	Gahnia filum	Chaffy Saw-sedge
	Isolepis cernua	Nodding Club-sedge
	Isolepis nodosa	Knobby Club-sedge
	Lepidosperma congestum	Clustered Sword-sedge
	Lepidosperma curtisiae	Little Sword-sedge
	Lepidosperma gladiatum	Coast Sword-sedge
	Schoenus nitens	Shiny Bog-sedge
IRIDACEAE		
	* *Romulea rosea*	Onion Grass
JUNCACEAE		
	* *Juncus articulatus*	Jointed Rush
	Juncus bufonius	Toad Rush
	Juncus kraussii ssp. *australiensis*	Sea Rush
r	*Juncus revolutus*	Creeping Rush
JUNCAGINACEAE		
	Triglochin striatum s.l. (small saltmarsh form)	Streaked Arrowgrass
ORCHIDACEAE		
	Pterostylis ? nana+	Greenhood
PHORMIACEAE		
	Dianella brevicaulis	Short-stalk Flax-lily
	Dianella aff. *revoluta* (coastal)+	Black-anther Flax-lily (non glaucous coastal form
POACEAE		
	Agrostis avenacea	Common Blown-grass

	Agrostis billardierei var. *billardierei*	Coast Blown-grass
*	*Aira elegans*	Delicate Hair-grass
*	*Aira* sp.	Hair Grass
*	*Ammophila arenaria*	Marram Grass
	Amphibromus nervosus	Common Swamp Wallaby-grass
	Austrodanthonia caespitosa	Common Wallaby-grass
	Austrodanthonia pilosa	Velvet Wallaby-grass
	Austrodanthonia racemosa var. *racemosa*	Stiped Wallaby-grass
	Austrostipa flavescens	Coast Spear-grass
	Austrostipa ? mollis	Supple Spear-grass
	Austrostipa stipoides+	Prickly Spear-grass
*	*Avena fatua*	Wild Oat
*	*Avena* sp.	Oat
*	*Briza maxima*	Large Quaking-grass
*	*Briza minor*	Lesser Quaking-grass
*	*Bromus catharticus*	Prairie Grass
*	*Bromus diandrus*	Great Brome
*	*Bromus hordeaceus* ssp. *hordeaceus*	Soft Brome
*	*Catapodium rigidum*	Fern Grass
*	*Cortaderia selloana*+	Silver Pampas Grass
*	*Critesion hystrix*+	Mediterranean Barley-grass
*	*Critesion marinum*	Sea Barley-grass
*	*Critesion murinum* ssp. *glaucum*	Blue Barley-grass
*	*Cynodon dactylon* var. *dactylon*	Couch
*	*Dactylis glomerata*	Cocksfoot
	Deyeuxia quadriseta+	Reed Bent-grass
	Distichlis distichophylla	Australian Salt-grass
*	*Ehrharta erecta*	Panic Veldt Grass
*	*Ehrharta longiflora*	Annual Veldt Grass
	Elymus scaber	Common Wheat-grass
*	*Holcus lanatus*	Yorkshire Fog
*	*Lagurus ovatus*	Hare's Tail
*	*Lolium perenne*	Perennial Rye-grass
*	*Lolium rigidum*	Wimmera Rye-grass
	Microlaena stipoides var. *stipoides*	Weeping Grass
*	*Nassella trichotoma*	Serrated Tussock
*	*Parapholis incurvata*+	Coast Barb-grass
*	*Parapholis strigosa*	Slender Barb-grass
*	*Paspalum dilatatum*	Paspalum
*	*Pennisetum clandestinum*	Kikuyu
*	*Phalaris aquatica*	Toowoomba Canary-grass
*	*Piptatherum miliaceum*	Rice Millet
	Poa poiformis var. *poiformis*	Blue Tussock-grass
*	*Polypogon monspeliensis*	Annual Beard-grass
*	*Puccinellia fasciculata*	Borrer's Saltmarsh-grass
	Puccinellia stricta var. *perlaxa*	Plains Saltmarsh-grass
	Puccinellia stricta var. *stricta*	Australian Saltmarsh-grass
	Spinifex sericea+	Hairy Spinifex
*	*Sporobolus indicus* var. *capensis*	Rat-tail Grass
	Sporobolus virginicus	Salt Couch
*	*Tribolium acutiflorum*	Desmazeria
*	*Vulpia ciliata*	Fringed Fescue
*	*Vulpia myuros*	Rat's-tail Fescue

* *Vulpia* sp.	Fescue
POTAMOGETONACEAE	
Potamogeton ochreatus	Blunt Pondweed
Ruppia megacarpa+	Large-fruit Tassel
RESTIONACEAE	
Leptocarpus sp. +	Twine-rush
TYPHACEAE	
Typha sp.	No Common Name
ZANNICHELLIACEAE	
Lepilaena cylindrocarpa	Long-fruit Water-mat

DICOTYLEDONS

AIZOACEAE	
Carpobrotus rossii	Karkalla
Disphyma crassifolium ssp. *clavellatum*	Rounded Noon-flower
* *Galenia pubescens*	Galenia
Tetragonia implexicoma	Bower Spinach
AMARANTHACEAE	
Hemichroa pentandra	Trailing Hemichroa
APIACEAE	
* *Foeniculum vulgare*	Fennel
Hydrocotyle laxiflora	Stinking Pennywort
Lilaeopsis polyantha	Australian Lilaeopsis
ASTERACEAE	
* *Arctotheca calendula*	Cape Weed
* *Aster subulatus*	Aster-weed
* *Carduus pycnocephalus*	Slender Thistle
* *Chrysanthemoides monilifera* ssp. *monilifera*	Boneseed
* *Cirsium vulgare*	Spear Thistle
* *Conyza albida*	Tall Fleabane
* *Conyza* sp. +	
* *Cotula coronopifolia*	Water Buttons
* *Delairea odorata*	Cape Ivy
* *Helminthotheca echioides*	Ox-tongue
* *Hypochoeris radicata*	Cat's Ear
* *Lactuca serriola*	Prickly Lettuce
* *Leontodon taraxacoides*	Hairy Hawkbit
Microseris sp. +	
Olearia axillaris	Coast Daisy-Bush
* *Senecio elegans*	Purple Groundsel
Senecio glomeratus+	Annual Fire-weed
Senecio sp.	Groundsel
* *Silybum marianum*	Variegated Thistle
* *Sonchus asper* ssp. *asper*	Rough Sow-thistle

	Sonchus hydrophilus	Native Sow-thistle
*	*Sonchus oleraceus*	Common Sow-thistle
*	*Stenotaphrum secundatum*+	Buffalo Grass
*	*Taraxacum officinale*+	Dandelion
*	*Tragopogon porrifolius*+	Salsify
	BORAGINACEAE	
	Cynoglossum australe	Australian Hound's-tongue
	BRASSICACEAE	
*	*Brassica fruticulosa*	Twiggy Turnip
*	*Rapistrum rugosum*	Giant Mustard
*	*Diplotaxis tenuifolia*	Sand Rocket
	CAMPANULACEAE	
	Lobelia alata	Angled Lobelia
	Pratia irrigua	Salt Pratia
	Pratia pedunculata+	Matted Pratia
	CARYOPHYLLACEAE	
	Caryophyllaceae sp.	No Common Name
*	*Arenaria serpyllifolia*	Thyme-leaved Sandwort
*	*Cerastium* sp.	Mouse-ear Chickweed
*	*Silene* sp.	Catchfly
	Spergularia marina s.s.	Lesser Sea-spurrey
*	*Spergularia rubra* s.l.	Red Sand-spurrey
	CASUARINACEAE	
	Allocasuarina verticillata	Drooping She-oak
	CHENOPODIACEAE	
*	*Chenopodium album*	Fat Hen
	Chenopodium glaucum	Glaucous Goosefoot
*	*Chenopodium murale*	Sowbane
	Chenopodium pumilio	Clammy Goosefoot
	Enchylaena tomentosa var. *tomentosa*	Ruby Saltbush
	Halosarcia pergranulata ssp. *pergranulata*	Blackseed Glasswort
	Rhagodia candolleana ssp. *candolleana*	Seaberry Saltbush
	Sarcocornia blackiana	Thick-head Glasswort
	Sarcocornia quinqueflora ssp. *quinqueflora*	Beaded Glasswort
	Sclerostegia arbuscula	Shrubby Glasswort
	Threlkeldia diffusa	Coast Bonefruit
	CONVOLVULACEAE	
	Dichondra repens	Kidney-weed
	Wilsonia rotundifolia	Round-leaf Wilsonia
	CRASSULACEAE	
	Crassula helmsii	Swamp Crassula
	EPACRIDACEAE	
	Leucopogon parviflorus	Coast Beard-heath

EUPHORBIACEAE		
	* *Euphorbia peplus*	Petty Spurge
	* *Euphorbia terracina*	Terracina Spurge
FABACEAE		
	* *Medicago polymorpha*	Burr Medic
	* *Melilotus indicus*	Sweet Melilot
	Swainsona lessertiifolia	Coast Swainson-pea
	* *Trifolium glomeratum*	Cluster Clover
	* *Trifolium subterraneum*	Subterranean Clover
	* *Trifolium* sp.	Clover
	* *Trifolium tomentosum* var. *tomentosum*	Woolly Clover
	* *Ulex europaeus*	Gorse
FRANKENIACEAE		
	Frankenia pauciflora var. *gunnii*	Southern Sea-heath
GENTIANACEAE		
	* *Centaurium erythraea*	Common Centaury
GERANIACEAE		
	* *Erodium moschatum*	Musky Heron's-bill
LAMIACEAE		
	* *Marrubium vulgare*	Horehound
LYTHRACEAE		
	Lythrum hyssopifolia	Small Loosestrife
MALVACEAE		
	* *Malva parviflora*	Small-flower Mallow
MIMOSACEAE		
	Acacia longifolia var. *sophorae*	Coast Wattle
	Acacia paradoxa	Hedge Wattle
	Acacia pycnantha	Golden Wattle
r	*Acacia retinodes* var. *uncifolia*	Coast Wirilda
	* *Acacia saligna*	Golden Wreath Wattle
	* *Paraserianthes lophantha* ssp. *lophantha*	Cape Wattle
MYRTACEAE		
	Leptospermum laevigatum	Coast Tea-tree
	Melaleuca lanceolata ssp. *lanceolata*	Moonah
ONAGRACEAE		
	Epilobium billardierianum ssp. *cinereum*	Grey Willow-herb
	Epilobium billardierianum ssp. *intermedium*	Variable Willow-herb
	Epilobium hirtigerum	Hairy Willow-herb
OXALIDACEAE		
	* *Oxalis corniculata* ssp. *corniculata*	Creeping Wood-sorrel
	Oxalis exilis	Shady Wood-sorrel

Oxalis perennans	Grassland Wood-sorrel
PLANTAGINACEAE	
* *Plantago coronopus*	Buck's-horn Plantain
* *Plantago lanceolata*	Ribwort
Plantago varia+	Native Plantain
POLYGONACEAE	
* *Acetosella vulgaris*	Sheep Sorrel
Persicaria prostrata	Creeping Knotweed
* *Polygonum aviculare* s.s.	Prostrate Knotweed
* *Rumex conglomeratus*	Clustered Dock
* *Rumex crispus*	Curled Dock
* *Rumex crispus* x *R. pulcher*	Curled/Fiddle Dock
PRIMULACEAE	
* *Anagallis arvensis*	Pimpernel
Samolus repens	Creeping Brookweed
RANUNCULACEAE	
Clematis microphylla var. *microphylla*	Small-leaved Clematis
* *Clematis vitalba*	Traveller's Joy
RHAMNACEAE	
* *Rhamnus alaternus*	Italian Buckthorn
ROSACEAE	
Acaena novae-zelandiae	Bidgee-widgee
* *Cotoneaster glaucophyllus f. serotinus*	Large-leaf Cotoneaster
* *Cotoneaster pannosus*	Velvet Cotoneaster
* *Malus X domestica*	Apple
* *Rosa rubiginosa*	Sweet Briar
Rubus parvifolius	Small-leaf Bramble
SCROPHULARIACEAE	
* *Kickxia spuria*	Blunt-leaved Fluellen
Mimulus repens	Creeping Monkey-flower
* *Verbascum virgatum*	Twiggy Mullein
Veronica gracilis	Slender Speedwell
SOLANACEAE	
* *Lycium ferocissimum*	African Box-thorn
Solanum laciniatum	Large Kangaroo Apple
* *Solanum nigrum*	Black Nightshade

Appendix 2. Quadrat data recorded for the proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course, Torquay.

* denotes exotic taxa.

C/A		Scientific Name	Common Name
D19725 No. of Spp. : 6 Date : 24 Sep 1993 Location : 144°22'16 38°18'25" Altitude : 2			
+	1073	*Disphyma crassifolium* ssp. *clavellatum*	Rounded Noon-flower
5	1592	*Halosarcia pergranulata*	Blackseed Glasswort
2	2640	* *Polypogon monspeliensis*	Annual Beard-grass
1	3001	*Samolus repens*	Creeping Brookweed
1	3012	*Sarcocornia quinqueflora*	Beaded Glasswort
+	3084	*Sclerostegia arbuscula*	Shrubby Glasswort
Q01 (E04727) No. of Spp. : 27 Date : 15 Feb 2000 Location : 144°21'39 38°21'48" Altitude : Collector : GWC CF			
1	223	* *Anagallis arvensis*	Pimpernel
1	488	* *Brassica fruticulosa*	Twiggy Turnip
1	500	* *Bromus diandrus*	Great Brome
1	687	* *Catapodium rigidum*	Fern Grass
+	746	* *Chenopodium murale*	Sowbane
+	770	* *Chrysanthemoides monilifera*	Boneseed
+	4312	*Clematis microphylla* var. *microphylla*	Small-leaved Clematis
+	4554	* *Cynodon dactylon* var. *dactylon*	Couch
1	908	*Cynoglossum australe*	Australian Hound's-tongue
+	4412	*Dianella brevicaulis*	Short-stalk Flax-lily
1	1036	*Dichondra repens*	Kidney-weed
1	1128	* *Ehrharta erecta*	Panic Veldt Grass
1	1129	* *Ehrharta longiflora*	Annual Veldt Grass
+	1156	*Enchylaena tomentosa* var. *tomentosa*	Ruby Saltbush
1	1864	* *Lagurus ovatus*	Hare's Tail
1	2037	* *Lolium rigidum*	Wimmera Rye-grass
3	2078	* *Lycium ferocissimum*	African Box-thorn
5	2150	*Melaleuca lanceolata* ssp. *lanceolata*	Moonah
+	2451	* *Pennisetum clandestinum*	Kikuyu
1	2561	* *Plantago lanceolata*	Ribwort
3	2927	*Rhagodia candolleana* ssp. *candolleana*	Seaberry Saltbush
+	2932	* *Rhamnus alaternus*	Italian Buckthorn
+	3179	*Solanum laciniatum*	Large Kangaroo Apple
1	3204	* *Sonchus oleraceus*	Common Sow-thistle
1	3343	*Tetragonia implexicoma*	Bower Spinach
1	3393	*Threlkeldia diffusa*	Coast Bonefruit
1	9223	* *Vulpia* sp.	Fescue
Q02 (E04728) No. of Spp. : 24 Date : 15 Feb 2000 Location : 144°21'54 38°18'35" Altitude : Collector : GWC CF			
1	8024	* *Aira* sp.	Hair Grass
+	223	* *Anagallis arvensis*	Pimpernel
1	496	* *Briza minor*	Lesser Quaking-grass
1	500	* *Bromus diandrus*	Great Brome
1	501	* *Bromus hordeaceus* ssp. *hordeaceus*	Soft Brome
+	782	* *Cirsium vulgare*	Spear Thistle

1	810	*	*Conyza albida*	Tall Fleabane
2	1073		*Disphyma crassifolium* ssp. *clavellatum*	Rounded Noon-flower
2	1375		*Frankenia pauciflora* var. *gunnii*	Southern Sea-heath
1	4576		*Halosarcia pergranulata* ssp. *pergranulata*	Blackseed Glasswort
1	2511	*	*Helminthotheca echioides*	Ox-tongue
1	1656		*Hemichroa pentandra*	Trailing Hemichroa
1	1782		*Isolepis nodosa*	Knobby Club-sedge
+	1839	r	*Juncus revolutus*	Creeping Rush
1	2037	*	*Lolium rigidum*	Wimmera Rye-grass
1	2553	*	*Plantago coronopus*	Buck's-horn Plantain
3	4833		*Poa poiformis* var. *poiformis*	Blue Tussock-grass
1	2640	*	*Polypogon monspeliensis*	Annual Beard-grass
+	2927		*Rhagodia candolleana* ssp. *candolleana*	Seaberry Saltbush
1	3001		*Samolus repens*	Creeping Brookweed
1	4947		*Sarcocornia quinqueflora* ssp. *quinqueflora*	Beaded Glasswort
1	3084		*Sclerostegia arbuscula*	Shrubby Glasswort
+	4661		*Sonchus hydrophilus*	Native Sow-thistle
1	3204	*	*Sonchus oleraceus*	Common Sow-thistle

Q03 (E04729) No. of Spp. : 6 Date : 15 Feb 2000 Location : 144°21'48 38°18'37" Altitude : Collector : GWC CF

1	1073		*Disphyma crassifolium* ssp. *clavellatum*	Rounded Noon-flower
3	1375		*Frankenia pauciflora* var. *gunnii*	Southern Sea-heath
1	4833		*Poa poiformis* var. *poiformis*	Blue Tussock-grass
1	2640	*	*Polypogon monspeliensis*	Annual Beard-grass
+	4947		*Sarcocornia quinqueflora* ssp. *quinqueflora*	Beaded Glasswort
5	3084		*Sclerostegia arbuscula*	Shrubby Glasswort

Q04 (E04730) No. of Spp. : 27 Date : 15 Feb 2000 Location : 144°21'50 38°18'35" Altitude : Collector : GWC CF

+	105		*Acaena novae-zelandiae*	Bidgee-widgee
2	8098	*	*Avena* sp.	Oat
1	500	*	*Bromus diandrus*	Great Brome
2	501	*	*Bromus hordeaceus* ssp. *hordeaceus*	Soft Brome
1	782	*	*Cirsium vulgare*	Spear Thistle
1	1073		*Disphyma crassifolium* ssp. *clavellatum*	Rounded Noon-flower
1	1076		*Distichlis distichophylla*	Australian Salt-grass
1	1375		*Frankenia pauciflora* var. *gunnii*	Southern Sea-heath
+	1389		*Gahnia filum*	Chaffy Saw-sedge
2	2511	*	*Helminthotheca echioides*	Ox-tongue
1	1656		*Hemichroa pentandra*	Trailing Hemichroa
1	1782		*Isolepis nodosa*	Knobby Club-sedge
+	1860	*	*Lactuca serriola*	Prickly Lettuce
1	1987		*Leucopogon parviflorus*	Coast Beard-heath
+	2301		*Olearia axillaris*	Coast Daisy-Bush
2	2476	*	*Phalaris aquatica*	Toowoomba Canary-grass
2	2553	*	*Plantago coronopus*	Buck's-horn Plantain
1	2561	*	*Plantago lanceolata*	Ribwort
3	4833		*Poa poiformis* var. *poiformis*	Blue Tussock-grass
+	2927		*Rhagodia candolleana* ssp. *candolleana*	Seaberry Saltbush
1	3001		*Samolus repens*	Creeping Brookweed
1	3011		*Sarcocornia blackiana*	Thick-head Glasswort
1	4947		*Sarcocornia quinqueflora* ssp. *quinqueflora*	Beaded Glasswort
3	3051		*Schoenus nitens*	Shiny Bog-sedge
1	3204	*	*Sonchus oleraceus*	Common Sow-thistle

