Referral of proposed action

Project title:

Caloundra South Master Planned Community

1 Summary of proposed action

1.1 **Short description**

The proposed action is the development of a master planned community catering for approximately 46,000 residents over a parcel of land (approximately 2,400 ha) at Caloundra on Queensland's Sunshine Coast. The Caloundra South Master Planned Community (Caloundra South) will be staged over a time period of 30 years. Caloundra South (the Project Area) will cater for the expected growth within the Sunshine Coast region by providing housing, employment and community infrastructure. The Project Area is within the 'urban footprint' of the SEQ Regional Plan 2009 – 2031 and is strategically located in relation to regional road networks, planned major rail, and road transport infrastructure and state industrial lands. The Project Area, once covered with pine, but now largely cleared, currently consists of agricultural land and vacant land. It is within the catchment for the Pumicestone Passage, which forms part of the Moreton Bay Ramsar Wetland, and it is traversed by three waterways that are Lamerough Creek, Bells Creek North and Bells Creek South. The Project Area has been heavily degraded by previous land uses, mainly forestry practices.

1.2 **Latitude and longitude**

Latitude and longitude details are used to accurately map the boundary of the proposed action. If these coordinates are inaccurate or insufficient it may delay the processing of your referral.

	Longitude			Latitude		
location point	**degrees**	**minutes**	**seconds**	**degrees**	**minutes**	**seconds**
North-west	153	1	55.07	26	48	3.31
North-east	153	6	11.17	26	48	3.31
South-east	153	6	11.17	26	51	11.24
South-west	153	1	55.07	26	51	11.24

The Project Area is an irregular shape. The points described above represent four boundary points around the Project Area. The Project Area and these boundary points are represented in **Appendix A, Figure 1.2.**

1.3 **Locality and property description**

The Project Area is located on Queensland's Sunshine Coast, approximately 2km south-west of Caloundra City. The Project Area incorporates parts of Caloundra West and Bells Creek. Bells Creek Road forms the southern boundary. Land use surrounding the Project Area is varied, but includes: Caloundra Aerodrome to the north-east; commercial, residential and industrial uses to the north; agricultural land to the south; turf farming to the southeast; a nationally important wetland to the east, then Pelican Waters and finally the Pumicestone Passage; the Bruce Highway and State Forestry areas are located to the west. Refer to **Appendix A**, **Figure 1.3** for land use patterns surrounding the Project Area.

1.4 **Size of the development footprint or work area (hectares)**

2,400 ha total (approx. only)
1606 ha development footprint (Approx. only)
740 ha conservation and open space (Approx. only)

1.5 **Street address of the site**

1 – Bellvista Boulevard, Caloundra West
2 - Bruce Highway, Bells Creek
3 - 167 Bells Creek Road, Bells Creek

1.6 **Lot description**

1 – Part of Lot 22 SP190373
2 – Lot 505 RP884348
3 – Lot 3 RP910849

1.7 **Local Government Area and Council contact (if known)**

Sunshine Coast Regional Council

1.8	**Time frame** The development is likely to commence in mid 2013. It would be a staged development extending over a 30 year period.		
1.9	**Alternatives to proposed action** Were any feasible alternatives to taking the proposed action (including not taking the action) considered but are not proposed?	X 	No
1.10	**Alternative time frames etc** Does the proposed action include alternative time frames, locations or activities?	X 	No
1.11	**State assessment** Is the action subject to a state or territory environmental impact assessment?	X 	No
1.12	**Component of larger action** Is the proposed action a component of a larger action?	X 	No
1.13	**Related actions/proposals** Is the proposed action related to other actions or proposals in the region (if known)?	 X	No **Yes,** The area of the Sunshine Coast that incorporates Caloundra South has been subject to planning studies over a number of years, dating as far back as the late 1990's. As such there are a number of proposals that relate to the Project Area. <u>Bellvista II</u> is a proposed master planned community on 65 hectares of land to the north of the subject site and is an extension to Bellvista development already in existence. Bellvista II is a separate project to the Caloundra project from a planning, delivery and ecological perspective and hence was subject to a separate referral and determined not to be a controlled action. The Caloundra South project and Bellvista II are not interdependent. Either can proceed without the other. <u>CAMCOS</u> The existing gazetted alignment for the Department of Transport & Main Roads (DTMR) Caboolture to Maroochydore Railway Corridor (CAMCOS) traverses the southern boundary of the Project Area and to the west of Pelican Waters. <u>Kawana Arterial</u> The Kawana Arterial (previously known as the Multi Modal Transport Corridor) is a planned major arterial road (combined with busway and cyclist lanes) by the Queensland Department of Transport and Main Roads, ultimately linking the Bruce Highway with the Sunshine Motorway at Kawana. A referral for the northern component of the Kawana Arterial was made in 2004 and was determined not to be a controlled action. It is intended that the Kawana Arterial will be extended south of Caloundra Road, through Caloundra South to Bells Creek Road. <u>Land south of Caloundra South</u> The land to the south of the Project Area is owned by Stockland (Lots 1 and 2 on RP910848 and Lots 1 and 2 on RP129373). Its status within the *SEQ Regional Plan 2009 – 2031* is Regional Landscape and Rural Production Area; this designation does not