1	3226	* *Sporobolus indicus* var. *capensis*	Rat-tail Grass
+	2547	* *Tribolium acutiflorum*	Desmazeria

Q05 (E04731) No. of Spp. : 18 Date : 15 Feb 2000 Location : 144°21'48 38°18'35" Altitude : Collector : GWC CF

1	223	* *Anagallis arvensis*	Pimpernel
1	255	* *Arctotheca calendula*	Cape Weed
2	341	* *Avena fatua*	Wild Oat
3	488	* *Brassica fruticulosa*	Twiggy Turnip
1	498	* *Bromus catharticus*	Prairie Grass
1	500	* *Bromus diandrus*	Great Brome
+	770	* *Chrysanthemoides monilifera*	Boneseed
2	1128	* *Ehrharta erecta*	Panic Veldt Grass
2	1370	* *Foeniculum vulgare*	Fennel
1	1399	* *Galenia pubescens*	Galenia
3	2078	* *Lycium ferocissimum*	African Box-thorn
+	2263	* *Nassella trichotoma*	Serrated Tussock
+	2386	*Oxalis perennans*	Grassland Wood-sorrel
3	2451	* *Pennisetum clandestinum*	Kikuyu
3	2476	* *Phalaris aquatica*	Toowoomba Canary-grass
1	2561	* *Plantago lanceolata*	Ribwort
3	2919	* *Rapistrum rugosum*	Giant Mustard
1	2942	* *Romulea rosea*	Onion Grass

Q06 (E04732) No. of Spp. : 4 Date : 15 Feb 2000 Location : 144°21'48 38°18'36" Altitude : Collector : GWC CF

3	4576	*Halosarcia pergranulata* ssp. *pergranulata*	Blackseed Glasswort
+	2640	* *Polypogon monspeliensis*	Annual Beard-grass
1	4947	*Sarcocornia quinqueflora* ssp. *quinqueflora*	Beaded Glasswort
1	3084	*Sclerostegia arbuscula*	Shrubby Glasswort

Q07 (E04733) No. of Spp. : 2 Date : 15 Feb 2000 Location : 144°21'40 38°18'39" Altitude : Collector : GWC CF Vegetation : Not known "

5	1934	*Lepilaena cylindrocarpa*	Long-fruit Water-mat
1	4947	*Sarcocornia quinqueflora* ssp. *quinqueflora*	Beaded Glasswort

Q08 (E04734) No. of Spp. : 5 Date : 15 Feb 2000 Location : 144°21'30 38°18'38" Altitude : Collector : GWC Cf

1	1375	*Frankenia pauciflora* var. *gunnii*	Southern Sea-heath
4	4576	*Halosarcia pergranulata* ssp. *pergranulata*	Blackseed Glasswort
1	2640	* *Polypogon monspeliensis*	Annual Beard-grass
2	4947	*Sarcocornia quinqueflora* ssp. *quinqueflora*	Beaded Glasswort
+	3204	* *Sonchus oleraceus*	Common Sow-thistle

Q09 (E04735) No. of Spp. : 16 Date : 15 Feb 2000 Location : 144°21'30 38°18'35" Altitude : Collector : GWC CF

1	501	* *Bromus hordeaceus* ssp. *hordeaceus*	Soft Brome
1	782	* *Cirsium vulgare*	Spear Thistle
1	1702	* *Critesion marinum*	Sea Barley-grass
1	1073	*Disphyma crassifolium* ssp. *clavellatum*	Rounded Noon-flower
2	1076	*Distichlis distichophylla*	Australian Salt-grass
1	1375	*Frankenia pauciflora* var. *gunnii*	Southern Sea-heath
3	1389	*Gahnia filum*	Chaffy Saw-sedge
2	4576	*Halosarcia pergranulata* ssp. *pergranulata*	Blackseed Glasswort
1	1656	*Hemichroa pentandra*	Trailing Hemichroa
+	1864	* *Lagurus ovatus*	Hare's Tail

1	2037	* *Lolium rigidum*	Wimmera Rye-grass
1	2419	* *Parapholis strigosa*	Slender Barb-grass
1	4833	*Poa poiformis* var. *poiformis*	Blue Tussock-grass
1	4947	*Sarcocornia quinqueflora* ssp. *quinqueflora*	Beaded Glasswort
1	3204	* *Sonchus oleraceus*	Common Sow-thistle
1	3343	*Tetragonia implexicoma*	Bower Spinach

Q10 (E04736) No. of Spp. : 17 Date : 15 Feb 2000 Location : 144°20'40 38°18'47" Altitude : Collector : GWC CF

1	2966	* *Acetosella vulgaris*	Sheep Sorrel
1	255	* *Arctotheca calendula*	Cape Weed
2	977	*Austrodanthonia racemosa* var. *racemosa*	Stiped Wallaby-grass
+	341	* *Avena fatua*	Wild Oat
1	500	* *Bromus diandrus*	Great Brome
3	501	* *Bromus hordeaceus* ssp. *hordeaceus*	Soft Brome
1	736	* *Chenopodium album*	Fat Hen
1	748	*Chenopodium pumilio*	Clammy Goosefoot
+	1235	* *Erodium moschatum*	Musky Heron's-bill
1	1748	* *Hypochoeris radicata*	Cat's Ear
3	2037	* *Lolium rigidum*	Wimmera Rye-grass
1	2123	* *Marrubium vulgare*	Horehound
1	2263	* *Nassella trichotoma*	Serrated Tussock
1	3906	* *Oxalis corniculata* ssp. *corniculata*	Creeping Wood-sorrel
1	2476	* *Phalaris aquatica*	Toowoomba Canary-grass
1	3440	* *Trifolium subterraneum*	Subterranean Clover
2	3549	* *Vulpia myuros*	Rat's-tail Fescue

Q11 (E04737) No. of Spp. : 26 Date : 15 Feb 2000 Location : 144°20'52 38°18'40" Altitude : Collector : GWC CF

2	151	*Agrostis avenacea*	Common Blown-grass
1	3628	*Amphibromus nervosus*	Common Swamp Wallaby-grass
+	255	* *Arctotheca calendula*	Cape Weed
1	748	*Chenopodium pumilio*	Clammy Goosefoot
1	848	* *Cotula coronopifolia*	Water Buttons
1	1702	* *Critesion marinum*	Sea Barley-grass
+	4554	* *Cynodon dactylon* var. *dactylon*	Couch
2	1139	*Eleocharis acuta*	Common Spike-sedge
1	1179	*Epilobium hirtigerum*	Hairy Willow-herb
1	1810	*Juncus bufonius*	Toad Rush
1	1895	* *Leontodon taraxacoides*	Hairy Hawkbit
1	2037	* *Lolium rigidum*	Wimmera Rye-grass
1	2092	*Lythrum hyssopifolia*	Small Loosestrife
+	2140	* *Medicago polymorpha*	Burr Medic
+	2635	*Persicaria prostrata*	Creeping Knotweed
1	2553	* *Plantago coronopus*	Buck's-horn Plantain
1	2626	* *Polygonum aviculare* s.l.	Prostrate Knotweed
1	2640	* *Polypogon monspeliensis*	Annual Beard-grass
1	2690	*Potamogeton ochreatus*	Blunt Pondweed
+	2969	* *Rumex conglomeratus*	Clustered Dock
1	2970	* *Rumex crispus*	Curled Dock
+	9058	*Senecio* sp.	Groundsel
1	5322	* *Solanum nigrum* s.s.	Black Nightshade
1	4923	* *Sonchus asper* ssp. *asper*	Rough Sow-thistle
+	3204	* *Sonchus oleraceus*	Common Sow-thistle
1	3429	* *Trifolium glomeratum*	Cluster Clover

Q12 (E04738) No. of Spp. : 20 Date : 15 Feb 2000 Location : 144°21'13 38°18'33" Altitude : Collector : GWC CF

1	416		*Bolboschoenus caldwellii*	Salt Club-sedge
1	848	*	*Cotula coronopifolia*	Water Buttons
1	1702	*	*Critesion marinum*	Sea Barley-grass
2	1772		*Isolepis cernua*	Nodding Club-sedge
2	1826		*Juncus kraussii* ssp. *australiensis*	Sea Rush
1	1839	r	*Juncus revolutus*	Creeping Rush
+	2197		*Mimulus repens*	Creeping Monkey-flower
1	2419	*	*Parapholis strigosa*	Slender Barb-grass
2	2553	*	*Plantago coronopus*	Buck's-horn Plantain
1	2640	*	*Polypogon monspeliensis*	Annual Beard-grass
1	2731		*Pratia irrigua*	Salt Pratia
1	2833	*	*Puccinellia fasciculata*	Borrer's Saltmarsh-grass
1	4838		*Puccinellia stricta* var. *perlaxa*	Plains Saltmarsh-grass
1	4849		*Puccinellia stricta* var. *stricta*	Australian Saltmarsh-grass
1	3001		*Samolus repens*	Creeping Brookweed
1	4947		*Sarcocornia quinqueflora* ssp. *quinqueflora*	Beaded Glasswort
1	5323		*Spergularia marina* s.s.	Lesser Sea-spurrey
1	3219	*	*Spergularia rubra* s.l.	Red Sand-spurrey
1	3230		*Sporobolus virginicus*	Salt Couch
3	3449		*Triglochin striatum*	Streaked Arrowgrass

Q13 (E04739) No. of Spp. : 26 Date : 19 Feb 2000 Location : 144°21'40 38°18'45" Altitude : Collector : GWC

2	4210	r	*Acacia retinodes* var. *uncifolia*	Coast Wirilda
1	166	*	*Aira elegans*	Delicate Hair-grass
2	961		*Austrodanthonia caespitosa*	Common Wallaby-grass
1	975		*Austrodanthonia pilosa*	Velvet Wallaby-grass
1	977		*Austrodanthonia racemosa* var. *racemosa*	Stiped Wallaby-grass
1	3276		*Austrostipa flavescens*	Coast Spear-grass
2	627		*Carex breviculmis*	Common Grass-sedge
1	687	*	*Catapodium rigidum*	Fern Grass
1	702	*	*Centaurium erythraea*	Common Centaury
1	770	*	*Chrysanthemoides monilifera*	Boneseed
1	4312		*Clematis microphylla* var. *microphylla*	Small-leaved Clematis
1	908		*Cynoglossum australe*	Australian Hound's-tongue
1	4412		*Dianella brevicaulis*	Short-stalk Flax-lily
1	1782		*Isolepis nodosa*	Knobby Club-sedge
+	1864	*	*Lagurus ovatus*	Hare's Tail
+	1925		*Lepidosperma curtisiae*	Little Sword-sedge
+	1922		*Lepidosperma gladiatum*	Coast Sword-sedge
1	1957	#	*Leptospermum laevigatum*	Coast Tea-tree
2	1987		*Leucopogon parviflorus*	Coast Beard-heath
5	2150		*Melaleuca lanceolata* ssp. *lanceolata*	Moonah
2	4833		*Poa poiformis* var. *poiformis*	Blue Tussock-grass
1	2919	*	*Rapistrum rugosum*	Giant Mustard
1	2927		*Rhagodia candolleana* ssp. *candolleana*	Seaberry Saltbush
1	2932	*	*Rhamnus alaternus*	Italian Buckthorn
1	3343		*Tetragonia implexicoma*	Bower Spinach
1	9223	*	*Vulpia* sp.	Fescue

Q14 (E04740) No. of Spp. : 27 Date : 19 Feb 2000 Location : 144°21'43 38°18'44" Altitude : Collector : GWC

1	72		*Acacia paradoxa*	Hedge Wattle
2	4210	r	*Acacia retinodes* var. *uncifolia*	Coast Wirilda
1	961		*Austrodanthonia caespitosa*	Common Wallaby-grass
1	3276		*Austrostipa flavescens*	Coast Spear-grass
1	495	*	*Briza maxima*	Large Quaking-grass
1	627		*Carex breviculmis*	Common Grass-sedge
1	7065		*Caryophyllaceae* sp.	No Common Name
1	687	*	*Catapodium rigidum*	Fern Grass
1	8213	*	*Cerastium* sp.	Mouse-ear Chickweed
1	770	*	*Chrysanthemoides monilifera*	Boneseed
1	4312		*Clematis microphylla* var. *microphylla*	Small-leaved Clematis
1	908		*Cynoglossum australe*	Australian Hound's-tongue
1	4412		*Dianella brevicaulis*	Short-stalk Flax-lily
1	1036		*Dichondra repens*	Kidney-weed
1	1864	*	*Lagurus ovatus*	Hare's Tail
1	1922		*Lepidosperma gladiatum*	Coast Sword-sedge
1	1987		*Leucopogon parviflorus*	Coast Beard-heath
5	2150		*Melaleuca lanceolata* ssp. *lanceolata*	Moonah
1	4833		*Poa poiformis* var. *poiformis*	Blue Tussock-grass
1	2919	*	*Rapistrum rugosum*	Giant Mustard
1	2927		*Rhagodia candolleana* ssp. *candolleana*	Seaberry Saltbush
1	2932	*	*Rhamnus alaternus*	Italian Buckthorn
1	3051		*Schoenus nitens*	Shiny Bog-sedge
+	3318		*Swainsona lessertiifolia*	Coast Swainson-pea
2	3343		*Tetragonia implexicoma*	Bower Spinach
1	3545	*	*Vulpia ciliata*	Fringed Fescue
1	9223	*	*Vulpia* sp.	Fescue

Q15 (E04741) No. of Spp. : 18 Date : 19 Feb 2000 Location : 144°21'55 38°18'36" Altitude : Collector : GWC

+	223	*	*Anagallis arvensis*	Pimpernel
+	297	*	*Aster subulatus*	Aster-weed
1	782	*	*Cirsium vulgare*	Spear Thistle
+	810	*	*Conyza albida*	Tall Fleabane
+	1036		*Dichondra repens*	Kidney-weed
2	1076		*Distichlis distichophylla*	Australian Salt-grass
1	4447		*Epilobium billardierianum* ssp. *intermedium*	Variable Willow-herb
+	2511	*	*Helminthotheca echioides*	Ox-tongue
+	1692	*	*Holcus lanatus*	Yorkshire Fog
2	1782		*Isolepis nodosa*	Knobby Club-sedge
3	1826		*Juncus kraussii* ssp. *australiensis*	Sea Rush
+	1895	*	*Leontodon taraxacoides*	Hairy Hawkbit
1	2553	*	*Plantago coronopus*	Buck's-horn Plantain
3	4833		*Poa poiformis* var. *poiformis*	Blue Tussock-grass
1	3001		*Samolus repens*	Creeping Brookweed
1	4947		*Sarcocornia quinqueflora* ssp. *quinqueflora*	Beaded Glasswort
+	4661		*Sonchus hydrophilus*	Native Sow-thistle
+	3204	*	*Sonchus oleraceus*	Common Sow-thistle

Q16 (E04742) No. of Spp. : 10 Date : 19 Feb 2000 Location : 144°21'27 38°18'43" Altitude : Collector : GWC

2	4210	r	*Acacia retinodes* var. *uncifolia*	Coast Wirilda

1	961		*Austrodanthonia caespitosa*	Common Wallaby-grass
2	3276		*Austrostipa flavescens*	Coast Spear-grass
2	1864	*	*Lagurus ovatus*	Hare's Tail
2	2078	*	*Lycium ferocissimum*	African Box-thorn
3	2150		*Melaleuca lanceolata* ssp. *lanceolata*	Moonah
1	2179		*Microlaena stipoides* var. *stipoides*	Weeping Grass
1	2919	*	*Rapistrum rugosum*	Giant Mustard
1	2927		*Rhagodia candolleana* ssp. *candolleana*	Seaberry Saltbush
1	3343		*Tetragonia implexicoma*	Bower Spinach

Q17 (E04743) No. of Spp. : 10 Date : 19 Feb 2000 Location : 144°21'23 38°18'47" Altitude : Collector : GWC

4	4210	r	*Acacia retinodes* var. *uncifolia*	Coast Wirilda
2	961		*Austrodanthonia caespitosa*	Common Wallaby-grass
2	977		*Austrodanthonia racemosa* var. *racemosa*	Stiped Wallaby-grass
3	3276		*Austrostipa flavescens*	Coast Spear-grass
1	8213	*	*Cerastium* sp.	Mouse-ear Chickweed
+	146		*Elymus scaber*	Common Wheat-grass
1	1782		*Isolepis nodosa*	Knobby Club-sedge
1	1864	*	*Lagurus ovatus*	Hare's Tail
1	1987		*Leucopogon parviflorus*	Coast Beard-heath
1	3343		*Tetragonia implexicoma*	Bower Spinach

Q18 (E04744) No. of Spp. : 12 Date : 19 Feb 2000 Location : 144°21'18 38°18'47" Altitude : Collector : GWC

1	977		*Austrodanthonia racemosa* var. *racemosa*	Stiped Wallaby-grass
1	3276		*Austrostipa flavescens*	Coast Spear-grass
1	500	*	*Bromus diandrus*	Great Brome
1	908		*Cynoglossum australe*	Australian Hound's-tongue
1	1036		*Dichondra repens*	Kidney-weed
2	1692	*	*Holcus lanatus*	Yorkshire Fog
2	1782		*Isolepis nodosa*	Knobby Club-sedge
1	1864	*	*Lagurus ovatus*	Hare's Tail
1	1895	*	*Leontodon taraxacoides*	Hairy Hawkbit
1	2381		*Oxalis exilis*	Shady Wood-sorrel
2	4833		*Poa poiformis* var. *poiformis*	Blue Tussock-grass

Q19 (E04745) No. of Spp. : 20 Date : 19 Feb 2000 Location : 144°21'13 38°18'52" Altitude : Collector : GWC

+	4210	r	*Acacia retinodes* var. *uncifolia*	Coast Wirilda
1	977		*Austrodanthonia racemosa* var. *racemosa*	Stiped Wallaby-grass
1	500	*	*Bromus diandrus*	Great Brome
1	501	*	*Bromus hordeaceus* ssp. *hordeaceus*	Soft Brome
1	687	*	*Catapodium rigidum*	Fern Grass
1	782	*	*Cirsium vulgare*	Spear Thistle
1	908		*Cynoglossum australe*	Australian Hound's-tongue
1	1235	*	*Erodium moschatum*	Musky Heron's-bill
1	1692	*	*Holcus lanatus*	Yorkshire Fog
1	1748	*	*Hypochoeris radicata*	Cat's Ear
2	1782		*Isolepis nodosa*	Knobby Club-sedge
2	1864	*	*Lagurus ovatus*	Hare's Tail
1	1987		*Leucopogon parviflorus*	Coast Beard-heath
1	2553	*	*Plantago coronopus*	Buck's-horn Plantain
4	4833		*Poa poiformis* var. *poiformis*	Blue Tussock-grass
+	2919	*	*Rapistrum rugosum*	Giant Mustard

1	2950	*	*Rosa rubiginosa*	Sweet Briar
1	3051		*Schoenus nitens*	Shiny Bog-sedge
1	3226	*	*Sporobolus indicus* var. *capensis*	Rat-tail Grass
1	9223	*	*Vulpia* sp.	Fescue

Q20 (E04746) No. of Spp. : 12 Date : 19 Feb 2000 Location : 144°21'14 38°18'55" Altitude : Collector : GWC

5	205	*	*Ammophila arenaria*	Marram Grass
1	782	*	*Cirsium vulgare*	Spear Thistle
+	908		*Cynoglossum australe*	Australian Hound's-tongue
1	1036		*Dichondra repens*	Kidney-weed
+	1723		*Hydrocotyle laxiflora*	Stinking Pennywort
1	1748	*	*Hypochoeris radicata*	Cat's Ear
2	1782		*Isolepis nodosa*	Knobby Club-sedge
1	1864	*	*Lagurus ovatus*	Hare's Tail
1	1895	*	*Leontodon taraxacoides*	Hairy Hawkbit
1	1987		*Leucopogon parviflorus*	Coast Beard-heath
1	2553	*	*Plantago coronopus*	Buck's-horn Plantain
1	4833		*Poa poiformis* var. *poiformis*	Blue Tussock-grass

Q21 (E04747) No. of Spp. : 21 Date : 19 Feb 2000 Location : 144°21'20 38°18'55" Altitude : Collector : GWC

2	4210	r	*Acacia retinodes* var. *uncifolia*	Coast Wirilda
1	205	*	*Ammophila arenaria*	Marram Grass
1	274	*	*Asparagus asparagoides*	Bridal Creeper
1	961		*Austrodanthonia caespitosa*	Common Wallaby-grass
1	977		*Austrodanthonia racemosa* var. *racemosa*	Stiped Wallaby-grass
1	3276		*Austrostipa flavescens*	Coast Spear-grass
1	500	*	*Bromus diandrus*	Great Brome
1	948	*	*Dactylis glomerata*	Cocksfoot
1	4412		*Dianella brevicaulis*	Short-stalk Flax-lily
1	1128	*	*Ehrharta erecta*	Panic Veldt Grass
1	1129	*	*Ehrharta longiflora*	Annual Veldt Grass
1	1782		*Isolepis nodosa*	Knobby Club-sedge
1	1864	*	*Lagurus ovatus*	Hare's Tail
2	1922		*Lepidosperma gladiatum*	Coast Sword-sedge
4	1987		*Leucopogon parviflorus*	Coast Beard-heath
1	2263	*	*Nassella trichotoma*	Serrated Tussock
1	4833		*Poa poiformis* var. *poiformis*	Blue Tussock-grass
2	2927		*Rhagodia candolleana* ssp. *candolleana*	Seaberry Saltbush
1	3226	*	*Sporobolus indicus* var. *capensis*	Rat-tail Grass
2	3343		*Tetragonia implexicoma*	Bower Spinach
1	9223	*	*Vulpia* sp.	Fescue

Q22 (E04748) No. of Spp. : 16 Date : 21 Feb 2000 Location : 144°21'05 38°18'58" Altitude : Collector : GWC

4	4210	r	*Acacia retinodes* var. *uncifolia*	Coast Wirilda
1	223	*	*Anagallis arvensis*	Pimpernel
1	259	*	*Arenaria serpyllifolia*	Thyme-leaved Sandwort
1	3276		*Austrostipa flavescens*	Coast Spear-grass
1	500	*	*Bromus diandrus*	Great Brome
1	620	*	*Carduus pycnocephalus*	Slender Thistle
1	687	*	*Catapodium rigidum*	Fern Grass
1	1128	*	*Ehrharta erecta*	Panic Veldt Grass
2	1129	*	*Ehrharta longiflora*	Annual Veldt Grass

2	1864	*	*Lagurus ovatus*	Hare's Tail
1	1987		*Leucopogon parviflorus*	Coast Beard-heath
1	2927		*Rhagodia candolleana* ssp. *candolleana*	Seaberry Saltbush
1	2932	*	*Rhamnus alaternus*	Italian Buckthorn
3	3343		*Tetragonia implexicoma*	Bower Spinach
1	3545	*	*Vulpia ciliata*	Fringed Fescue
1	9223	*	*Vulpia* sp.	Fescue

Q23 (E04749) No. of Spp. : 23 Date : 21 Feb 2000 Location : 144°20'56 38°18'58" Altitude : Collector : GWC

2	78		*Acacia pycnantha*	Golden Wattle
2	4210	r	*Acacia retinodes* var. *uncifolia*	Coast Wirilda
2	84	*	*Acacia saligna*	Golden Wreath Wattle
1	105		*Acaena novae-zelandiae*	Bidgee-widgee
2	685		*Allocasuarina verticillata*	Drooping She-oak
1	223	*	*Anagallis arvensis*	Pimpernel
1	977		*Austrodanthonia racemosa* var. *racemosa*	Stiped Wallaby-grass
1	495	*	*Briza maxima*	Large Quaking-grass
+	702	*	*Centaurium erythraea*	Common Centaury
1	4554	*	*Cynodon dactylon* var. *dactylon*	Couch
1	948	*	*Dactylis glomerata*	Cocksfoot
1	4412		*Dianella brevicaulis*	Short-stalk Flax-lily
1	1692	*	*Holcus lanatus*	Yorkshire Fog
1	1782		*Isolepis nodosa*	Knobby Club-sedge
2	1987		*Leucopogon parviflorus*	Coast Beard-heath
1	2078	*	*Lycium ferocissimum*	African Box-thorn
2	2451	*	*Pennisetum clandestinum*	Kikuyu
1	2476	*	*Phalaris aquatica*	Toowoomba Canary-grass
1	4833		*Poa poiformis* var. *poiformis*	Blue Tussock-grass
1	2919	*	*Rapistrum rugosum*	Giant Mustard
1	3226	*	*Sporobolus indicus* var. *capensis*	Rat-tail Grass
2	3343		*Tetragonia implexicoma*	Bower Spinach

Q24 (E04750) No. of Spp. : 29 Date : 21 Feb 2000 Location : 144°21'10 38°18'55" Altitude : Collector : GWC

2	4210	r	*Acacia retinodes* var. *uncifolia*	Coast Wirilda
1	105		*Acaena novae-zelandiae*	Bidgee-widgee
1	4221		*Agrostis billardierei* var. *billardierei*	Coast Blown-grass
1	205	*	*Ammophila arenaria*	Marram Grass
1	223	*	*Anagallis arvensis*	Pimpernel
1	977		*Austrodanthonia racemosa* var. *racemosa*	Stiped Wallaby-grass
1	500	*	*Bromus diandrus*	Great Brome
1	501	*	*Bromus hordeaceus* ssp. *hordeaceus*	Soft Brome
+	657		*Carpobrotus rossii*	Karkalla
1	687	*	*Catapodium rigidum*	Fern Grass
1	702	*	*Centaurium erythraea*	Common Centaury
+	770	*	*Chrysanthemoides monilifera*	Boneseed
1	4312		*Clematis microphylla* var. *microphylla*	Small-leaved Clematis
1	1748	*	*Hypochoeris radicata*	Cat's Ear
1	1782		*Isolepis nodosa*	Knobby Club-sedge
2	1864	*	*Lagurus ovatus*	Hare's Tail
1	1895	*	*Leontodon taraxacoides*	Hairy Hawkbit
2	1987		*Leucopogon parviflorus*	Coast Beard-heath
1	2161	*	*Melilotus indicus*	Sweet Melilot
+	169	*	*Paraserianthes lophantha* ssp. *lophantha*	Cape Wattle

1	2561	*	*Plantago lanceolata*	Ribwort
2	4833		*Poa poiformis* var. *poiformis*	Blue Tussock-grass
2	2927		*Rhagodia candolleana* ssp. *candolleana*	Seaberry Saltbush
+	4923	*	*Sonchus asper* ssp. *asper*	Rough Sow-thistle
2	3343		*Tetragonia implexicoma*	Bower Spinach
1	3495	*	*Verbascum virgatum*	Twiggy Mullein
+	3506		*Veronica gracilis*	Slender Speedwell
1	3545	*	*Vulpia ciliata*	Fringed Fescue
1	9223	*	*Vulpia* sp.	Fescue

Q25 (E04751) No. of Spp. : 3 Date : 19 Feb 2000 Location : 144°22'10 38°18'35" Altitude : Collector : GWC

1	1375		*Frankenia pauciflora* var. *gunnii*	Southern Sea-heath
1	2640	*	*Polypogon monspeliensis*	Annual Beard-grass
5	4947		*Sarcocornia quinqueflora* ssp. *quinqueflora*	Beaded Glasswort

Q26 (E04752) No. of Spp. : 12 Date : 19 Feb 2000 Location : 144°21'24 38°18'45" Altitude : Collector : GWC Vegetation : Not known "

2	72		*Acacia paradoxa*	Hedge Wattle
3	4210	r	*Acacia retinodes* var. *uncifolia*	Coast Wirilda
1	961		*Austrodanthonia caespitosa*	Common Wallaby-grass
3	3276		*Austrostipa flavescens*	Coast Spear-grass
1	4312		*Clematis microphylla* var. *microphylla*	Small-leaved Clematis
1	1864	*	*Lagurus ovatus*	Hare's Tail
2	1987		*Leucopogon parviflorus*	Coast Beard-heath
2	2150		*Melaleuca lanceolata* ssp. *lanceolata*	Moonah
+	4833		*Poa poiformis* var. *poiformis*	Blue Tussock-grass
1	2919	*	*Rapistrum rugosum*	Giant Mustard
2	3343		*Tetragonia implexicoma*	Bower Spinach
1	9223	*	*Vulpia* sp.	Fescue

Q27 (E04753) No. of Spp. : 4 Date : 21 Feb 2000 Location : 144°21'25 38°18'30" Altitude : Collector : GWC

+	848	*	*Cotula coronopifolia*	Water Buttons
1	2640	*	*Polypogon monspeliensis*	Annual Beard-grass
1	4838		*Puccinellia stricta* var. *perlaxa*	Plains Saltmarsh-grass
4	3575		*Wilsonia rotundifolia*	Round-leaf Wilsonia

Appendix 3. Frequency of plant species recorded in quadrats, proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course, Torquay, February 2000.

* denotes exotic taxa.

	Name	Frequency	Freq	No. of sites
	Acacia longifolia var. *sophorae*	Coast Wattle	3.4%	1 sites
	Acacia paradoxa	Hedge Wattle	6.8%	2 sites
	Acacia pycnantha	Golden Wattle	3.4%	1 sites
r	*Acacia retinodes* var. *uncifolia*	Coast Wirilda	34.4%	10 sites
*	*Acacia saligna*	Golden Wreath Wattle	3.4%	1 sites
	Acaena novae-zelandiae	Bidgee-widgee	10.3%	3 sites
*	*Acetosella vulgaris*	Sheep Sorrel	3.4%	1 sites
	Agrostis avenacea	Common Blown-grass	3.4%	1 sites
	Agrostis billardierei var. *billardierei*	Coast Blown-grass	3.4%	1 sites
*	*Aira elegans*	Delicate Hair-grass	3.4%	1 sites
*	*Aira* sp.	Hair Grass	3.4%	1 sites
	Allocasuarina verticillata	Drooping She-oak	3.4%	1 sites
*	*Ammophila arenaria*	Marram Grass	10.3%	3 sites
	Amphibromus nervosus	Common Swamp Wallaby-grass	3.4%	1 sites
*	*Anagallis arvensis*	Pimpernel	24.1%	7 sites
*	*Arctotheca calendula*	Cape Weed	10.3%	3 sites
*	*Arenaria serpyllifolia*	Thyme-leaved Sandwort	3.4%	1 sites
*	*Asparagus asparagoides*	Bridal Creeper	3.4%	1 sites
*	*Asphodelus fistulosus*	Onion Weed	3.4%	1 sites
*	*Aster subulatus*	Aster-weed	3.4%	1 sites
	Austrodanthonia caespitosa	Common Wallaby-grass	20.6%	6 sites
	Austrodanthonia pilosa	Velvet Wallaby-grass	3.4%	1 sites
	Austrodanthonia racemosa var. *racemosa*	Stiped Wallaby-grass	27.5%	8 sites
	Austrostipa flavescens	Coast Spear-grass	27.5%	8 sites
	Austrostipa mollis	Supple Spear-grass	3.4%	1 sites
*	*Avena fatua*	Wild Oat	6.8%	2 sites
*	*Avena* sp.	Oat	3.4%	1 sites

	Bolboschoenus caldwellii	Salt Club-sedge	3.4%	1 sites
*	*Brassica fruticulosa*	Twiggy Turnip	6.8%	2 sites
*	*Briza maxima*	Large Quaking-grass	6.8%	2 sites
*	*Briza minor*	Lesser Quaking-grass	3.4%	1 sites
*	*Bromus catharticus*	Prairie Grass	3.4%	1 sites
*	*Bromus diandrus*	Great Brome	34.4%	10 sites
*	*Bromus hordeaceus* ssp. *hordeaceus*	Soft Brome	20.6%	6 sites
*	*Carduus pycnocephalus*	Slender Thistle	3.4%	1 sites
	Carex breviculmis	Common Grass-sedge	6.8%	2 sites
	Carpobrotus rossii	Karkalla	3.4%	1 sites
	Caryophyllaceae sp.		3.4%	1 sites
*	*Catapodium rigidum*	Fern Grass	20.6%	6 sites
*	*Centaurium erythraea*	Common Centaury	10.3%	3 sites
*	*Cerastium* sp.	Mouse-ear Chickweed	10.3%	3 sites
*	*Chenopodium album*	Fat Hen	3.4%	1 sites
	Chenopodium glaucum	Glaucous Goosefoot	3.4%	1 sites

Name		**Frequency**	**Freq**	**No. of sites**
*	*Chenopodium murale*	Sowbane	3.4%	1 sites
	Chenopodium pumilio	Clammy Goosefoot	6.8%	2 sites
*	*Chrysanthemoides monilifera*	Boneseed	17.2%	5 sites
*	*Cirsium vulgare*	Spear Thistle	20.6%	6 sites
	Clematis microphylla var. *microphylla*	Small-leaved Clematis	17.2%	5 sites
*	*Clematis vitalba*	Traveller's Joy	3.4%	1 sites
*	*Conyza albida*	Tall Fleabane	6.8%	2 sites
*	*Cotoneaster glaucophyllus f. serotinus*	Large-leaf Cotoneaster	3.4%	1 sites
*	*Cotoneaster pannosus*	Velvet Cotoneaster	3.4%	1 sites
*	*Cotula coronopifolia*	Water Buttons	10.3%	3 sites
	Crassula helmsii	Swamp Crassula	3.4%	1 sites
*	*Critesion marinum*	Sea Barley-grass	10.3%	3 sites
*	*Critesion murinum* ssp. *glaucum*	Blue Barley-grass	3.4%	1 sites
*	*Cynodon dactylon* var. *dactylon*	Couch	10.3%	3 sites
	Cynoglossum australe	Australian Hound's-tongue	20.6%	6 sites

*	*Dactylis glomerata*	Cocksfoot	6.8%	2 sites
*	*Delairea odorata*	Cape Ivy	3.4%	1 sites
	Dianella brevicaulis	Short-stalk Flax-lily	17.2%	5 sites
	Dichondra repens	Kidney-weed	17.2%	5 sites
	Disphyma crassifolium ssp. *clavellatum*	Rounded Noon-flower	17.2%	5 sites
	Distichlis distichophylla	Australian Salt-grass	10.3%	3 sites
*	*Ehrharta erecta*	Panic Veldt Grass	13.7%	4 sites
*	*Ehrharta longiflora*	Annual Veldt Grass	10.3%	3 sites
	Eleocharis acuta	Common Spike-sedge	3.4%	1 sites
	Elymus scaber	Common Wheat-grass	3.4%	1 sites
	Enchylaena tomentosa var. *tomentosa*	Ruby Saltbush	3.4%	1 sites
	Epilobium billardierianum ssp. *cinereum*	Grey Willow-herb	3.4%	1 sites
	Epilobium billardierianum ssp. *intermedium*	Variable Willow-herb	3.4%	1 sites
	Epilobium hirtigerum	Hairy Willow-herb	3.4%	1 sites
*	*Erodium moschatum*	Musky Heron's-bill	6.8%	2 sites
*	*Euphorbia peplus*	Petty Spurge	3.4%	1 sites
*	*Euphorbia terracina*	Terracina Spurge	3.4%	1 sites
*	*Foeniculum vulgare*	Fennel	3.4%	1 sites
	Frankenia pauciflora var. *gunnii*	Southern Sea-heath	20.6%	6 sites
	Gahnia filum	Chaffy Saw-sedge	6.8%	2 sites
*	*Galenia pubescens*	Galenia	3.4%	1 sites
	Halosarcia pergranulata	Blackseed Glasswort	3.4%	1 sites
	Halosarcia pergranulata ssp. *pergranulata*	Blackseed Glasswort	13.7%	4 sites
*	*Helminthotheca echioides*	Ox-tongue	10.3%	3 sites
	Hemichroa pentandra	Trailing Hemichroa	10.3%	3 sites
*	*Holcus lanatus*	Yorkshire Fog	13.7%	4 sites
	Hydrocotyle laxiflora	Stinking Pennywort	3.4%	1 sites
*	*Hypochoeris radicata*	Cat's Ear	13.7%	4 sites
	Isolepis cernua	Nodding Club-sedge	3.4%	1 sites
	Isolepis nodosa	Knobby Club-sedge	37.9%	11 sites
*	*Juncus articulatus*	Jointed Rush	3.4%	1 sites
	Juncus bufonius	Toad Rush	3.4%	1 sites
	Juncus kraussii ssp. *australiensis*	Sea Rush	6.8%	2 sites
r	*Juncus revolutus*	Creeping Rush	6.8%	2 sites

	Name	Frequency	Freq	No. of sites
*	*Kickxia spuria*	Blunt-leaved Fluellen	3.4%	1 sites
*	*Lactuca serriola*	Prickly Lettuce	3.4%	1 sites
*	*Lagurus ovatus*	Hare's Tail	44.8%	13 sites
*	*Leontodon taraxacoides*	Hairy Hawkbit	17.2%	5 sites
	Lepidosperma congestum	Clustered Sword-sedge	3.4%	1 sites
	Lepidosperma curtisiae	Little Sword-sedge	3.4%	1 sites
	Lepidosperma gladiatum	Coast Sword-sedge	10.3%	3 sites
	Lepilaena cylindrocarpa	Long-fruit Water-mat	3.4%	1 sites
	Leptospermum laevigatum	Coast Tea-tree	3.4%	1 sites
	Leucopogon parviflorus	Coast Beard-heath	37.9%	11 sites
	Lilaeopsis polyantha	Australian Lilaeopsis	3.4%	1 sites
	Lobelia alata	Angled Lobelia	3.4%	1 sites
*	*Lolium perenne*	Perennial Rye-grass	3.4%	1 sites
*	*Lolium rigidum*	Wimmera Rye-grass	17.2%	5 sites
*	*Lycium ferocissimum*	African Box-thorn	13.7%	4 sites
	Lythrum hyssopifolia	Small Loosestrife	3.4%	1 sites
*	*Malus X domestica*	Apple	3.4%	1 sites
*	*Malva parviflora*	Small-flower Mallow	3.4%	1 sites
*	*Marrubium vulgare*	Horehound	3.4%	1 sites
*	*Medicago polymorpha*	Burr Medic	3.4%	1 sites
	Melaleuca lanceolata ssp. *lanceolata*	Moonah	17.2%	5 sites
*	*Melilotus indicus*	Sweet Melilot	3.4%	1 sites
	Microlaena stipoides var. *stipoides*	Weeping Grass	3.4%	1 sites
	Mimulus repens	Creeping Monkey-flower	3.4%	1 sites
*	*Nassella trichotoma*	Serrated Tussock	10.3%	3 sites
	Olearia axillaris	Coast Daisy-Bush	3.4%	1 sites
*	*Oxalis corniculata* ssp. *corniculata*	Creeping Wood-sorrel	3.4%	1 sites
	Oxalis exilis	Shady Wood-sorrel	3.4%	1 sites
	Oxalis perennans	Grassland Wood-sorrel	3.4%	1 sites
*	*Parapholis strigosa*	Slender Barb-grass	6.8%	2 sites
*	*Paraserianthes lophantha* ssp. *lophantha*	Cape Wattle	6.8%	2 sites
*	*Paspalum dilatatum*	Paspalum	3.4%	1 sites