			authorise development of this land for urban purposes. It is one of two sites that have been identified as potential future Identified Growth Areas (IGA) requiring significant investigations for consideration for future inclusion within the Urban Footprint. Land south of Caloundra South is situated within the Halls Creek catchment (separate to Caloundra South) and due to the site currently being prohibited for urban development, there are no plans for urban development of the site. This parcel of land is not the subject of this referral. If in the future, development rights change for the site, then a referral will be submitted. Such a referral will be required to take into consideration the cumulative impact of development of Caloundra South.
1.14	**Australian Government funding** Has the person proposing to take the action received any Australian Government grant funding to undertake this project?	**X** 	**No** Yes, provide details:
1.15	**Great Barrier Reef Marine Park** Is the proposed action inside the Great Barrier Reef Marine Park?	**X** 	**No** Yes, you must also complete Section 3.1 (h), 3.2 (e)

2 Detailed description of proposed action

2.1 Description of proposed action

Due to its long-standing recognised potential for urban development, the Project Area has been the subject of numerous investigations by private industry, local government and State Government stakeholders. This planning process is explained more fully in **Section 2.4**.

The proposed action is the development of a master planned community over an area of approximately 2,400ha within the locality of Caloundra and Bells Creek. **Appendix A, Figure 2.1a** shows the urban development footprint and ecological areas proposed for Caloundra South. Land use has been separated into three categories: developable land, conservation/open space and scenic amenity/acoustic buffer. In this figure, conservation/open space areas represent areas of environmental protection, rehabilitation, environmental buffers and passive open space. The developable land represents the town centre, community, commercial, residential, light industrial and local district open space.

Economic Benefits

An Economic Benefit Assessment undertaken by Urbis has quantified the total employment benefits generated by the Caloundra South Urban Development Area.

Effectively, Caloundra South is expected to generate in the order of 24,000 jobs within the Sunshine Coast Region on an ongoing basis through its development activity and from businesses housed in Caloundra South. Work previously undertaken by Urbis estimated that the new residents to Caloundra South will require in the order of 19,000 jobs. On this basis Caloundra South generates a net employment dividend to the Sunshine Coast Region of 5,000 jobs.

Based on Gross State Product per employee benchmarks, Caloundra South is estimated to contribute approximately $2,848.9 million in Gross State Product (economic growth) to the local region and state economies each year on an ongoing basis (in 2011 dollars). This represents approximately 23% of the current Gross Regional Product of the Sunshine Coast. **Appendix B, Chart 1.1,** provides a comparison of the Sunshine Coast and Caloundra South employment and Gross State Product figures.

Over a 20 year period, it is estimated that Caloundra South would contribute approximately $57 billion to the local and state economies. **Appendix B** provides further details of the Employment Benefits Assessment undertaken for Caloundra South.

Social Benefits

Since 2007, the Hornery Institute has conducted an extensive program of community planning and place making studies, recognising the scale of the project and the long term opportunity it affords for regional development. This work is documented in **Appendix C**.

The emerging Caloundra South community is expected to exert a positive influence on the regional development of the Sunshine Coast, delivering social, economic and environmental benefits beyond the boundary of the site. With its anticipated resident base of 50,000 people, it can influence the key regional drivers of population diversity, deliver new employment opportunity on a broader scale and influence the choice and affordability of the housing offer on a regional basis.

The vision for Caloundra South centres on the following themes:

- Excellence in education through the implementation of a cross sectoral, whole of life learning approach;
- A whole of life social and human services network that delivers local and district self containment and a net gain to the regional network;
- A new cultural node for the region focusing on music and performing arts;
- Signature destinations for the local, regional and visitor communities centralised around a major recreational precinct, sporting infrastructure and a significant wetland rehabilitation and conservation program;
- A tapestry of blue and green with 800 hectares of land dedicated to conservation, active and passive recreation as well as embellished water sensitive urban design; and
- A community development approach that encourages active engagement with the community to build strong social capital.

Additional long term regional benefits to the community are anticipated to include a mixed use town centre enriching retail and entertainment opportunities for the region, comprehensive active and public transport

networks connecting into the South East region and extensive employment opportunity to address structural weaknesses in the current Sunshine Coast economy, as described above.

The network provision for social and community infrastructure has not yet been formally documented and it is recognised that the delivery of many of these assets will require a range of partnerships. It is therefore envisaged that a detailed Community Plan will be developed in the early stages of the project, to itemise the elements of infrastructure and their delivery mechanisms.

Environmental Conditions

Approximately 85% of the pre-existing pine plantation has been cleared from the site and as a consequence the site hydrology has been significantly altered, weeds are abundant, remnant vegetation is fragmented and fire regimes changed. A detailed study of land use changes over time has been undertaken and is included in the Caloundra South Consolidated Water Report (**Appendix D; Section 3.3)**. The ecological values of Caloundra South are concentrated along the waterways and within a small area of wetland in the east of the Project Area, where vegetation has been retained and is considered significant under Queensland legislation. Less than 15% of the Project Area contains remnant vegetation. The area of land that is planned for conservation and open space purposes is equivalent to approximately 740 ha or 30% of the Project Area. Of this area only 189 ha is extant remnant vegetation; additional areas will be rehabilitated to form part of the core habitat network including a protective buffer to core habitat areas. This will include some rehabilitation, stormwater treatment and passive and active open space. The proposed ecological area in the east of the site provides a substantial 'net gain' to the amount of natural habitat currently available in this part of the Project Area. The increase in vegetation along waterways together with the protective buffer areas will also contribute to the management of water quality within the Project Area and in important areas downstream, such as the confluence of Bells Creek North and South and the Pumicestone Passage.

Development Activities

In order for the development to come to realisation, the following activities will be undertaken:

- Removal of regrowth and exotic vegetation (i.e. pine seedlings) outside of conservation areas and within conservation areas for the purposes of installing infrastructure;
- Establishment of drainage for the site to allow access for construction purposes;
- Earthworks to establish access for construction machinery;
- Earthworks to establish temporary water, erosion and sediment control measures;
- Cutting and filling of the ground surface to comply with requirements for flood mitigation and to install water quality protection features;
- Earthworks to establish infrastructure (e.g. water supply, sewerage etc);
- Earthworks to establish roads and pedestrian network;
- Earthworks to establish permanent water sensitive urban design (WSUD) features;
- Earthworks to establish proposed land uses;
- Establishment of landscaping within open space areas and road verges;
- Construction related to the development of the proposed land uses; and
- Rehabilitation to buffer waterways, wetlands and remnant vegetation.

A haul road is proposed to be constructed between Caloundra South and Bellvista II to allow for the transportation of fill material prior to the commencement of works at Caloundra South. This will require a temporary crossing of Lamerough Creek. The construction of this temporary road is for the Bellvista II project and does not form part of this referral. It is not likely to have a significant impact on a Matter of National Environmental Significance.

2.2 Alternatives to taking the proposed action

The *South East Queensland Regional Plan (2009-2031)* has identified the Project Area as being part of the Urban Footprint and an appropriate location to allow for future population growth on the Sunshine Coast. There is limited land on the Sunshine Coast that is available and suitable for urban growth, therefore it is not feasible that the land remains in its existing state or is used for an alternative purpose.