*	*Pennisetum clandestinum*	Kikuyu	10.3%	3 sites
	Persicaria prostrata	Creeping Knotweed	3.4%	1 sites
*	*Phalaris aquatica*	Toowoomba Canary-grass	13.7%	4 sites
*	*Piptatherum miliaceum*	Rice Millet	3.4%	1 sites
*	*Plantago coronopus*	Buck's-horn Plantain	24.1%	7 sites
*	*Plantago lanceolata*	Ribwort	13.7%	4 sites
	Poa poiformis var. *poiformis*	Blue Tussock-grass	48.2%	14 sites
*	*Polygonum aviculare* s.l.	Prostrate Knotweed	3.4%	1 sites
*	*Polygonum aviculare* s.s.	Prostrate Knotweed	3.4%	1 sites
*	*Polypogon monspeliensis*	Annual Beard-grass	31%	9 sites
	Potamogeton ochreatus	Blunt Pondweed	3.4%	1 sites
	Pratia irrigua	Salt Pratia	3.4%	1 sites
*	*Puccinellia fasciculata*	Borrer's Saltmarsh-grass	3.4%	1 sites
	Puccinellia stricta var. *perlaxa*	Plains Saltmarsh-grass	6.8%	2 sites
	Puccinellia stricta var. *stricta*	Australian Saltmarsh-grass	3.4%	1 sites
*	*Rapistrum rugosum*	Giant Mustard	24.1%	7 sites
	Rhagodia candolleana ssp. *candolleana*	Seaberry Saltbush	31%	9 sites
	Name	**Frequency**	**Freq**	**No. of sites**
*	*Rhamnus alaternus*	Italian Buckthorn	13.7%	4 sites
*	*Romulea rosea*	Onion Grass	3.4%	1 sites
*	*Rosa rubiginosa*	Sweet Briar	3.4%	1 sites
	Rubus parvifolius	Small-leaf Bramble	3.4%	1 sites
*	*Rumex conglomeratus*	Clustered Dock	3.4%	1 sites
*	*Rumex crispus*	Curled Dock	6.8%	2 sites
*	*Rumex pulcher* ssp. *pulcher*	Fiddle Dock	3.4%	1 sites
	Samolus repens	Creeping Brookweed	17.2%	5 sites
	Sarcocornia blackiana	Thick-head Glasswort	3.4%	1 sites
	Sarcocornia quinqueflora	Beaded Glasswort	3.4%	1 sites
	Sarcocornia quinqueflora ssp. *quinqueflora*	Beaded Glasswort	34.4%	10 sites
	Schoenus nitens	Shiny Bog-sedge	10.3%	3 sites
	Sclerostegia arbuscula	Shrubby Glasswort	13.7%	4 sites
*	*Senecio elegans*	Purple Groundsel	3.4%	1 sites
	Senecio sp.	Groundsel	3.4%	1 sites

*	*Silene* sp.	Catchfly	3.4%	1 sites
*	*Silybum marianum*	Variegated Thistle	3.4%	1 sites
	Solanum laciniatum	Large Kangaroo Apple	3.4%	1 sites
*	*Solanum nigrum* s.s.	Black Nightshade	3.4%	1 sites
*	*Sonchus asper* ssp. *asper*	Rough Sow-thistle	6.8%	2 sites
	Sonchus hydrophilus	Native Sow-thistle	6.8%	2 sites
*	*Sonchus oleraceus*	Common Sow-thistle	24.1%	7 sites
	Spergularia marina s.s.	Lesser Sea-spurrey	3.4%	1 sites
*	*Spergularia rubra* s.l.	Red Sand-spurrey	3.4%	1 sites
*	*Sporobolus indicus* var. *capensis*	Rat-tail Grass	13.7%	4 sites
	Sporobolus virginicus	Salt Couch	3.4%	1 sites
	Swainsona lessertiifolia	Coast Swainson-pea	3.4%	1 sites
	Tetragonia implexicoma	Bower Spinach	37.9%	11 sites
	Threlkeldia diffusa	Coast Bonefruit	3.4%	1 sites
*	*Tribolium acutiflorum*	Desmazeria	3.4%	1 sites
*	*Trifolium glomeratum*	Cluster Clover	3.4%	1 sites
*	*Trifolium subterraneum*	Subterranean Clover	3.4%	1 sites
*	*Trifolium tomentosum* var. *tomentosum*	Woolly Clover	3.4%	1 sites
	Triglochin striatum	Streaked Arrowgrass	3.4%	1 sites
	Typha sp.		3.4%	1 sites
*	*Ulex europaeus*	Gorse	3.4%	1 sites
*	*Verbascum virgatum*	Twiggy Mullein	3.4%	1 sites
	Veronica gracilis	Slender Speedwell	3.4%	1 sites
*	*Vulpia ciliata*	Fringed Fescue	10.3%	3 sites
*	*Vulpia myuros*	Rat's-tail Fescue	3.4%	1 sites
*	*Vulpia* sp.	Fescue	27.5%	8 sites
	Wilsonia rotundifolia	Round-leaf Wilsonia	3.4%	1 sites

Appendix 4. Vegetation quality assessment method.

CRITERIA AND WEIGHTING

The weightings provided below, when added up, generate a total condition score. Remnants within a particular score range are given a rating. If required, this coarse scale rating can be supplemented by the actual score to provide a finer level of resolution.

A	**WEED INVASION (% COVER)**		**WEIGHTING**
•	**< 5**		5
•	**5 - 25**	- mostly woody species	4
	5 - 25	- mostly herbaceous species	3
•	**25 - 50**	- mostly woody species	3
	25 - 50	- mostly herbaceous species	2
•	**> 50**	- mostly woody species	2
	> 50	- mostly herbaceous species	1
B	**PHYSICAL AND OTHER DISTURBANCE**		
•	**low** levels of disturbance		4
•	**moderate** levels of disturbance		2
•	**high** levels of disturbance		0
C	**STRUCTURE**		
•	**intact**; original strata present		2
•	**moderately intact**; original strata somewhat modified		1
•	**highly modified**; one or more strata severely reduced or absent		0
•	insufficient information		1
D	**SPECIES-RICHNESS**		
•	**high**		2
•	**average**		1
•	**poor**		0
•	insufficient information		1

Equating 'score' with rating

'SCORE'	RATING
12 - 13	1
8 - 11	2
5 - 7	3
2 - 4	4
1	5

Ratings

1. **Intact.** Vegetation structurally and floristically **intact** or almost so; weed invasions **minimal** or weeds absent; disturbance **minimal** or absent.
2. **Substantially intact.** Vegetation structurally and floristically **substantially intact**; low levels of weed invasion; **low levels** of disturbance.
3. **Partially intact**. Vegetation **partially intact** structurally and/or floristically; **moderate** levels of weed invasion**:** woody vegetation intact and herbaceous vegetation greater than 50% cover; **moderate** levels of disturbance.
4. **Highly modified**. Vegetation comprised of **less than 50% cover** of indigenous species and/or with **much reduced** species richness; in the case of woody vegetation the upper strata may provide moderate to high cover but field layer substantially exotic; **high** levels of disturbance.
5. **Very highly modified.** Vegetation **grossly modified** with scattered to rare dominants of upper strata only persisting; **very high cover** of weeds; current or former levels of disturbance **high or very high**.

Appendix 5. Atlas of Victorian Wildlife Printout

ATLAS OF VICTORIAN WILDLIFE - INTERPRETING PRINTOUTS

SPECIES LIST

Species code in far left column

Type Type of record

O	Observation i.e. seen or heard
S	Seen
H	Heard
X	Observation, Seen or Heard with supporting evidence e.g. written description
T	Trapped and released i.e. hand held
I	Indirect evidence e.g. scats, burrows
A	Identified from hair sample
M	Specimen in a museum or other institution
L	Literature
P	Pers. comm.

Reliab Reliability, our assessment of the accuracy of identification

C	Confirmed
A	Acceptable
H	Hybrid
?	Doubtful
blank	unchecked

Extra Extra coded information

B	Breeding confirmed (birds: nest with eggs; or dependent young out of nest)
F	Subfossil record
W	Beachwashed, stranded
K	Road-kill
R	Released or introduction to a local site (does not include feral populations)
E	Escapee, presumed to have escaped from captivity
C	Roost site: eg. bat cave
X	Believed no longer at this site
Z	Sample found in predator scat or pellet
N	RAOU Nest record card completed #
D	Doubtful breeding #
6	Extra information on identification available #
7	hybrid #
8,9	subspecies information #

are applicable to RAOU atlas data only.

Last Year of most recent record

Listed Number of records on lists, i.e. non-incidental sheets (birds only)

Incid Number of incidental records

Total Total number of records

RR% Reporting Rate (Birds only), listed records as a percentage of total lists (20 minimum).

CST Conservation status in Victoria

CEn	Critically Endangered
End	Endangered
Vul	Vulnerable
R/R	Rare
LR	Lower Risk Near Threatened
R/C	Restricted colonial, breeding or roosting sites.
Ins	Insufficiently known, suspected of being in one of the above categories.
Ext	Presumed extinct
•	Alien
Cmp	Comprising several taxa
Ssp	Sub-species

Atlas of Victorian Wildlife. List of species. Resolution: 180. 08/12/1999.
Edges of the block are N: 38 14, S: 38 23, W: 144 16, E: 144 30. 142 birdlists. No selection used. Species range 1 to 5999.

	Type	Reliab	Extra	Last	Listed	Incid	Total	RR%	TOTREC	CST	FFG	HDP	INT	Species	
5	O			1989	2		2	1	2					Little Penguin	Eudyptula minor
9	S	A		1991	1		1	1	1					Stubble Quail	Coturnix pectoralis
56	O			1998	2		2	1	2					Dusky Moorhen	Gallinula tenebrosa
58	OS	A		1998	6	2	8	4	8					Purple Swamphen	Porphyrio porphyrio
59	O			1999	13	5	18	9	18					Eurasian Coot	Fulica atra
61	OS	A		1997	5		5	4	5					Australasian Grebe	Tachybaptus novaehollandiae
62	OS	A		1999	10	2	12	7	12					Hoary-headed Grebe	Poliocephalus poliocephalus
63	O	A		1986		2	2		2				J	Wilson's Storm-Petrel	Oceanites oceanicus
64	O	A		1985		1	1		1					Grey-backed Storm-Petrel	Garrodia nereis
67				1973		1	1		1					Little Shearwater	Puffinus assimilis
68	O			1988	1		1	1	1					Fluttering Shearwater	Puffinus gavia
70	O	A	W	1987		1	1		1				CJ	Sooty Shearwater	Puffinus griseus
75				1959	1	1	2	1	2					Great-winged Petrel	Pterodroma macroptera
77				1959	1	1	2	1	2					White-headed Petrel	Pterodroma lessonii
80	O	A		1988	1	2	3	1	3					Cape Petrel	Daption capense
83	O	A		1988	1	3	4	1	4	LR				Fairy Prion	Pachyptila turtur
85	O	A		1985		1	1		1	LR				Common Diving-Petrel	Pelecanoides urinatrix
88	O			1988	1		1	1	1					Black-browed Albatross	Diomedea melanophris
91	O			1989	2		2	1	2					Shy Albatross	Diomedea cauta
96	OS	A	B	1998	12	3	15	8	15					Great Cormorant	Phalacrocorax carbo
97	OS	A		1998	4	1	5	3	5					Little Black Cormorant	Phalacrocorax sulcirostris
99	OS	A		1998	5		5	4	5	LR				Pied Cormorant	Phalacrocorax varius
100	SO	A		1998	13	3	16	9	16					Little Pied Cormorant	Phalacrocorax melanoleucos
104	O			1988	1		1	1	1	Vul				Australasian Gannet	Morus serrator
106	SO	A		1998	13	1	14	9	14					Australian Pelican	Pelecanus conspicillatus
110	O			1997	6	1	7	4	7	LR				Whiskered Tern	Chlidonias hybridus
111	S	A		1993		8	8		8	End				Gull-billed Tern	Sterna nilotica
112	SO	A		1998	8	5	13	6	13	Vul			CJ	Caspian Tern	Sterna caspia
115	OS	A		1998	7	1	8	5	8	LR				Crested Tern	Sterna bergii
117	OS	A		1997	3	1	4	2	4	Vul	L		CJ	Little Tern	Sterna albifrons
118	S	A		1995	1	2	3	1	3	Vul	L			Fairy Tern	Sterna nereis
125	SO	A		1998	19	5	24	13	24					Silver Gull	Larus novaehollandiae
126	OS	A		1996	8	3	11	6	11	LR				Pacific Gull	Larus pacificus
129	S	A		1996	1		1	1	1				CJ	Ruddy Turnstone	Arenaria interpres
130	SO	A		1998	3	1	4	2	4					Pied Oystercatcher	Haematopus longirostris
131	OS	A		1992	1	1	2	1	2					Sooty Oystercatcher	Haematopus fuliginosus
132	O			1997	3		3	2	3					Red-kneed Dotterel	Erythrogonys cinctus
133	9SO	A	NB	1998	29	4	33	20	33					Masked Lapwing	Vanellus miles
135	O	A	BN	1999	2	6	8	1	10					Banded Lapwing	Vanellus tricolor
138	OS	A	B	1997	6	22	28	4	31	End	L			Hooded Plover	Thinornis rubricollis
140	SO	A		1998	9	1	10	6	10					Double-banded Plover	Charadrius bicinctus
143	SO	A		1998	16	2	18	11	18					Red-capped Plover	Charadrius ruficapillus
144	O			1997	4		4	3	4					Black-fronted Dotterel	Elseyornis melanops
146	OS	A		1997	9		9	6	9					Black-winged Stilt	Himantopus himantopus
147	OS	A		1995	2		2	1	2					Banded Stilt	Cladorhynchus leucocephalus

	Type	Reliab	Extra	Last	Listed	Incid	Total	RR%	TOTRec	CST	FFG	HDP	INT	Species	
148	OS	A		1998	3	3	6	2	6					Red-necked Avocet	Recurvirostra novaehollandiae
149	S	A		1998	3	2	5	2	5	LR			CJ	Eastern Curlew	Numenius madagascariensis
153	O	A		1988	1	2	3	1	3				CJ	Bar-tailed Godwit	Limosa lapponica
154	O			1997	1		1	1	1				CJ	Wood Sandpiper	Tringa glareola
155	O			1988	1		1	1	1				CJ	Grey-tailed Tattler	Heteroscelus brevipes
157	O	A		1985		2	2		2				CJ	Common Sandpiper	Actitis hypoleucos
158	SO	A		1998	13	1	14	9	14				CJ	Common Greenshank	Tringa nebularia
159	OS	A		1997	3		3	2	3				CJ	Marsh Sandpiper	Tringa stagnatilis
160	S	A		1998	1		1	1	1				CJ	Terek Sandpiper	Xenus cinereus
161	SO	A		1998	11	1	12	8	12				CJ	Curlew Sandpiper	Calidris ferruginea
162	SO	A		1998	15	5	20	11	20				CJ	Red-necked Stint	Calidris ruficollis
163	OS	A		1998	8	2	10	6	10				CJ	Sharp-tailed Sandpiper	Calidris acuminata
164	SO	A		1998	1	1	2	1	2				CJ	Red Knot	Calidris canutus
165	O	A		1986		2	2		2				CJ	Great Knot	Calidris tenuirostris
166	O	A		1990	2	4	6	1	6				CJ	Sanderling	Calidris alba
167	S	A		1992		1	1		1				CJ	Broad-billed Sandpiper	Limicola falcinellus
168	O			1993	1	1	2	1	2				CJ	Latham's Snipe	Gallinago hardwickii
170	O			1985	1		1	1	1	End			C	Painted Snipe	Rostratula benghalensis
178	OS	A		1997	6		6	4	6	Vul			C	Glossy Ibis	Plegadis falcinellus
179	SO	A		1998	17	4	21	12	21					Australian White Ibis	Threskiornis molucca
180	OS	A		1998	12	1	13	8	13					Straw-necked Ibis	Threskiornis spinicollis
181	SO	A		1998	14	2	16	10	16	Vul				Royal Spoonbill	Platalea regia
182	SO	A		1998	11		11	8	11					Yellow-billed Spoonbill	Platalea flavipes
185	O	A		1990	3	2	5	2	5	CEn				Little Egret	Egretta garzetta
187	SO	A		1998	12	4	16	8	16	End	L		CJ	Great Egret	Ardea alba
188	SO	A		1998	22	6	28	15	28					White-faced Heron	Egretta novaehollandiae
189	O			1978	1	1	2	1	2					White-necked Heron	Ardea pacifica
192	O		B	1971		1	1		1	Vul				Nankeen Night Heron	Nycticorax caledonicus
195	O		B	1969		1	1		1	End				Little Bittern	Ixobrychus minutus
197	S	A		1995	1	2	3	1	3	End				Australasian Bittern	Botaurus poiciloptilus
199	O			1999	1		1	1	1	End				Magpie Goose	Anseranas semipalmata
202	O			1996	4	3	7	3	7			T		Australian Wood Duck	Chenonetta jubata
203	SO	A	B	1999	39	8	47	27	47					Black Swan	Cygnus atratus
207	SO	A		1999	29	6	35	20	35			T		Australian Shelduck	Tadorna tadornoides
208	SO	A		1999	23	10	33	16	33					Pacific Black Duck	Anas superciliosa
209				1889		1	1		1				CJ	Garganey	Anas querquedula
210	SO	A		1998	19	8	27	13	27			T		Chestnut Teal	Anas castanea
211	OS	A		1999	19	6	25	13	25			T		Grey Teal	Anas gracilis
212	OS	A		1999	10	1	11	7	11	Vul				Australasian Shoveler	Anas rhynchotis
213	O			1979		1	1		1			P		Pink-eared Duck	Malacorhynchus membranaceus
215	OS	A		1999	6	1	7	4	7	Vul				Hardhead	Aythya australis
217	OS	A		1998	3		3	2	3	Vul				Musk Duck	Biziura lobata
218	O	A		1982		1	1		1					Spotted Harrier	Circus assimilis
219	SO	A		1998	11	1	12	8	12					Swamp Harrier	Circus approximans
220	O	A		1991		2	2		2	LR				Grey Goshawk	Accipiter novaehollandiae
221	S	A		1997	1		1	1	1					Brown Goshawk	Accipiter fasciatus
224	O	A		1992	1		1	1	1					Wedge-tailed Eagle	Aquila audax
225	SO	A		1997	2		2	1	2					Little Eagle	Hieraaetus morphnoides
228	SO	A		1997	3		3	2	3					Whistling Kite	Haliastur sphenurus