2.3 Alternative locations, time frames or activities that form part of the referred action

N/A

2.4 Context, planning framework and state / local government requirements

Planning Framework

The *South East Queensland Regional Plan (2009-2031)* is the key document for managing the growth and development of South East Queensland. It is a statutory instrument made under the *Sustainable Planning Act 2009.* In terms of guiding development, the SEQ Regional Plan identifies areas as Regional Landscape and Rural Production Areas, Rural Living or Urban Footprint (with urban footprint areas being recognised as suitable for development). The Regional Plan identifies Caloundra as a Major Activity Centre serving *"the sub-regional catchment and accommodating key concentrations of employment"*. It has established a requirement to undertake the necessary planning to accommodate an additional 34,750 dwellings in Caloundra over the period of the plan. Existing urban areas are required to accommodate 8,200 of these dwellings (as infill dwellings) and the remainder will be catered for in new urban areas. Caloundra South is intended to cater for a large portion of these additional dwellings.

The project area was included in the Urban Footprint in 2009 and on the 18th December 2009, the Minister for the Department of Infrastructure and Planning declared Caloundra South a Master Planned Area under section 132 of the *Sustainable Planning Act 2009*. Chapter 4 of the Act required the Local Government to prepare the Structure Plan and include it within their Planning Scheme. Council released on the 7th April 2010 the draft Structure Plan for Caloundra South for public comment.

In October 2010 the State Government declared an area of land totalling 2,400 hectares, and including Caloundra South to be an Urban Development Area (UDA) pursuant to the *Urban Land Development Authority Act 2007* (ULDA Act). This means that planning for Caloundra South is now under the jurisdiction of the Urban Land Development Authority (ULDA). The ULDA is a statutory authority created by the Queensland Government in November 2007 as a key part of the Queensland Housing Affordability Strategy. The ULDA works with local and state governments, communities, local landholders and development industry representatives to help deliver developments that include affordable and sustainable outcomes. When exercising its powers under the ULDA Act, the ULDA is obliged, amongst other things, to facilitate planning principles that give effect to ecological sustainability which includes protection of ecological processes and natural systems at local, regional, State and wider levels.

Simultaneously with the UDA declaration the ULDA released an Interim Land Use Plan (ILUP) which identified three precincts within the UDA for immediate development. The ILUP sets a vision and intent for development of the UDA and establishes a series of 'Development Requirements' which regulate development within the precincts. Development of the balance land the subject of this referral is largely prohibited until the release of a Development Scheme for the entire area by the ULDA. A draft Development Scheme was released for public comment in April 2011 which outlines proposed development criteria for a range of outcomes including housing diversity and affordability, employment, greenspace, community facilities and natural values. The SEQ Regional Plan must be considered when the Development Scheme is prepared and the local government and State agencies must be consulted. The Development Scheme has been publicly notified. All submissions received must be considered before the Development Scheme is approved by regulation.

Supreme Court proceedings commenced by the Sunshine Coast Regional Council (BS Application 444/11), seek to challenge the making of the regulation under which Caloundra South was declared as a ULDA. The proceedings are being strenuously defended by Stockland and the Queensland Minister for Infrastructure and Planning.

As part of an application for development, Stockland will need to demonstrate the achievement of the outcomes sought by the Development Scheme and identify how impacts will be managed and mitigated. Once approved the Development Scheme will guide and inform the preparation and approval of subsequent development approvals.

The referral does include an additional land parcel outside of the Urban Development Area, on the western side of the Bruce Highway. There is no development proposed for this land parcel; it is included in the referral as road works may be necessary on this site to provide access to Caloundra South.

Legislation

In addition to meeting the outcomes of the Development Scheme, the project will be subject to the requirements of the following key State legislation, and may require approval applications. **Table 2.4a** is not an exhaustive list of all applicable legislation, as it relates to the elements discussed specifically in this referral.