	Type	Reliab	Extra	Last	Listed	Incid	Total	RR%	TOTRec	CST	FFG	HDP	INT	Species	
232	S	A		1998	3	1	4	2	4					Black-shouldered Kite	Elanus axillaris
235	S	A		1997	1	1	2	1	2					Australian Hobby	Falco longipennis
239	SO	A		1998	4	1	5	3	5					Brown Falcon	Falco berigora
240	O		B	1989	2	1	3	1	3			P		Nankeen Kestrel	Falco cenchroides
250	L	A	W	1983		1	1		1	End	L	T		Masked Owl	Tyto novaehollandiae
267	S	A		1997	1		1	1	1			T		Yellow-tailed Black-Cockatoo	Calyptorhynchus funereus
271	S	A		1990		1	1		1			T		Little Corella	Cacatua sanguinea
273	S	A		1991	1	1	2	1	2			T		Galah	Cacatua roseicapilla
288	O	A		1992	1		1	1	1			T		Eastern Rosella	Platycercus eximius
295	OS	A		1998	1	1	2	1	2			T		Red-rumped Parrot	Psephotus haematonotus
305	SO	A		1994	59		59	42	63	CEn	L			Orange-bellied Parrot	Neophema chrysogaster
306	OS	A		1998	9	2	11	6	11			P		Blue-winged Parrot	Neophema chrysostoma
311				1909	1		1	1	2	Vul	L			Ground Parrot	Pezoporus wallicus
334	O			1989	1	1	2	1	2				CJ	White-throated Needletail	Hirundapus caudacutus
335	O			1989	1	1	2	1	2				CJ	Fork-tailed Swift	Apus pacificus
344	M	C		1991		1	1		1					Shining Bronze-Cuckoo	Chrysococcyx lucidus
357	OS	A		1998	8	1	9	6	9			P		Welcome Swallow	Hirundo neoxena
359	O			1989	1		1	1	1			T		Tree Martin	Hirundo nigricans
360				1972		1	1		1			P		Fairy Martin	Hirundo ariel
364	S	A		1997	3	1	4	2	4					Willie Wagtail	Rhipidura leucophrys
365	M	C		1992		1	1		1					Leaden Flycatcher	Myiagra rubecula
382	S	A		1997	1		1	1	1					Flame Robin	Petroica phoenicea
408	O			1989	1		1	1	1			P		Grey Shrike-thrush	Colluricincla harmonica
415	OS	A	N	1997	2	3	5	1	5					Magpie-lark	Grallina cyanoleuca
448	SO	A	B	1998	12	2	14	8	14					White-fronted Chat	Epthianura albifrons
475	SO	A		1997	4		4	3	4					Brown Thornbill	Acanthiza pusilla
486	M	A		1997	1		1	1	1					Yellow-rumped Thornbill	Acanthiza chrysorrhoa
488	OS	A		1997	3		3	2	3					White-browed Scrubwren	Sericornis frontalis
500	SO	A	N	1991	4	1	5	3	5	Cmp				unidentified fieldwren	Calmanthus sp.
508	S	A		1993		1	1		1					Brown Songlark	Cincloramphus cruralis
522	SO	A		1998	6		6	4	6					Little Grassbird	Megalurus gramineus
525	SO	A		1998	8	1	9	6	9					Golden-headed Cisticola	Cisticola exilis
526	O	A		1992	2		2	1	2					Southern Emu-wren	Stipiturus malachurus
529	SO	A	N	1997	6	2	8	4	8					Superb Fairy-wren	Malurus cyaneus
574	OM	A	N	1997	2	1	3	1	3					Silvereye	Zosterops lateralis
593	O			1989	1		1	1	1					Tawny-crowned Honeyeater	Phylidonyris melanops
608	SO	A		1997	5		5	4	5					Singing Honeyeater	Lichenostomus virescens
614	O	A		1992	2		2	1	2					Yellow-faced Honeyeater	Lichenostomus chrysops
617	O			1989	1		1	1	1					White-eared Honeyeater	Lichenostomus leucotis
625	O	A		1992	1	1	2	1	2					White-plumed Honeyeater	Lichenostomus penicillatus
630	O	A		1992	2		2	1	2					Crescent Honeyeater	Phylidonyris pyrrhoptera
631	SO	A	N	1997	4	3	7	3	7					New Holland Honeyeater	Phylidonyris novaehollandiae
638	O	A		1992	2	2	4	1	4					Red Wattlebird	Anthochaera carunculata
640	S	A		1997	1		1	1	1					Spiny-cheeked Honeyeater	Acanthagenys rufogularis
647	O		B	1988	1	2	3	1	3					Richard's Pipit	Anthus novaeseelandiae
662	O	A		1992	1		1	1	1					Red-browed Finch	Neochmia temporalis
702	M	A		1997	1		1	1	1					Grey Butcherbird	Cracticus torquatus
705	OM	AC		1992	3	3	6	2	6					Australian Magpie	Gymnorhina tibicen
929	O	A		1988	1	3	4	1	4	End				Southern Giant-Petrel	Macronectes giganteus

	Type	Reliab	Extra	Last	Listed	Incid	Total	RR%	TOTRec	CST	FFG	HDP	INT	Species	
934	O			1995	1	1	2	1	2				CJ	Ruff	Philomachus pugnax
935				1975		1	1		1					Kerguelen Petrel	Lugensa brevirostris
937	O	A		1988	1	1	2	1	2	End				Northern Giant-Petrel	Macronectes halli
941	S	A	W	1985		1	1		1					Salvin's Prion	Pachyptila salvini
942	O			1988	1		1	1	1					Slender-billed Prion	Pachyptila belcheri
947	O	A	W	1984		1	1		1					Fulmar Prion	Pachyptila crassirostris
953	O	A		1983		1	1		1				CJ	Common Tern	Sterna hirundo
954	OS	A		1998	7		7	5	7					Little Raven	Corvus mellori
957	O			1989	1		1	1	1	*				Rock Dove	Columba livia
978	O			1997	1		1	1	1	Ins			J	Pectoral Sandpiper	Calidris melanotos
981	O			1988	1		1	1	1	CEn				Kelp Gull	Larus dominicanus
991	SO	A		1997	3	1	4	2	4	*				Common Blackbird	Turdus merula
993	SO	A		1998	7		7	5	7	*				Skylark	Alauda arvensis
995	OS	A		1997	4	1	5	3	5	*				House Sparrow	Passer domesticus
996	OS	A	B	1997	3	1	4	2	4	*				European Goldfinch	Carduelis carduelis
997	O			1989	1	1	2	1	2	*				European Greenfinch	Carduelis chloris
998				1972		1	1		1	*				Common Myna	Acridotheres tristis
999	OS	A		1998	4		4	3	4	*		P		Common Starling	Sturnus vulgaris
1003	S	A		1993			1		1					Short-beaked Echidna	Tachyglossus aculeatus
1092	M	C		1971			2		2					Southern Brown Bandicoot	Isoodon obesulus
1113	S	A	K	1994			2		2			T		Common Brushtail Possum	Trichosurus vulpecula
1129	SP		K	1989			2		2			P		Common Ringtail Possum	Pseudocheirus peregrinus
1162	O	C		1987			1		1					Koala	Phascolarctos cinereus
1165	L	C	F	0			2		2					Common Wombat	Vombatus ursinus
1242	O			1989			1		1					Black Wallaby	Wallabia bicolor
1265	I			1989			1		1					Eastern Grey Kangaroo	Macropus giganteus
1395	T	A		1998			1		1					Bush Rat	Rattus fuscipes
1408	P			1988			1		1	*				Black Rat	Rattus rattus
1412	IP			1988			2		2	*				House Mouse	Mus musculus
1415	O		K	1989			1		1					Water Rat	Hydromys chrysogaster
1510	OI		K	1989			3		3	*				European Rabbit	Oryctolagus cuniculus
1511	S	C		1983			1		1	*				Brown Hare	Lepus capensis
1532	OIS	A	K	1999			7		7	*	T			Red Fox	Canis vulpes
1536	O	C		1983			1		1	*				Cat (feral)	Felis catus
1542	OS	A	KT	1999			8		8	Vul				Australian Fur Seal	Arctocephalus pusillus
1549	LOS	CA		1993			8		8					Leopard Seal	Hydrurga leptonyx
1561	PSO	CA	B	1997			14		22	CEn	L			Southern Right Whale	Eubalaena australis
1567	M	A	W	1865			1		1	CEn	L			Blue Whale	Balaenoptera musculus
1581	S	A	W	1999			1		1					Pygmy Sperm Whale	Kogia breviceps
1591	M	C	W	1992			1		1					Strap-toothed Whale	Mesoplodon layardi
1612	XMS	CA	W	1989			3		3					Bottlenose Dolphin	Tursiops truncatus
1616	MP	CA	W	1988			4		4					Common Dolphin	Delphinus delphis
1801	I			1989			1		1	Cmp				unidentified bandicoot	Bandicoot sp.
2034	M	C	R	1989			1		1					Murray River Tortoise	Emydura macquarii
2375	S			1995			1		1					Large Striped Skink	Ctenotus robustus
2578	M			1959			2		2					Blotched Blue-tongued Lizard	Tiliqua nigrolutea
2580	O		K	1989			1		1					Common Blue-tongued Lizard	Tiliqua scincoides
2682	M		K	1991			1		1					Eastern Three-lined Skink	Bassiana duperreyi
2905		A	W	1991			1		1	Cmp					Marine Turtle sp.

	Type	Reliab	Extra	Last Listed	Incid Total	RR%	TOTREC	CST	FFG	HDP	INT	Species	
2948	O			1988	1		1	Ssp				grass skink FORM (P.pag/cry)	
2961	T		K	1999	1		1	Cmp				unidentified blue-tongued lizard	Tiliqua sp.
2973	O			1992	1		1					Lowland Copperhead	Austrelaps superbus
2989	S		K	1995	2		2	Cmp				unidentified copperhead	Austrelaps sp.
2994	M			1977	1		1					Southern Grass Skink	Pseudemoia entrecasteauxii
2995	M			1977	5		5					unidentified grass skink	
3117	M	A		1966	7		7					Bibron's Toadlet	Pseudophryne bibronii
3125	M			1989	1		1					Southern Toadlet	Pseudophryne semimarmorata
3134	MOH	A		1997	3		3					Common Froglet	Crinia signifera
3182	M			1962	22		22					Southern Brown Tree Frog	Litoria ewingii
3207	P			1988	1		1	Vul				Warty Bell Frog	Litoria raniformis
4031	O			1873	1		1	Vul	L			Australian Grayling	Prototroctes maraena
5005	L	A	B	1988	3		3					Altona Skipper	Hesperilla flavescens flavescens

Note: Listed, Incid and RR% apply only to birds. Listed is the number of lists the species appears on; Incid is the number of incidental records (i.e. coverage = I); total is the total of these; RR% is the % of all lists the species was recorded on and TOTREC is the total number of records of the species (i.e. counting multiple records on a sheet).

Appendix 6. Indigenous plant species from the regional wetland flora suitable for constructed wetland plantings, proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course, Torquay.

Zone I. Permanently or near permanently wet margins; shallow short-term seasonal inundation <10 cm deep; upper summer drawdown zone. Dense plantings of amphibious tussock-forming, rhizomatous and climbing herbs and shrub			
Scientific Name	**Common Name**	**Family**	**Lifeform**
Agrostis avenacea	Common Blown-grass	Poaceae	F
Amphibromus nervosus	Common Swamp Wallaby-grass	Poaceae	F
Apium prostratum ssp. *prostratum* var. *filiforme*	Sea Celery	Apiaceae	D
Baumea juncea	Bare Twig-sedge	Cyperaceae	D
Calystegia sepium	Large Bindweed	Convolvulaceae	V
Carex appressa	Tall Sedge	Cyperaceae	F
Carex inversa	Common Sedge	Cyperaceae	F
Carex tereticaulis	Hollow Sedge	Cyperaceae	F
Crassula helmsii	Swamp Crassula	Crassulaceae	D
Distichlis distichophylla	Australian Salt-grass	Poaceae	D
Epilobium billardierianum ssp. *billardierianum*	Smooth Willow-herb	Onagraceae	D
Epilobium hirtigerum	Hairy Willow-herb	Onagraceae	F
Hemarthria uncinata var. *uncinata*	Mat Grass	Poaceae	D
Isolepis cernua	Nodding Club-sedge	Cyperaceae	F
Isolepis inundata	Swamp Club-sedge	Cyperaceae	D
Juncus amabilis	Hollow Rush	Juncaceae	F
Juncus gregiflorus	Green Rush	Juncaceae	F
Juncus holoschoenus	Joint-leaf Rush	Juncaceae	F
Juncus kraussii ssp. *australiensis*	Sea Rush	Juncaceae	F

Scientific Name	Common Name	Family	Lifeform
Leptinella reptans	Creeping Cotula	Asteraceae	D
Lilaeopsis polyantha	Australian Lilaeopsis	Liliaceae	D
Lobelia alata	Angled Lobelia	Campanulaceae	D
Marsilea hirsuta	Short-fruit Nardoo	Marsileaceae	D
Mimulus repens	Creeping Monkey-flower	Scrophulariaceae	E
Muehlenbeckia florulenta	Tangled Lignum	Polygonaceae	S
Neopaxia australasica	White Purslane	Portulacaceae	A/B/D
Persicaria lapathifolia	Pale Knotweed	Polygonaceae	G
Poa labillardierei	Common Tussock-grass	Poaceae	F
Poa poiformis var. poiformis	Blue Tussock-grass	Poaceae	F
Pratia irrigua	Salt Pratia	Campanulaceae	D
Ranunculus amphitrichus	Small River Buttercup	Ranunculaceae	D
Schoenus nitens	Shiny Bog-sedge	Cyperaceae	D
Villarsia reniformis	Running Marsh-flower	Menyanthaceae	B, D
Viminaria juncea	Golden Spray	Fabaceae	S

Zone II. Shallow inundation; upper minimum depth of inundation c. 10 cm; maximum depth of water c. 120 cm amphibious and emergent aquatic herbs, some straddling Zones I and II.			
Scientific Name	**Common Name**	**Family**	**Lifeform**
Amphibromus nervosus	Common Swamp Wallaby-grass	Poaceae	F
Bolboschoenus caldwellii	Salt Club-sedge	Cyperaceae	B
Carex appressa	Tall Sedge	Cyperaceae	F
Carex fascicularis	Tassel Sedge	Cyperaceae	F
Crassula helmsii	Swamp Crassula	Crassulaceae	D
Cyperus lucidus	Leafy Flat-sedge	Cyperaceae	F
Elatine gratioloides	Waterwort	Elatinaceae	D
Eleocharis acuta	Common Spike-sedge	Cyperaceae	B/D
Eleocharis sphacelata	Tall Spike-sedge	Cyperaceae	B
Glyceria australis	Australian Sweet-grass	Poaceae	B
Isolepis cernua	Nodding Club-sedge	Cyperaceae	F
Isolepis inundata	Swamp Club-sedge	Cyperaceae	D
Juncus amabilis	Hollow Rush	Juncaceae	F
Juncus gregiflorus	Green Rush	Juncaceae	F
Lilaeopsis polyantha	Australian Lilaeopsis	Apiaceae	D
Lycopus australis	Australian Gipsywort	Lamiaceae	A
Mimulus repens	Creeping Monkey-flower	Scrophulariaceae	E
Myriophyllum crispatum	Upright Water-milfoil	Haloragaceae	A/B/D
Myriophyllum verrucosum	Red Water-milfoil	Haloragaceae	A/B/D
Neopaxia australasica	White Purslane	Portulacaceae	A/B/D

Scientific Name	Common Name	Family	Lifeform
Ottelia ovalifolia	Swamp Lily	Hydrocharitaceae	C
Persicaria decipiens	Slender Knotweed	Polygonaceae	B/D
Persicaria lapathifolia	Pale Knotweed	Polygonaceae	G
Persicaria prostrata	Creeping Knotweed	Polygonaceae	D
Phragmites australis	Common Reed	Poaceae	B
Potamogeton tricarinatus s.l.	Floating Pondweed	Potamogetonaceae	B
Pratia irrigua	Salt Pratia	Campanulaceae	D
Ranunculus amphitrichus	Small River Buttercup	Ranunculaceae	D
Rumex bidens	Mud Dock	Polygonaceae	B
Schoenoplectus pungens	Sharp Club-sedge	Cyperaceae	B
Schoenoplectus validus	River Club-sedge	Cyperaceae	B
Triglochin procerum s.l. (erect broad-leaved form)	Water Ribbons	Juncaginaceae	C
Villarsia reniformis	Running Marsh-flower	Menyanthaceae	B, D

Zone III. Permanent water > c. 1100 cm deep; submerged aquatic herbs.			
Scientific Name	**Common Name**	**Family**	**Lifeform**
Potamogeton ochreatus	Blunt Pondweed	Potamogetonaceae	A
Potamogeton pectinatus	Fennel Pondweed	Potamogetonaceae	A

A Rhizomatous / stoloniferous submerged aquatic perennial herb
B Rhizomatous / stoloniferous emergent aquatic perennial herb
C Tufted emergent aquatic annual or perennial herb
D Stoloniferous / rhizomatous amphibious perennial herb
E Mat-forming submerged or emergent aquatic or amphibious perennial herb
F Tussock-forming amphibious perennial herb
G Annual amphibious herb
S Large shrub
V Herbaceous vine

Appendix 7. Plant species suitable for revegetation, proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course, Torquay.

1. Coastal Dune Complex (1.0)	
Species	**Common Name**
Trees	
Acacia implexa	Lightwood
Acacia mearnsii	Black Wattle
Acacia melanoxylon	Blackwood
Acacia pycnantha	Golden Wattle
Acacia retinodes var. *uncifolia*	Coast Wirilda
Allocasuarina verticillata	Drooping She-oak
Bursaria spinosa ssp. *spinosa*	Sweet Bursaria
Melaleuca lanceolata ssp. *lanceolata*	Moonah
Myoporum insulare	Common Boobialla
Shrubs	
Acacia paradoxa	Hedge Wattle
Acacia verticillata var. *verticillata*	Prickly Moses
Adriana quadripartita	Rare Bitter-bush
Alyxia buxifolia	Sea Box
Goodenia ovata	Hop Goodenia
Lasiopetalum baueri	Slender Velvet-bush
Leucopogon parviflorus	Coast Beard-heath
Olearia axillaris	Coast Daisy-Bush
Ozothamnus turbinatus	Coast Everlasting
Pimelea serpyllifolia ssp. *serpyllifolia*	Thyme Rice-flower
Pomaderris paniculosa ssp. *paralia*	Coast Pomaderris
Rhagodia candolleana ssp. *candolleana*	Seaberry Saltbush
Solanum laciniatum	Large Kangaroo Apple
Enchylaena tomentosa var. *tomentosa*	Ruby Saltbush
Eutaxia microphylla	Common Eutaxia
Hibbertia sericea	Silky Guinea-flower
Pimelea glauca	Smooth Rice-flower
Pultenaea tenuifolia	Slender Bush-pea
Muehlenbeckia adpressa	Climbing Lignum
Rubus parvifolius	Small-leaf Bramble
Tussock-forming and rhizomatous perennial herbs (grasses and graminoids)	
Agrostis billardierei var. *billardierei*	Coast Blown-grass
Austrodanthonia caespitosa	Common Wallaby-grass
Austrostipa flavescens	Coast Spear-grass

1. Coastal Dune Complex (1.0)	
Species	**Common Name**
Austrostipa mollis	Supple Spear-grass
Deyeuxia quadriseta	Reed Bent-grass
Dianella aff. revoluta s.l. (coastal)	Black-anther Flax-lily
Dianella brevicaulis	Short-stalk Flax-lily
Dichelachne crinita	Long-hair Plume-grass
Elymus scaber	Common Wheat-grass
Imperata cylindrica	Blady Grass
Isolepis nodosa	Knobby Club-sedge
Lepidosperma curtisiae	Little Sword-sedge
Lepidosperma gladiatum	Coast Sword-sedge
Lomandra longifolia ssp. *longifolia*	Spiny-headed Mat-rush
Microlaena stipoides var. *stipoides*	Weeping Grass
Poa poiformis var. *poiformis*	Blue Tussock-grass
Schoenus nitens	Shiny Bog-sedge
Themeda triandra	Kangaroo Grass
Tricoryne elatior	Yellow Rush-lily
Perennial Dicot herb	
Acaena novae-zelandiae	Bidgee-widgee
Apium prostratum ssp. *prostratum* var. *prostratum*	Sea Celery
Atriplex semibaccata	Berry Saltbush
Carpobrotus rossii	Karkalla
Chrysocephalum apiculatum s.l.	Common Everlasting
Cynoglossum australe	Australian Hound's-tongue
Cynoglossum suaveolens	Sweet Hound's-tongue
Dichondra repens	Kidney-weed
Einadia nutans ssp. *nutans*	Nodding Saltbush
Geranium retrorsum s.l.	Grassland Cranesbill
Geranium solanderi s.l.	Austral Cranesbill
Gonocarpus tetragynus	Common Raspwort
Hydrocotyle laxiflora	Stinking Pennywort
Kennedia prostrata	Running Postman
Leptorhynchos squamatus	Scaly Buttons
Lotus australis	Austral Trefoil
Malva australiana ssp. *australiana*	Australian Hollyhock
Pelargonium australe	Austral Stork's-bill
Rumex brownii	Slender Dock
Senecio pinnatifolius	Variable Groundsel
Senecio quadridentatus	Cotton Fireweed
Swainsona lessertiifolia	Coast Swainson-pea

1. Coastal Dune Complex (1.0)	
Species	**Common Name**
Tetragonia implexicoma	Bower Spinach
Threlkeldia diffusa	Coast Bonefruit
Veronica gracilis	Slender Speedwell
Zygophyllum billardierei	Coast Twin-leaf
Ferns	
Pteridium esculentum	Austral Bracken
Vines	
Clematis microphylla var. *microphylla*	Small-leaved Clematis
Mistletoe	
Amyema preissii	Wire-leaf Mistletoe

2. Saltmarsh Complex (2.0)	
Species	**Common Name**
Shrubs	
Atriplex paludosa ssp. *paludosa*	Marsh Saltbush
Sclerostegia arbuscula	Shrubby Glasswort
Wilsonia backhousei	Narrow-leaf Wilsonia
Wilsonia humilis	Silky Wilsonia
Wilsonia rotundifolia	Round-leaf Wilsonia
Frankenia pauciflora var. *gunnii*	Southern Sea-heath
Halosarcia pergranulata ssp. *pergranulata*	Blackseed Glasswort
Suaeda australis	Austral Seablite
Tussock-forming and rhizomatous perennial herbs (grasses and graminoids)	
Austrostipa stipoides	Prickly Spear-grass
Baumea juncea	Bare Twig-sedge
Distichlis distichophylla	Australian Salt-grass
Gahnia filum	Chaffy Saw-sedge
Hemichroa pentandra	Trailing Hemichroa
Isolepis nodosa	Knobby Club-sedge
Juncus kraussii ssp. *australiensis*	Sea Rush
Poa poiformis var. *poiformis*	Blue Tussock-grass
Puccinellia stricta var. *perlaxa*	Plains Saltmarsh-grass
Puccinellia stricta var. *stricta*	Australian Saltmarsh-grass
Schoenus nitens	Shiny Bog-sedge
Sporobolus virginicus	Salt Couch
Triglochin striatum	Streaked Arrowgrass
Perennial Dicot herb	
Angianthus preissianus	Salt Angianthus
Apium prostratum ssp. *prostratum* var. *filiforme*	Sea Celery
Disphyma crassifolium ssp. *clavellatum*	Rounded Noon-flower
Samolus repens	Creeping Brookweed
Sarcocornia blackiana	Thick-head Glasswort
Sarcocornia quinqueflora ssp. *quinqueflora*	Beaded Glasswort
Sebaea albidiflora	White Sebaea
Selliera radicans	Shiny Swamp-mat
Spergularia marina s.l.	Salt Sand-spurrey

Appendix 8. Weed species at the proposed Golden Beach (Torquay Sands) Residential Lakes and Golf Course, Torquay requiring control or elimination.

Species	Common Name	Life Form	Distribution[2]	Control Method
***Acacia saligna*[1]**	Golden Wreath Wattle	Ls/T	1.1, 1.2	4, 5
**Ammophila arenaria*	Marram Grass	P	1.3	1
***Asparagus asparagoides*[1]**	Bridal Creeper	Gt	1.1	1
***Asphodelus fistulosus*▲**	Onion Weed	X	1.1	1
**Brassica fruticulosa*	Twiggy Turnip	B/P	1.1	1
**Carduus pycnocephalus*	Slender Thistle	A	1.1	1
**Chrysanthemoides monilifera* ssp. *monilifera*▲	Boneseed	Ls	1.1, 1.2	1, 3
Cirsium vulgare	Spear Thistle	B	1.1, 1.2, 2.0	1
***Clematis vitalba*[1]**	Traveller's Joy	V	1.1	1, 2
**Coprosma repens*	New Zealand Mirror Bush	Ls		2
***Cotoneaster glaucophyllus* f. *serotinus*[1]**	Large-leaf Cotoneaster	Ls	1.1	2
***Cotoneaster pannosus*[1]**	Velvet Cotoneaster	Ls	1.1	2
**Cynodon dactylon* var. *dactylon*	Couch	P	1.1, 1.2	1
***Delairea odorata*[1]**	Cape Ivy	V	1.1	1, 2
**Diplotaxis tenuifolia*▲	Sand Rocket	P	1.1, 1.2	1
**Ehrharta erecta*	Panic Veldt Grass	P	1.1	1
**Euphorbia terracina*	Terracina Spurge	P	1.1	?1, ?2
***Foeniculum vulgare*▲**	Fennel	P	1.1	1
Galenia pubescens	Galenia	P	1.1	1, 2, 3
**Helminthotheca echioides*	Ox-tongue	A/B	1.1, 1.2, 2.4	1
**Juncus articulatus*	Jointed Rush	Ea(P)	3.0	1
Lycium ferocissimum	African Boxthorn	Ls	1.1, 1.2	2
***Malus x domestica*[1]**	Apple	T	1.1	2
***Marrubium vulgare*▲**	Horehound	P	1.1, 1.2	1
**Melilotus indicus*	Sweet Melilot	A	1.1, 1.2	1
***Nassella trichotoma*●**	Serrated Tussock	P	1.1, 1.2	1
**Paraserianthes lophantha* ssp. *lophantha*[1]	Cape Wattle	Ls/T	1.1, 1.2	3, 4, 5
**Paspalum dilatatum*	Paspalum	P	4.0	1
**Pennisetum clandestinum*	Kikuyu	P	1.1, 1.2	1

Species	Common Name	Life Form	Distribution[2]	Control Method
**Phalaris aquatica*	Toowoomba Canary-grass	P	1.1, 1.2, 2.4	1
**Piptatherum miliaceum*	Rice Millet	P	1.1	1, 3
**Rapistrum rugosum*	Giant Mustard	A	1.1, 1.2	1
****Rhamnus alaternus***[1]	Italian Buckthorn	Ls	1.1	2
**Rosa rubiginosa* ▲	Sweet Briar	Ls	1.2	2
****Senecio elegans***	Purple Groundsel	A	1.1	1
****Silybum marianum***	Variegated Thistle	A	1.1	1
**Sonchus asper* ssp. *asper*	Rough Sow-thistle	A	1.1, 1.2, 2.4, 3.0	1
**Sporobolus indicus* var. *capensis*	Rat-tail Grass	P	1.1, 1.2	1
****Ulex europaeus***	Gorse	Ls	1.2	1
**Verbascum virgatum*	Twiggy Mullein	Bs	1.1, 1.2	1, 3

* **Regionally prohibited** species under the *Catchment and Land Protection Act 1994*

▲ **Regionally controlled** species under the *Catchment and Land Protection Act 1994*

Species in **bold** should be eliminated from the site; other species should be controlled in designated areas.

[1] Species which have escaped from cultivation locally.

[2] Distribution of weed species within vegetation communities / sub-communities.

1.0 Coastal Dune Complex

- 1.1 Moonah (*Melaleuca lanceolata*) - Coast Wirilda (*Acacia retinodes* var. *uncifolia*) Shrubland
- 1.2 Blue Tussock-grass (*Poa poiformis*) – Knobby Club-sedge (*Isolepis nodosa*) Grassland/Sedgeland
- 1.3 Marram Grass (**Ammophila arenaria*) Grassland

2.0 Saltmarsh Complex

- 2.1 Shrubby Glasswort (*Sclerostegia arbuscula*) Shrubland
- 2.2 Blackseed Glasswort (*Halosarcia pergranulata*) Shrubland
- 2.3 Beaded Glasswort (*Sarcocornia quinqueflora* ssp. *quinqueflora*) Herbfield
- 2.4 Blue Tussock-grass (*Poa poiformis*) – Sea Rush (*Juncus kraussii*) Grassland/Sedgeland
- 2.5 Sea Rush (*Juncus kraussii*) – Streaked Arrow-grass (*Triglochin striatum*) Herbfield
- 2.6 Long-fruit Water-mat (*Lepilaena cylindrocarpa*) Submerged Herbfield
- 2.7 Round-leaf Wilsonia (*Wilsonia rotundifolia*) Herbfield

3.0 Freshwater Herbfield

Life Form

A	annual	P	perennial herb
B	biennial	Pa	parasite
Ea	emergent aquatic	Rc	root climber
Fa	floating aquatic	S	small to medium shrub
Gb	bulbous geophyte	Sa	submergent aquatic
Gc	cormous geophyte	Ss	subshrub
Gr	rhizomatous geophyte	T	tree
Gt	tuberous geophyte	V	vine
Ls	large shrub	X	succulent herb, subshrub or shrub

Appendix 9. Indigenous plant species potentially suitable for landscape and amenity plantings, Golden Beach (Torquay Sands) Golf Course and Residential Development, Torquay.

Species	Common name	Broad environments	Potential applications		
			Street trees	Median strips/traffic islands	General landscape plantings
Trees					
Acacia implexa	Lightwood	Non-coastal	✓	✓	✓
Acacia melanoxylon	Blackwood	Non-coastal, non-saline	✓	✓	✓
Acacia pycnantha	Golden Wattle	Coastal, non-coastal			✓
Allocasuarina littoralis	Black She-oak	Non-coastal	✓	✓	✓
Acacia verticillata var. *verticillata*	Prickly Moses	Non-coastal, non-saline			✓
Banksia marginata (tree form)	Silver Banksia	Non-coastal	✓	✓	✓
Bursaria spinosa var. *macrophylla*	Large-leaf Sweet Bursaria	Coastal, non-coastal	✓	✓	✓
Bursaria spinosa var. *spinosa*	Sweet Bursaria	Non-coastal		✓	✓
Eucalyptus camaldulensis	River Red Gum	Non-coastal, non-saline			✓
Eucalyptus leucoxylon ssp. *bellarinensis*	Bellarine Yellow Gum	Non-coastal	✓	✓	✓
Eucalyptus ovata var. *ovata*	Swamp Gum	Non-coastal, non-saline	✓	✓	✓
Eucalyptus pauciflora ssp. *pauciflora*	White Sallee	Non-coastal	✓	✓	✓
Eucalyptus tricarpa	Red Ironbark	Non-coastal	✓	✓	✓
Eucalyptus viminalis ssp. *pryoriana*	Coast Manna Gum	Non-coastal	✓	✓	✓
Melaleuca lanceolata	Moonah	Coastal	✓	✓	✓
Large Shrubs					✓
Acacia paradoxa	Hedge Wattle	Coastal, non-coastal			✓
Allocasuarina paludosa	Swamp Sheoke	Non saline			✓
Daviesia latifolia		Non-coastal		✓	✓
Kunzea ericoides	Burgan	Non-coastal		✓	✓
Leptospermum continentale		Non-coastal			✓
Leptospermum lanigerum	Woolly Tea-tree	Non-saline			✓

Species	Common name	Broad environments	Potential applications		
			Street trees	Median strips/traffic islands	General landscape plantings
Leucopogon parviflorus	Coast Beard-heath	Coastal		✓	✓
Muehlenbeckia florulenta	Climbing Lignum	Non-saline			✓
Myoporum insulare	Boobialla	Non-coastal		✓	✓
Ozothamnus turbinatus		Non-coastal			✓
Pomaderris paniculosa ssp. *paniculosa*	Coast Pomaderris	Non-coastal		✓	✓
Solanum aviculare	Kangaroo Apple	Non-coastal			✓
Viminaria juncea	Golden Spray	Non-saline		✓	✓
Medium Shrubs					✓
Alyxia buxifolia	Sea Box	Coastal		✓	✓
Atriplex paludosa ssp. *paludosa*		Saline			✓
Indigofera australis	Austral Indigo	Non-coastal			✓
Leptospermum myrsinoides	Silky Tea-tree	Non-coastal			✓
Olearia axillaris		Coastal		✓	✓
Olearia glutinosa		Coastal		✓	✓
Rhagodia candolleana ssp. *candolleana*	Seaberry Saltbush	Coastal		✓	✓
Spyridium parvifolium	Dusty Miller	Non-coastal		✓	✓
Small Shrubs					
Beyeria viscosa		Coastal		✓	
Correa alba var. *alba*	White Correa	Coastal		✓	
Correa reflexa var. *reflexa*	Common Correa	Non-coastal		✓	
Dillwynia cinerascens	Grey Parrot-pea	Non-coastal		✓	
Einadia nutans ssp. *nutans*		Coastal, Non-coastal		✓	
Epacris impressa	Common Heath	Non-coastal		✓	
Halosarcia pergranulata ssp. *pergranulata*	Blackseeded Glasswort	Saline			✓

Species	Common name	Broad environments	Potential applications		
			Street trees	Median strips/traffic islands	General landscape plantings
Hibbertia riparia		Non-coastal		✓	
Hibbertia sericea var. *sericea*		Non-coastal		✓	
Lasiopetalum baueri		Coastal		✓	
Lavatera plebeia var. *plebeia*		Coastal		✓	
Leucophyta brownii	Cushion Bush	Coastal		✓	
Olearia ramulosa var. *ramulosa*		Coastal, Non-coastal		✓	
Pimelea glauca		Coastal		✓	
Pimelea serpyllifolia		Coastal		✓	
Platylobium obtusangulum		Non-coastal		✓	
Senecio odoratus		Coastal		✓	
Xanthorrhoea australis	Austral Grass-tree	Non-coastal		✓	✓
Woody Vines					
Billardiera scandens var. *scandens*		Non-coastal		✓	
Clematis microphylla var. *microphylla*		Coastal, Non-coastal		✓	✓
Hardenbergia violacea		Non-coastal		✓	
Muehlenbeckia adpressa		Coastal		✓	✓
Prostrate or low ground covers: herbaceous					
Disphyma crassifolium ssp. *clavellatum*		Coastal		✓	
Einadia nutans ssp. *nutans*		Coastal		✓	
Enchylaena tomentosa		Coastal		✓	
Kennedia prostrata		Coastal, Non-coastal		✓	
Swainsona lessertiifolia		Coastal		✓	
Tetragonia implexicoma		Coastal		✓	✓
Zygophyllum billardieri		Coastal		✓	
Chrysocephalum apiculatum		Coastal, Non-coastal		✓	

Species	Common name	Broad environments	Potential applications		
			Street trees	Median strips/traffic islands	General landscape plantings
Chrysocephalum semipapposum		Non-coastal		✓	
Prostrate or low ground covers: woody					
Carpobrotus rossii		Coastal		✓	
Goodenia ovata (prostrate coastal form from Jan Juc)		Coastal		✓	
Pultenaea tenuifolia		Coastal		✓	
Threlkeldia diffusa		Coastal		✓	
Tussock forming grasses or graminoids					
Austrodanthonia caespitosa		Coastal, Non-coastal		✓	
Austrodanthonia geniculata		Non-coastal		✓	
Austrodanthonia setacea		Non-coastal		✓	
Austrodanthonia racemosa		Coastal, Non-coastal		✓	
Gahnia filum		Saline		✓	
Gahnia trifida		Saline		✓	
Lomandra longifolia ssp. *longifolia*		Coastal, Non-coastal		✓	
Poa labillardierei		Non-saline		✓	
Poa poiformis var. *poiformis*		Coastal, Non-coastal, Saline		✓	
Stipa flavescens		Coastal		✓	
Stipa mollis		Coastal, Non-coastal		✓	
Austrostipa stipoides		Saline		✓	
Themeda triandra		Coastal, Non-coastal		✓	
Xanthorrhoea minor ssp. *lutea*		Non-coastal		✓	
Rhizomatous perennial herbs					
Dianella brevicaulis		Coastal, Non-coastal		✓	✓
Dianella aff. *revoluta* (coastal)		Coastal, Non-coastal		✓	✓

Species	Common name	Broad environments	Potential applications		
			Street trees	Median strips/traffic islands	General landscape plantings
Distichlis distichophylla		Non-saline		✓	
Imperata cylindrica		Coastal		✓	✓
Lepidosperma gladiatum		Coastal		✓	✓
Spinifex sericeus		Coastal		✓	

Appendix 10. Plant species with weed potential that should not be planted within the Golden Beach (Torquay Sands) Residential Lakes and Golf Course, Torquay.

Botanical name	Common name
Acacia baileyana	Cootamundra Wattle
Acacia decurrens	Early Black Wattle
Acacia elata	Cedar Wattle
Acacia floribunda	White Sallow Wattle
Acacia longifolia var. *longifolia*	Sallow Wattle
Acacia longifolia var. *sophorae*	Coast Wattle
Acacia retinodes var. *retinodes*	Wirilda
Acacia saligna	Golden Wreath Wattle
Agapanthus praecox ssp. *orientalis*	Agapanthus
Araujia hortorum	White Bladder-flower
Arctotis venusta	White Arctotis
Aristea ecklonii	Aristea
Asparagus asparagoides	Bridal Creeper
Asparagus scandens	Asparagus Fern
Carpobrotus aequilaterus	Angled Pigface
Carpobrotus edulis	Hottentot Fig
Chasmanthe floribunda	African Corn-flag
Clematis vitalba	Travellers Joy
Coprosma repens	New Zealand Mirror-bush
Cortaderia jubata	Pink Pampas Grass
Cortaderia selloana	Pampas Grass
Cotoneaster divaricata	Cotoneaster
Cotoneaster glaucophyllus	Cotoneaster
Cotoneaster pannosus	Cotoneaster
Crataegus monogyna	Hawthorn
Crocosmia x *crocosmiiflora*	Montbretia
Cytisus palmensis	Tagasaste or Tree Lucerne
Cytisus scoparius	English Broom
Delairea odorata	Cape Ivy
Dietes iridioides	Dietes
Dimorphotheca ecklonis	Dimorphotheca
Dimorphotheca pluvialis	Cape Marigold
Dipogon lignosus	Dipogon
Erica lusitanica	Spanish Heath
Fraxinus rotundifolia ssp. *rotundifolia*	Desert Ash
Freesia species and hybrids	Freesia
Gazania linearis	Gazania
Gazania rigens	Gazania
Genista linifolia	Flax-leaf Broom
Genista monspessulana	Montpellier Broom
Hakea laurina	Pincushion Hakea
Hakea salicifolia	Willow-leaf Hakea

Botanical name	Common name
Hakea suaveolens	Sweet Hakea
Hedera helix	Ivy
Ixia spp.	
Leptospermum laevigatum	Coast Tea-tree
Ligustrum lucidum	Large-leaf Privet
Lonicera japonica	Japanese Honeysuckle
Melaleuca armillaris	Giant Honey-myrtle
Melaleuca decussata	Totem-poles
Melaleuca diosmifolia	Green Honey-myrtle
Melaleuca hypericifolia	Red Honey-myrtle
Melaleuca nesophila	Mauve Honey-myrtle
Melaleuca parvistaminea	Rough Paperbark
Myrsiphyllum asparagoides	Bridal Creeper
Myrsiphyllum scandens	Myrsiphyllum
Oenothera glazioviana	Evening Primrose
Olea europaea ssp. *europaea*	Olive
Paraserianthes lophantha	Cape Wattle
Passiflora mollissima	Banana Passionfruit
Pennisetum alopecuroides	Swamp Foxtail-grass
Pennisetum villosum	Feathertop
Pinus radiata	Monterey or Radiata Pine
Pittosporum crassifolium	Pittosporum
Pittosporum undulatum	Sweet Pittosporum
Polygala myrtifolia	Myrtle-leaf Milkwort
Protasparagus densiflorus	Protasparagus
Psoralea pinnata	Blue Psoralea
Pyracantha angustifolia	Orange Firethorn
Pyracantha crenulata	Nepal Firethorn
Rhamnus alaternus	Italian Buckthorn
Rumex sagittatus	Climbing Dock
Senecio angulatus	Climbing Groundsel
Sollya heterophylla	Bluebell Creeper
Sparaxis bulbifera	Harlequin-flower
Tradescantia albiflora	Wandering Jew
Tritonia lineata	Lined Tritonia
Verbascum thapsus	Great Mullein
Vinca major	Blue Periwinkle
Watsonia borbonica	Watsonia
Watsonia meriana 'Bulbillifera'	Bulbil Watsonia
Watsonia versfeldii	Watsonia
Zantedeschia aethiopica	White Arum Lily

Appendix 11. Trust for Nature Conservation Covenant – Breamlea Saltmarsh

DEED OF COVENANT FOR THE CONSERVATION OF LAND

THIS DEED is made the 12th day of September 1995 by

GREATER GEELONG CITY COUNCIL
(formerly THE MAYOR COUNCILLORS AND CITIZENS
OF THE CITY OF SOUTH BARWON)

(the Owner)

and

VICTORIAN CONSERVATION TRUST

(the Trust)

RECITALS

A. Pursuant to Section 6(1)(a) of the City of Greater Geelong Act 1993 the Owner is the registered proprietor of the land described in the Schedule (the Land) and desires to enter into a covenant with the Trust which runs with the Land empowering the Trust to enforce such covenant against the Owner and persons deriving title from the Owner;

B. The Trust and the Owner being satisfied that the Land possesses the appropriate characteristics and acknowledging that their aims and purposes are the conservation of the Land its:

(i) native plants and wildlife;

(ii) natural interest and beauty;

(iii) ecological significance;

(iv) historical interest;

(v) watercourses, lakes, ponds, marshes and other bodies of water

have agreed to enter into this Deed.