Table 2.4a Relevant State Legislation

Legislation/Policy	Requirements	Level	Relevance to Caloundra Downs
Environmental Protection Act 1994	This Act defines Environmentally Relevant Activities that require permitting. It also guides the development of environmental management policies. Specific to this project is the *Environmental Protection (Water) Policy 2009*, which sets environmental values and water quality objectives for Queensland.	Queensland	Will guide water management systems at Caloundra South and determine water quality parameters.
Nature Conservation Act 1992 (NC Act 1992) (including Regulations and Conservation Plans)	This Act aims to protect Threatened species and recognised conservation areas. It requires application to the DERM (Department of Environment and Resource Management) to use, take or interfere with protected species.	Queensland	Threatened species protected by this legislation are known to utilise some areas of the Project Area. Habitat for threatened species will be included within the conservation area in the development.
Vegetation Management Act 1999 (VM Act 1999) (including regulations and policies)	This Act aims to halt broad scale clearing in Queensland and protect mapped remnant vegetation from unauthorised clearing. It recognises regional ecosystems and has a vegetation community focus. It requires an application to DERM for clearing of assessable vegetation.	Queensland	Remnant vegetation is present within the Project Area, but will not be cleared as a result of the development. A Property Map of Assessable Vegetation (PMAV) has been prepared for the Project Area.
Land Protection (Pest and Stock Route Management) Act 2002 (LP Act 2002)	This Act defines noxious pests, which are formally referred to in the Act as Declared Pests. It requires management of some Declared Pests.	Queensland	Development would require the management of pest species.
Water Act 2000	This Act defines waterways and riparian vegetation. Permits are required for clearing of riparian vegetation and interference with a waterway.	Queensland	Waterways and riparian vegetation protected by this legislation are located within the Project Area and will be catered for within the development layout. It is anticipated that permits may be required for construction of creek crossings and some infrastructure.
Coastal Protection & Management Act 1995	The main objects of this Act are to provide for the protection, conservation, rehabilitation and management of the coast, including its resources and biological diversity.	Queensland	Parts of the Project Area (in the east and along waterways) are mapped as being of High Ecological Significance under the *Queensland Coastal Plan 2011.* These areas will be retained within the development.

2.5 Environmental impact assessments under Commonwealth, state or territory legislation

N/A

2.6 Public consultation (including with Indigenous stakeholders)

Indigenous Stakeholders

A Cultural Heritage Management Plan (CHMP) was prepared jointly by Stockland and the Gubbi Gubbi for Caloundra South in March 2008 for construction purposes, and addressed:

- The cultural heritage management obligations of each party involved;
- Resources required for the implementation of the CHMP;
- A conflict resolution process;
- Management measures to protect identified cultural heritage;
- Monitoring requirements during surface disturbing activities; and
- Procedures to be followed in the event of discovery of Indigenous material.

Stockland is committed to ongoing engagement with the local Indigenous groups as the project progresses.

Public consultation

The first time public consultation was undertaken regarding the potential development of the Project Area was in 1999, along with various other studies. At this time the proponent conducted a social planning study and as part of this process, consultation with the state, local government, community organisations and the public was undertaken.

Since these early studies, Caloundra South has been subject to public comment associated with Council and State planning processes including a Local Growth Management Study. As part of the SCRC Structure Plan process, further public consultation was undertaken between April and June 2010. The Caloundra South UDA Proposed Development Scheme is available for public comment between the 31st March and 20th May, 2011. During this period, the ULDA is holding public information sessions and have set up a community information centre were staff are available to discuss planning progress.

In addition, Stockland has recently held stakeholder briefing sessions with the ULDA, Sunshine Coast Regional Council, Sunshine Coast Environmental Council (SCEC), Organisation of Sunshine Coast Association of Residents (OSCAR) and Take Action for Pumicestone Passage (TAPP). Stockland will continue to engage with the community as the project progresses.

2.7 A staged development or component of a larger project

Works will be staged over a 30 year program.

3 Description of environment & likely impacts

3.1 Matters of national environmental significance

3.1 (a) World Heritage Properties

Description

There are no World Heritage Properties within or adjacent to the Project Area.