NOW THIS DEED WITNESSETH:

OWNER COVENANTS

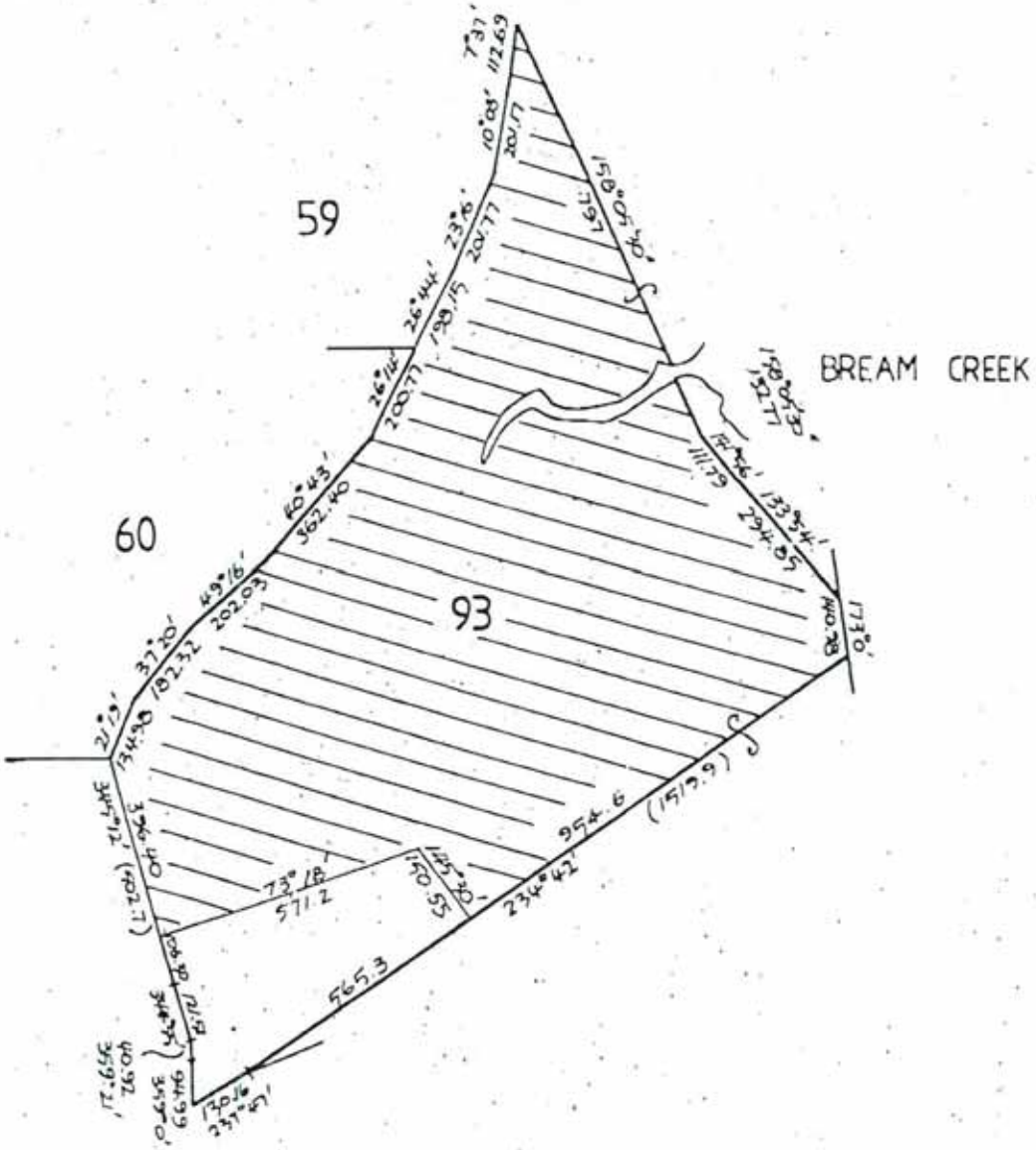
The Owner for the Owner and for all future owners COVENANTS at all times to observe and perform the following obligations and duties in relation to the Land to the extent that it is within the power of the Owner to do so:-

PLAN FOR COVENANT PURPOSES
PART OF CROWN ALLOTMENT 93
PARISH OF PUEBLA
COUNTY OF GRANT

LENGTHS ARE IN METRES

C/T VOL. 9117 FOL. 990

THE INTERNAL DIMENSIONS ARE DERIVED FROM PHOTOGRAMMETRIC MEASUREMENTS BASE PHOTOGRAPH NO. 8894-113 RUN 9 M/S 7721 GERLONG 19.2.84.



LAND SHOWN THUS ▨ (126.5 Ha)
SUBJECT TO THE COVENANT

THIS PLAN ACCORDS WITH TITLE AND IS MATHEMATICALLY CORRECT

1.10.93.

LICENSED SURVEYOR

1. Not to do any act or thing upon the Land which in the reasonable opinion of the Trust is prejudicial to its conservation.

2. In particular on and with respect to the Land, except with the prior written consent of the Trust (which consent will not be unreasonably withheld if the Trust is satisfied that the proposal will not prejudice the aims and purposes of this Covenant), the Owner SHALL NOT PERMIT:-

   (a) the destruction or removal of any local indigenous native trees, plants or grasses, nor plant any trees, grasses or plants other than local indigenous native flora;

   (b) any act or omission which may adversely affect any indigenous flora or fauna or their related habitats;

   (c) (unless required by law) any deterioration in the natural state or in the flow, supply, quantity or quality of any body of water;

   (d) livestock to enter and where the Land is adjacent to an area being grazed the Owner shall keep fences and gates between such area and the Land in good stockproof order and condition;

   (e) the introduction of any non-indigenous fauna or any cat, dog or other domestic animals;

   (f) the erection or display of any notice, hoarding or advertising matter save for identification, environmental, or cultural interpretation signs, or signs required to achieve the protection of the Land;

   (g) (unless required by law) any exploration or mining extraction or production of gas, petroleum, minerals or other substances or establish any transmission lines or other services or works. The Owner shall notify the Trust of any such activity and refrain from giving any consent until approved by the Trust;

   (h) subdivision of the Land or the operation of any trade, industry or business, the recreational use of trailbikes or four wheel drive vehicles, the unnecessary storage of rubbish or materials, or any other activities not consistent with the objectives of this Covenant;

   (i) guns or other wildlife hunting weapons to be used save for legitimate vermin control.

3. The Owner shall not place nor permit any structure or building on the Land save that the Trust may give consent to the construction of a non-habitable structure or building which is necessary for the proper management of the Land and which shall be approved in writing by the Trust prior to construction and located, designed and finished to blend with the natural environment.

4. The Owner shall ensure that public access to the Land does not adversely affect the conservation values of the Land. If in the opinion of the Trust, any such access does cause material damage to the conservation values of the Land, the Trust may require the Owner to prevent public access for a period to be specified by the Trust.

ACKNOWLEDGMENT BY THE TRUST

The Trust ACKNOWLEDGES that compliance with the prohibitions and restrictions may be treated as waived to the extent necessary for:

(i) reasonable fire protection, weed and pest control;

(ii) maintenance of fences, culverts, dams, bridges, watercourses, buildings, tracks, paths;

(iii) the proper management of the Land as a protected environment for indigenous flora and fauna.

FURTHER COVENANTS

The Owner for the Owner and for all future owners FURTHER COVENANTS AND AGREES:

(i) TO MAKE reasonable efforts to remove pests and weeds and to prevent their future invasion;

(ii) TO PERMIT upon being given reasonable prior notice, officers, agents or nominees of the Trust acting on behalf of the Trust to enter the Land in order to assess its condition.

(iii) UPON resolving to sell or lease any portion of the Land the Owner shall include within the contract or lease a copy of this covenant and shall promptly notify the Trust of any new owner or lessee.

SCHEDULE OF LAND

The land shown hatched on the attached plan being part of the land more particularly described in Certificate of Title Volume 9117 Folio 990.

EXECUTED as a Deed.

THE COMMON SEAL of GREATER GEELONG CITY COUNCIL)
was hereunto affixed by Authority of the Commissioners appointed)
under Section 7 of the City of Greater Geelong Act 1993 in the)
presence of:)

..... Commissioner

..... Commissioner

Common
GREATER GEELONG
CITY COUNCIL
Seal

THE COMMON SEAL of VICTORIAN CONSERVATION)
TRUST was hereto affixed by the authority)
of the Trustees in the presence of:)

..... Trustee

..... Trustee/~~Director~~

VICTORIAN CONSERVATION TRUST
THE
COMMON
SEAL
OF
★

It is hereby certified that the approval of the Minister under sub-section 3A(8) of the Victorian Conservation Trust Act 1972 has been obtained to this covenant. (Ref Schedule VCT 24).

..... Director
Victorian Conservation Trust

COV/GEELONG.CITY/deed.breamlea
1 February 1995

Appendix 12. Schedule of trees/shrubs to be removed

Common Name	Species	waypoint (unique identifier)	Condition	Number of plants	Species / Age class code	description of plant health
Boxthorn	**Lycium ferocissimum*	001	n/a	1	3	Medium size shrub
Radiata Pine	**Pinus radiata*	001-002	n/a	Row of 70 trees	7	All same age but diameter class varies from 15 to 35 cm. Generally in stunted condition but crowns healthy. Some evidence of salt spray pruning
Giant Honey-myrtle	*Melaleuca ?armillaris*	002	n/a	1	8C	Young Giant Honey-myrtle in good condition.
Radiata Pine	**Pinus radiata*	003-004	n/a	Row of 65 trees	7	All same age but trunk diameter class varies from 15 to 35 cm. Generally in stunted condition but crowns healthy. Some evidence of salt spray pruning
Radiata Pine	**Pinus radiata*	005-006	n/a	Row of 105 trees	7	First 6 trees on southern end of line are dead. All same age but diameter class varies from 15 to 35 cm. Generally in stunted condition but crowns healthy. Some evidence of salt spray pruning
Coast Wirilda	*Acacia retinodes var. uncifolia*	007	Fair	1	1A	Fallen, unhealthy, mostly dead, some recent suckering
Coast Wirilda	*Acacia retinodes var. uncifolia*	008	Moderate	1	1A	Fallen, crown generally healthy, stems with some splitting, rot and weeping sap.
Coast Wirilda	*Acacia retinodes var. uncifolia*	009	Good	1	1A	Fallen, healthy trunks and crown
Coast Wirilda	*Acacia retinodes var. uncifolia*	010	Poor	1	1B	Senescent, trunk in poor condition, weeping sap; crown in poor condition
Coast Wirilda	*Acacia retinodes var. uncifolia*	011	Good	1	1B	Multi-stemmed in good condition, crown healthy
Coast Wirilda	*Acacia retinodes var. uncifolia*	012	Moderate	1	1A	Fallen, trunk healthy, crown with some recent dieback; many suckers.
Coast Wirilda	*Acacia retinodes var. uncifolia*	013	Poor	1	1A	Trunk in poor condition, crown dying, occasional suckers
Coast Wirilda	*Acacia retinodes var. uncifolia*	014	Poor	1	1A	Trunk and crown in very poor condition, dying, few suckers
Boxthorn	**Lycium ferocissimum*	015	n/a	1	3	n/a
Coast Beard-heath	*Leucopogon parviflorus*	016	Excellent	1	5C	Excellent condition, very old

Common Name	Species	waypoint (unique identifier)	Condition	Number of plants	Species / Age class code	description of plant health
Coast Beard-heath	*Leucopogon parviflorus*	016-017	Excellent	1	5C	Excellent condition, very old
Coast Beard-heath	*Leucopogon parviflorus*	017	Good	1	5C	Good condition with deep split in trunk, very old
Coast Wirilda	*Acacia retinodes var. uncifolia*	018	Fair	1	1A	Multi-stemmed, partly fallen, remainder is senescent
Coast Wirilda	*Acacia retinodes var. uncifolia*	019a	Good	1	1B	Healthy trunk and crown
Coast Wirilda	*Acacia retinodes var. uncifolia*	019b	Good	1	1B	Healthy trunk and crown
Boxthorn	**Lycium ferocissimum*	019c	n/a	1	3	n/a
Coast Wirilda	*Acacia retinodes var. uncifolia*	020	Poor	1	1B	Almost fallen, very poor condition, may be a sucker
Coast Wirilda	*Acacia retinodes var. uncifolia*	021	Fair	1	1B	Large crack in trunk, crown illness evident
Coast Wirilda	*Acacia retinodes var. uncifolia*	022	Excellent	1	1C	Stem and crown healthy
Coast Wirilda	*Acacia retinodes var. uncifolia*	024	Excellent	1	1C	Stem and crown healthy
Coast Wirilda	*Acacia retinodes var. uncifolia*	024a	Poor	1	1C	Sick
Coast Wirilda	*Acacia retinodes var. uncifolia*	024b	Poor	1	1D	Sick
Coast Wirilda	*Acacia retinodes var. uncifolia*	024c	Poor	1	1C	Sick
Coast Wirilda	*Acacia retinodes var. uncifolia*	024d	Good	1	1D	Young stem sucker
Coast Wirilda	*Acacia retinodes var. uncifolia*	024e	Good	1	1C	Good stems
Coast Wirilda	*Acacia retinodes var. uncifolia*	024f	Good	1	1C	Good stems
Coast Wirilda	*Acacia retinodes var. uncifolia*	024g	Good	1	1C	Good stems
Coast Wirilda	*Acacia retinodes var. uncifolia*	024h	Moderate	1	1C	Dieback

Common Name	Species	waypoint (unique identifier)	Condition	Number of plants	Species / Age class code	description of plant health
Coast Wirilda	*Acacia retinodes var. uncifolia*	024i	Moderate	1	1B	Dieback
Coast Wirilda	*Acacia retinodes var. uncifolia*	024j	Moderate	1	1C	Dieback
Coast Wirilda	*Acacia retinodes var. uncifolia*	024k	Moderate	1	1C	Dieback
Coast Wirilda	*Acacia retinodes var. uncifolia*	024l	dead	1	1C	Dead
Coast Wirilda	*Acacia retinodes var. uncifolia*	024m	Poor	1	1C	Sick
Coast Wirilda	*Acacia retinodes var. uncifolia*	024n	dead	1	1C	Dead
Coast Wirilda	*Acacia retinodes var. uncifolia*	024o	Poor	1	1C	Sick
Coast Wirilda	*Acacia retinodes var. uncifolia*	024p	Good	1	1C	Healthy
Coast Wirilda	*Acacia retinodes var. uncifolia*	024q	Good	1	1C	Healthy
Coast Wirilda	*Acacia retinodes var. uncifolia*	024r	Poor	1	1C	Sick
Coast Wirilda	*Acacia retinodes var. uncifolia*	024s	Good	1	1C	Healthy
Coast Wirilda	*Acacia retinodes var. uncifolia*	024t	Good	1	1C	Healthy
Coast Wirilda	*Acacia retinodes var. uncifolia*	024u	Good	1	1C	Healthy
Coast Wirilda	*Acacia retinodes var. uncifolia*	024v	Good	1	1C	Healthy
Coast Wirilda	*Acacia retinodes var. uncifolia*	024w	Good	1	1C	Healthy
Boxthorn	**Lycium ferocissimum*	024x	n/a	1	3	n/a
Coast Beard-heath	*Leucopogon parviflorus*	025	Excellent	1	5C	Very healthy, extreme advanced age
Coast Beard-heath	*Leucopogon parviflorus*	026	n/a	1	5B	Outlier in reserve (for location purposes only) - fallen

Common Name	Species	waypoint (unique identifier)	Condition	Number of plants	Species / Age class code	description of plant health
Coast Wirilda	*Acacia retinodes var. uncifolia*	027	Good	1	1C	Trunk in good condition
Coast Wirilda	*Acacia retinodes var. uncifolia*	028	Fair	1	1A	Trunk in poor condition, weeping sap from many points but integrity is reasonable in part with crown remnants healthy.
Coast Wirilda	*Acacia retinodes var. uncifolia*	029	Good	1	1C	Trunk and crown in good condition.
Coast Wirilda	*Acacia retinodes var. uncifolia*	030	Fair	1	1C	Trunk damaged, weeping sap from many points, crown in good condition.
Coast Wirilda	*Acacia retinodes var. uncifolia*	031	Moderate	1	1C	Twin-stemmed: north stem with much damage and healthy crown.
Coast Wirilda	*Acacia retinodes var. uncifolia*	032	Excellent	1	1C	Very healthy.
Coast Wirilda	*Acacia retinodes var. uncifolia*	033	Excellent	1	1C	Very healthy.
Coast Wirilda	*Acacia retinodes var. uncifolia*	034	Fair	1	1B	Crown beginning to senesce, and some stem death - losing bark.
Coast Wirilda	*Acacia retinodes var. uncifolia*	035	Good	1	1C	Healthy with some stem death (1 stem), some dieback
Coast Wirilda	*Acacia retinodes var. uncifolia*	036	Fair	1	1A	Some stem illness and dieback, otherwise in fair condition
Coast Wirilda	*Acacia retinodes var. uncifolia*	037	Fair	1	1B	Twin-stemmed: one stem fallen, one erect. Healthy crown but stem damage and illness, many suckers
Coast Wirilda	*Acacia retinodes var. uncifolia*	038	Fair	1	1B	Severe stem cracking and dieback, crown reasonably healthy in parts
Coast Wirilda	*Acacia retinodes var. uncifolia*	039	Moderate	1	1C	Twin-stemmed: one dead, one healthy small stem
Coast Wirilda	*Acacia retinodes var. uncifolia*	040	Good	1	1C	very close to 039, some stem illness otherwise good condition
Coast Wirilda	*Acacia retinodes var. uncifolia*	041	Poor	1	1B	Almost fallen, stem and crown in poor condition
Coast Wirilda	*Acacia retinodes var. uncifolia*	042	Poor	1	1B	Stem cracked and generally in poor condition, crown unhealthy