Nature and extent of likely impact

N/A

3.1 (b) National Heritage Places

Description

The Glass House Mountains are approximately 15km to the south-west of the Project Area. They are iconic to the state of Queensland as well as to the Sunshine Coast area. The Glass House Mountains were named by Captain James Cook as he sailed north up the coast of Queensland in 1770. There are several definitions as to which mountains constitute the Glass House Mountains. For the purposes of this referral, it is assumed that the Glasshouse Mountains are those peaks included in the National Heritage Listing. The listing defines the Glasshouse Mountains as follows:

….. Beerwah (556 metres); Coonowrin (Crookneck) (377 metres); Tibrogargan & Cooee (364 metres & 177 metres); Ngungun (253 metres); the Coochin Hills (235 and 230 metres); Miketeebumulgrai 199.5m; and Elimbah (Saddleback) 109m. In addition there are a further three areas: Beerburrum (278 metres); Tunbubudla (the twins) 294 and 338 metres); and Tibberoowuccum (220 metres) which currently comprise sections of the Beerburrum Forest Reserve.

Several of the mountains are now protected in the Glass House Mountains National Park. It consists of a flat plain punctuated by volcanic plugs, and cores of extinct volcanoes that formed 27 to 26 million years ago.

The Glass House Mountains can be seen as far away as the Scenic Rim on the Queensland and New South Wales Border and the immediate view field is estimated to be an area close to 25kms by 40kms including views from the ocean off parts of the southern Sunshine Coast. The mountains can be viewed in their wider setting from Mary Cairncross Park and Mount Beerburrum and Wild Horse Mountain. From the lookouts panoramic views can be experienced of the family of mountains with their massive jagged peaks arising from an extensive plain with forested foothill reserves, agricultural land, small village roads, highways and coastal urban developments.

Nature and extent of likely impact

An action is likely to have a significant impact on the National Heritage values of a National Heritage place if there is a real chance or possibility that it will cause:

- one or more of the National Heritage values to be lost
- one or more of the National Heritage values to be degraded or damaged, or
- one or more of the National Heritage values to be notably altered, modified, obscured or diminished.

As Caloundra South is approximately 15km away from the Glasshouse Mountains and will not obscure the view to the mountains or create a significant change to the view of the coastline from the mountains, it will not have a significant impact on the National Heritage values of the Glasshouse Mountains.

The Project Area in its existing form is a mosaic of harvested pine plantation, grazing land, and native vegetation on predominantly flat terrain on the lowlands between the Blackall Range and the predominantly urbanised coastal landscape of the Caloundra area. The pine plantations that once dominated the site have now largely been harvested and are not being replanted. The visual character of Caloundra South would be expected to change over the next few decades as the area is progressively developed. Overall the appearance is likely to be one of a relatively contiguous and extensive urban area with its visual integration into the landscape increasing through time as planted vegetation grows.

The potential impact of the Caloundra South development on the aesthetic values of the Glasshouse Mountains has been assessed in a Visual Amenity Assessment Study (**Appendix E**) and has been assessed as not having a significant impact in terms of views to the Glasshouse Mountains from the site or other viewpoints or views from the Glasshouse Mountains.

3.1 (c) Wetlands of International Importance (declared Ramsar wetlands)

Description

Pumicestone Passage
There will be no direct impact on a declared Ramsar wetland caused by the development of Caloundra South. The waterways within the Project Area discharge to Pumicestone Passage, which forms part of the Moreton Bay Ramsar Wetland, and is a Nationally Important Wetland subject to the Ramsar Convention on Wetlands 1971. There is potential for the development of the Project Area to indirectly impact upon the Pumicestone Passage through changes in water quality and hydrology. The Project Area in relation to Pumicestone Passage is shown in **Appendix A, Figure 3.1a**.

The Pumicestone Passage is recognised as a Fish Habitat Area (under the *Queensland Fisheries Act 1994*) and is known to support a multitude of wading birds (many of which are listed as Threatened or Migratory under the *Nature Conservation Act 1992* (NC Act) and EPBC Act. The waders feed on the vast tidal flats formed by the build up of silt carried down by surrounding creeks and extensive habitat (seagrass meadows, mudflats, salt-marshes and mangrove communities) that occur throughout the passage. Hence, the Pumicestone Passage is also an integral part of the CAMBA[1] and JAMBA[2] agreements, with at least 50 listed migratory species (Pumicestone Passage Advisory Taskforce: 2007) found in the Pumicestone Passage. The Passage also supports other important marine species such as turtles and dugongs.