Common Name	Species	waypoint (unique identifier)	Condition	Number of plants	Species / Age class code	description of plant health
Coast Wirilda	*Acacia retinodes var. uncifolia*	043	Good	1	1C	Almost fallen, trunk and crown healthy, some suckering
Coast Teatree	*Leptospermum laevigatum*	044	Excellent	1	4	Edge of Coast Teatree.
Hedge Wattle	*Acacia paradoxa*	045	Excellent	1	2C	Very healthy, aged Hedge Wattle
Coast Wirilda	*Acacia retinodes var. uncifolia*	046	Excellent	1	1C	Large, old tree with spreading crown, very healthy, minor stem damage.
Coast Wirilda	*Acacia retinodes var. uncifolia*	047	Moderate	1	1B	North side of crown in poor condition, south side in better condition
Coast Wirilda	*Acacia retinodes var. uncifolia*	048	Poor	1	1D	Younger tree but in poor condition
Coast Wirilda	*Acacia retinodes var. uncifolia*	049	Excellent	1	1C	Healthy trunk and crown
Coast Wirilda	*Acacia retinodes var. uncifolia*	050	Moderate	1	1C	Trunk in fair condition, crown illness evident, surrounded by *Rhagodia candolleana*
Coast Wirilda	*Acacia retinodes var. uncifolia*	051	Poor	1	1B	Trunk in poor condition, almost fallen
Coast Wirilda	*Acacia retinodes var. uncifolia*	052	Poor	1	1B	Trunk in poor condition, almost fallen, small diameter
Coast Wirilda	*Acacia retinodes var. uncifolia*	053	Moderate	1	1B	Trunk and crown in fair condition but appears to be dying.
Coast Wirilda	*Acacia retinodes var. uncifolia*	054	Poor	1	1B	Poor condition
Coast Wirilda	*Acacia retinodes var. uncifolia*	055	Poor	1	1B	Poor condition
Coast Wirilda	*Acacia retinodes var. uncifolia*	056	Good	1	1D	Very small - not considered significant
Moonah	*Melaleuca lanceolata*	057	Excellent	1	6C	Very healthy
Coast Wirilda	*Acacia retinodes var. uncifolia*	(A) north of centreline of golf green	Good	1	1C	Healthy trunk and crown
Coast Wirilda	*Acacia retinodes var. uncifolia*	(B) north of centreline of golf green	Good	1	1C	Healthy trunk and crown
Coast Wirilda	*Acacia retinodes var. uncifolia*	(C) north of centreline of golf green	Good	1	1C	Healthy trunk and crown

Common Name	Species	waypoint (unique identifier)	Condition	Number of plants	Species / Age class code	description of plant health
Coast Wirilda	*Acacia retinodes var. uncifolia*	(D) south of centreline of golf green	Poor	1	1B	Trunk and crown in poor condition
Coast Wirilda	*Acacia retinodes var. uncifolia*	(E) south of centreline of golf green	Poor	1	1B	Trunk and crown in poor condition

KEY to Species / Age class code:

1 = Coast Wirilda *Acacia retinodes var. uncifolia*
2 = Hedge Wattle *Acacia paradoxa*
3 = Boxthorn *Lycium ferocissimum*
4 = Coast Teatree *Leptospermum laevigatum*
5 = Coast Beard-heath *Leucopogon parviflorus*
6 = Moonah *Melaleuca lanceolata*
7 = Monterey Pine *Pinus radiata*
8 = Giant Honey-myrtle *Melaleuca armillaris*

A = fallen
B = senescent
C = mature
D = immature

Appendix 12. Schedule of indigenous and exotic woody vegetation (trees and shrubs) identified for removal in the Golden Beach (Torquay Sands) Residential Development area

Common Name	Species	waypoint (unique identifier)	Condition	Number of plants	Species / Age class code	description of plant health
Boxthorn	**Lycium ferocissimum*	001	n/a	1	3	Medium size shrub
Radiata Pine	**Pinus radiata*	001-002	n/a	Row of 70 trees	7	All same age but diameter class varies from 15 to 35 cm. Generally in stunted condition but crowns healthy. Some evidence of salt spray pruning
Giant Honey-myrtle	*Melaleuca ?armillaris*	002	n/a	1	8C	Young Giant Honey-myrtle in good condition
Radiata Pine	**Pinus radiata*	003-004	n/a	Row of 65 trees	7	All same age but trunk diameter class varies from 15 to 35 cm. Generally in stunted condition but crowns healthy. Some evidence of salt spray pruning
Radiata Pine	**Pinus radiata*	005-006	n/a	Row of 105 trees	7	First 6 trees on southern end of line are dead. All same age but diameter class varies from 15 to 35 cm. Generally in stunted condition but crowns healthy. Some evidence of salt spray pruning
Coast Wirilda	*Acacia retinodes var. uncifolia*	007	Fair	1	1A	Fallen, unhealthy, mostly dead, some recent suckering
Coast Wirilda	*Acacia retinodes var. uncifolia*	008	Moderate	1	1A	Fallen, crown generally healthy, stems with some splitting, rot and weeping sap.
Coast Wirilda	*Acacia retinodes var. uncifolia*	009	Good	1	1A	Fallen, healthy trunks and crown
Coast Wirilda	*Acacia retinodes var. uncifolia*	010	Poor	1	1B	Senescent, trunk in poor condition, weeping sap; crown in poor condition
Coast Wirilda	*Acacia retinodes var. uncifolia*	011	Good	1	1B	Multi-stemmed in good condition, crown healthy
Coast Wirilda	*Acacia retinodes var. uncifolia*	012	Moderate	1	1A	Fallen, trunk healthy, crown with some recent dieback; many suckers.
Coast Wirilda	*Acacia retinodes var. uncifolia*	013	Poor	1	1A	Trunk in poor condition, crown dying, occasional suckers
Coast Wirilda	*Acacia retinodes var. uncifolia*	014	Poor	1	1A	Trunk and crown in very poor condition, dying, few suckers
Boxthorn	**Lycium ferocissimum*	015	n/a	1	3	n/a
Coast Beard-heath	*Leucopogon parviflorus*	016	Excellent	1	5C	Excellent condition, very old

Common Name	Species	waypoint (unique identifier)	Condition	Number of plants	Species / Age class code	description of plant health
Coast Beard-heath	*Leucopogon parviflorus*	016-017	Excellent	1	5C	Excellent condition, very old
Coast Beard-heath	*Leucopogon parviflorus*	017	Good	1	5C	Good condition with deep split in trunk, very old
Coast Wirilda	*Acacia retinodes var. uncifolia*	018	Fair	1	1A	Multi-stemmed, partly fallen, remainder is senescent
Coast Wirilda	*Acacia retinodes var. uncifolia*	019a	Good	1	1B	Healthy trunk and crown
Coast Wirilda	*Acacia retinodes var. uncifolia*	019b	Good	1	1B	Healthy trunk and crown
Boxthorn	**Lycium ferocissimum*	019c	n/a	1	3	n/a
Coast Wirilda	*Acacia retinodes var. uncifolia*	020	Poor	1	1B	Almost fallen, very poor condition, may be a sucker
Coast Wirilda	*Acacia retinodes var. uncifolia*	021	Fair	1	1B	Large crack in trunk, crown illness evident
Coast Wirilda	*Acacia retinodes var. uncifolia*	022	Excellent	1	1C	Stem and crown healthy
Coast Wirilda	*Acacia retinodes var. uncifolia*	024	Excellent	1	1C	Stem and crown healthy
Coast Wirilda	*Acacia retinodes var. uncifolia*	024a	Poor	1	1C	Sick
Coast Wirilda	*Acacia retinodes var. uncifolia*	024b	Poor	1	1D	Sick
Coast Wirilda	*Acacia retinodes var. uncifolia*	024c	Poor	1	1C	Sick
Coast Wirilda	*Acacia retinodes var. uncifolia*	024d	Good	1	1D	Young stem sucker
Coast Wirilda	*Acacia retinodes var. uncifolia*	024e	Good	1	1C	Good stems
Coast Wirilda	*Acacia retinodes var. uncifolia*	024f	Good	1	1C	Good stems
Coast Wirilda	*Acacia retinodes var. uncifolia*	024g	Good	1	1C	Good stems
Coast Wirilda	*Acacia retinodes var. uncifolia*	024h	Moderate	1	1C	Dieback

Common Name	Species	waypoint (unique identifier)	Condition	Number of plants	Species / Age class code	description of plant health
Coast Wirilda	*Acacia retinodes var. uncifolia*	024i	Moderate	1	1B	Dieback
Coast Wirilda	*Acacia retinodes var. uncifolia*	024j	Moderate	1	1C	Dieback
Coast Wirilda	*Acacia retinodes var. uncifolia*	024k	Moderate	1	1C	Dieback
Coast Wirilda	*Acacia retinodes var. uncifolia*	024l	dead	1	1C	Dead
Coast Wirilda	*Acacia retinodes var. uncifolia*	024m	Poor	1	1C	Sick
Coast Wirilda	*Acacia retinodes var. uncifolia*	024n	dead	1	1C	Dead
Coast Wirilda	*Acacia retinodes var. uncifolia*	024o	Poor	1	1C	Sick
Coast Wirilda	*Acacia retinodes var. uncifolia*	024p	Good	1	1C	Healthy
Coast Wirilda	*Acacia retinodes var. uncifolia*	024q	Good	1	1C	Healthy
Coast Wirilda	*Acacia retinodes var. uncifolia*	024r	Poor	1	1C	Sick
Coast Wirilda	*Acacia retinodes var. uncifolia*	024s	Good	1	1C	Healthy
Coast Wirilda	*Acacia retinodes var. uncifolia*	024t	Good	1	1C	Healthy
Coast Wirilda	*Acacia retinodes var. uncifolia*	024u	Good	1	1C	Healthy
Coast Wirilda	*Acacia retinodes var. uncifolia*	024v	Good	1	1C	Healthy
Coast Wirilda	*Acacia retinodes var. uncifolia*	024w	Good	1	1C	Healthy
Boxthorn	**Lycium ferocissimum*	024x	n/a	1	3	n/a
Coast Beard-heath	*Leucopogon parviflorus*	025	Excellent	1	5C	Very healthy, extreme advanced age
Coast Beard-heath	*Leucopogon parviflorus*	026	n/a	1	5B	Outlier in reserve (for location purposes only) - fallen

Common Name	Species	waypoint (unique identifier)	Condition	Number of plants	Species / Age class code	description of plant health
Coast Wirilda	*Acacia retinodes var. uncifolia*	027	Good	1	1C	Trunk in good condition
Coast Wirilda	*Acacia retinodes var. uncifolia*	028	Fair	1	1A	Trunk in poor condition, weeping sap from many points but integrity is reasonable in part with crown remnants healthy.
Coast Wirilda	*Acacia retinodes var. uncifolia*	029	Good	1	1C	Trunk and crown in good condition.
Coast Wirilda	*Acacia retinodes var. uncifolia*	030	Fair	1	1C	Trunk damaged, weeping sap from many points, crown in good condition.
Coast Wirilda	*Acacia retinodes var. uncifolia*	031	Moderate	1	1C	Twin-stemmed: north stem with much damage and healthy crown.
Coast Wirilda	*Acacia retinodes var. uncifolia*	032	Excellent	1	1C	Very healthy.
Coast Wirilda	*Acacia retinodes var. uncifolia*	033	Excellent	1	1C	Very healthy.
Coast Wirilda	*Acacia retinodes var. uncifolia*	034	Fair	1	1B	Crown beginning to senesce, and some stem death - losing bark.
Coast Wirilda	*Acacia retinodes var. uncifolia*	035	Good	1	1C	Healthy with some stem death (1 stem), some dieback
Coast Wirilda	*Acacia retinodes var. uncifolia*	036	Fair	1	1A	Some stem illness and dieback, otherwise in fair condition
Coast Wirilda	*Acacia retinodes var. uncifolia*	037	Fair	1	1B	Twin-stemmed: one stem fallen, one erect. Healthy crown but stem damage and illness, many suckers
Coast Wirilda	*Acacia retinodes var. uncifolia*	038	Fair	1	1B	Severe stem cracking and dieback, crown reasonably healthy in parts
Coast Wirilda	*Acacia retinodes var. uncifolia*	039	Moderate	1	1C	Twin-stemmed: one dead, one healthy small stem
Coast Wirilda	*Acacia retinodes var. uncifolia*	040	Good	1	1C	very close to 039, some stem illness otherwise good condition
Coast Wirilda	*Acacia retinodes var. uncifolia*	041	Poor	1	1B	Almost fallen, stem and crown in poor condition
Coast Wirilda	*Acacia retinodes var. uncifolia*	042	Poor	1	1B	Stem cracked and generally in poor condition, crown unhealthy

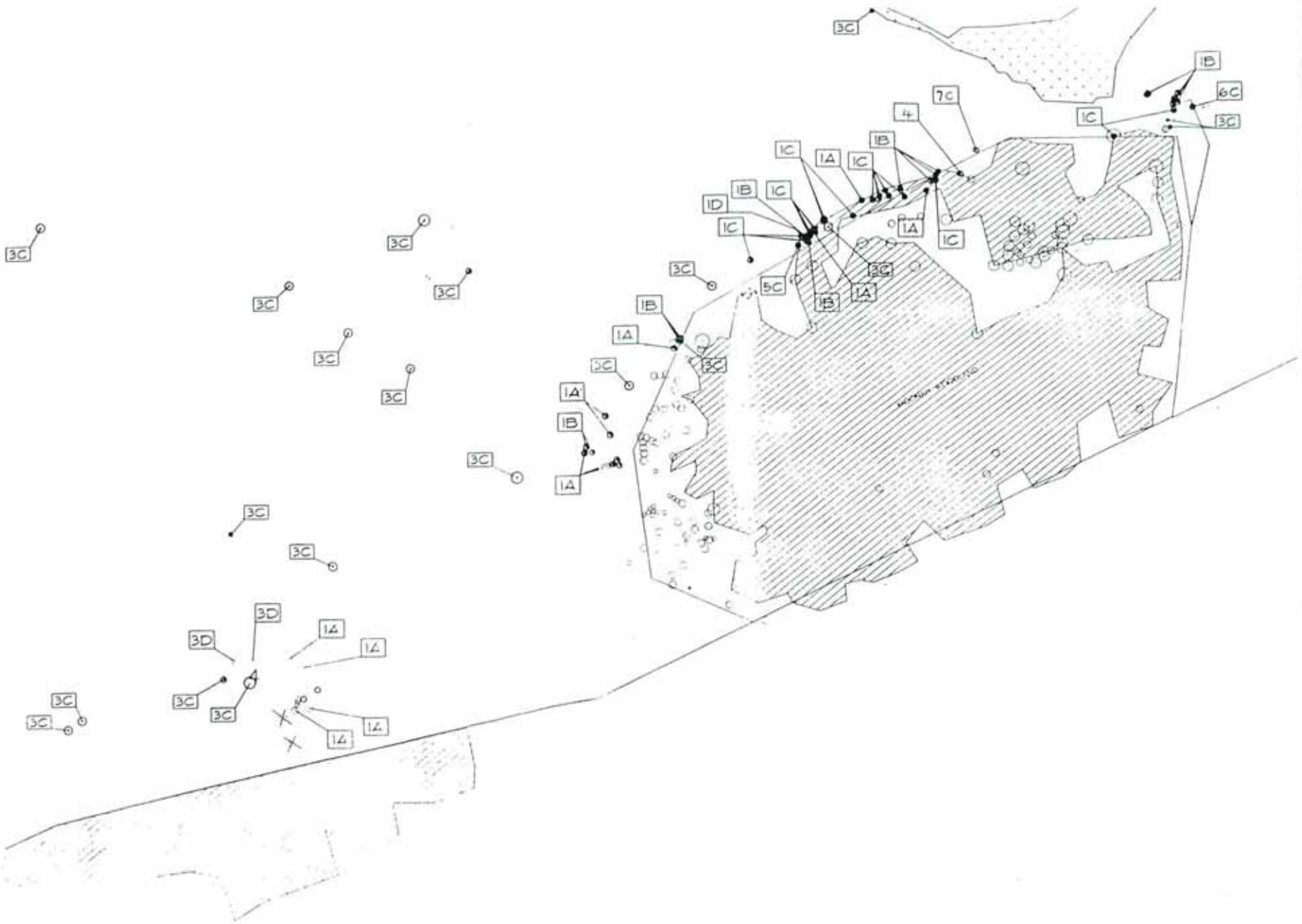
Common Name	Species	waypoint (unique identifier)	Condition	Number of plants	Species / Age class code	description of plant health
Coast Wirilda	*Acacia retinodes var. uncifolia*	043	Good	1	1C	Almost fallen, trunk and crown healthy, some suckering
Coast Teatree	*Leptospermum laevigatum*	044	Excellent	1	4	Edge of Coast Teatree.
Hedge Wattle	*Acacia paradoxa*	045	Excellent	1	2C	Very healthy, aged Hedge Wattle
Coast Wirilda	*Acacia retinodes var. uncifolia*	046	Excellent	1	1C	Large, old tree with spreading crown, very healthy, minor stem damage.
Coast Wirilda	*Acacia retinodes var. uncifolia*	047	Moderate	1	1B	North side of crown in poor condition, south side in better condition
Coast Wirilda	*Acacia retinodes var. uncifolia*	048	Poor	1	1D	Younger tree but in poor condition
Coast Wirilda	*Acacia retinodes var. uncifolia*	049	Excellent	1	1C	Healthy trunk and crown
Coast Wirilda	*Acacia retinodes var. uncifolia*	050	Moderate	1	1C	Trunk in fair condition, crown illness evident, surrounded by *Rhagodia candolleana*
Coast Wirilda	*Acacia retinodes var. uncifolia*	051	Poor	1	1B	Trunk in poor condition, almost fallen
Coast Wirilda	*Acacia retinodes var. uncifolia*	052	Poor	1	1B	Trunk in poor condition, almost fallen, small diameter
Coast Wirilda	*Acacia retinodes var. uncifolia*	053	Moderate	1	1B	Trunk and crown in fair condition but appears to be dying.
Coast Wirilda	*Acacia retinodes var. uncifolia*	054	Poor	1	1B	Poor condition
Coast Wirilda	*Acacia retinodes var. uncifolia*	055	Poor	1	1B	Poor condition
Coast Wirilda	*Acacia retinodes var. uncifolia*	056	Good	1	1D	Very small - not considered significant
Moonah	*Melaleuca lanceolata*	057	Excellent	1	6C	Very healthy
Coast Wirilda	*Acacia retinodes var. uncifolia*	(A) north of centreline of golf green	Good	1	1C	Healthy trunk and crown
Coast Wirilda	*Acacia retinodes var. uncifolia*	(B) north of centreline of golf green	Good	1	1C	Healthy trunk and crown
Coast Wirilda	*Acacia retinodes var. uncifolia*	(C) north of centreline of golf green	Good	1	1C	Healthy trunk and crown

Common Name	Species	waypoint (unique identifier)	Condition	Number of plants	Species / Age class code	description of plant health
Coast Wirilda	*Acacia retinodes var. uncifolia*	(D) south of centreline of golf green	Poor	1	1B	Trunk and crown in poor condition
Coast Wirilda	*Acacia retinodes var. uncifolia*	(E) south of centreline of golf green	Poor	1	1B	Trunk and crown in poor condition

KEY to Species / Age class code:

1 = Coast Wirilda *Acacia retinodes var. uncifolia*
2 = Hedge Wattle *Acacia paradoxa*
3 = Boxthorn *Lycium ferocissimum*
4 = Coast Teatree *Leptospermum laevigatum*
5 = Coast Beard-heath *Leucopogon parviflorus*
6 = Moonah *Melaleuca lanceolata*
7 = Monterey Pine *Pinus radiata*
8 = Giant Honey-myrtle *Melaleuca armillaris*

A = fallen
B = senescent
C = mature
D = immature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1B
6C
7C
4
1C
1A
1D
2C
5C
3D