From a hydrological perspective, several creek systems drain into Pumicestone Passage at the northern extent of Moreton Bay, including Lamerough Creek, Bells Creek North, Bells Creek South and Halls Creek. The direct flow of these waterways to the sea is interrupted by Bribie Island. The Passage is narrow and shallow with limited water exchange with the ocean. It is estuarine in nature, with the northern entrance opening to the Pacific Ocean via a shallow unstable sand bar, and the southern entrance joining Moreton Bay through a wide unobstructed opening. The Passage relies heavily on freshwater inflows from Bells, Coochin, Halls, Coonowrin, Saltwater, Tibrogargan, Hussey, Glass Mountain, Bullock, Elimbah and Ningi creeks. Freshwater received from these creeks does not result in a complete flushing of the system, hence, the Pumicestone Passage is vulnerable to changes in hydrology and water quality from within adjoining freshwater systems.

Existing conditions and potential impacts for the following aspects have been considered as part of this referral:

- Surface water quality and quantity
- Flooding
- Groundwater quality and quantity
- Acid Sulfate Soils
- Lyngbya
- Recreational Use

Surface Water Quality
Since 1982, changes in water quality, plant composition and structure have been recorded in Pumicestone Passage and its catchment. These changes indicate that past and current land use and management practices within the Pumicestone Passage catchment are affecting the estuary. The major water quality problems which have been recorded include exceedance of recommended (EPA 2009) water quality limits for nutrients and organic carbon, algal levels and turbidity and oxygen demanding substances. Long term data collected by the Ecosystem Health Monitoring Program (EHMP) indicates that water quality in Pumicestone Passage fails to meet water quality objectives set by the Department of Environment and Resource Management (DERM) in the 'Environmental Protection (Water) Policy 2009 (EPP) - Pumicestone Passage Environmental Values and Water Quality Objectives' (Pumicestone Passage WQO's). In the most recent (2010) EHMP Report Card, Pumicestone Passage (marine) received a D rating. This is a decrease from 2009 (C+), and 2007 (B-). This deterioration has been linked to increase turbidity and sewage nitrogen levels as well as a decrease in seagrass depth. Overall, most marine areas in the wider Moreton Bay Ramsar area have experienced an improvement in water quality since 2009 after extensive heavy rain and flood events, with Moreton Bay receiving an overall rating of C (an improvement from a D in 2009). The marine areas to the immediate south of Pumicestone Passage have received the same rating as the Passage (Deception Bay and Bramble Bay).

The Project Area itself is outside the boundaries of Pumicestone Passage, being at least 3.5km from the Passage in a direct line and approximately 5 km following Bells Creek, however, the Ramsar wetland incorporates Bells Creek at the point where the creek exits the Project Area (**Appendix A, Figure 3.1a).**

[1] China Australia Migratory Bird Agreement (CAMBA)
[2] Japan Australia Migratory Bird Agreement (JAMBA)

The portion of Pumicestone Passage which will receive runoff from Caloundra South is referred to by the EPP Water as Area PME1 (Pumicestone Passage north-mid estuary) and Area PLE1 (Bells and Lamerough Creek). The area contains several water quality monitoring points **(Appendix A, Figure 3.1b**). The EPP Water defines these waterways as being of High Ecological Value which implies a management objective of maintaining water quality at the 20th, 50th and 80th percentile levels (as listed in Table 2 (Water quality objectives to protect aquatic ecosystem environmental value of the Pumicestone Passage WQOs).

EHMP monitoring undertaken for the PME1 area indicates that existing water quality at the sites closest to Caloundra South do not currently meet some of the water quality objectives established by the EPP Water, especially with respect to turbidity and chlorophyll levels. The EHMP has explained these results in terms of poor water quality emanating from various upstream catchments, rather than point-source pollution.

As the EHMP monitoring does not collect data in Bells Creek, a water quality survey was conducted to collect a one off snapshot of conditions in the lower reaches of this waterway beyond the site boundary. Temperature and turbidity generally increase moving from the mouth of the creek to farther upstream; turbidity and pH generally meet WQO's. Dissolved Oxygen (DO) decreases moving from downstream to upstream, suggesting poor flushing within Bells Creek. DO concentrations mostly do not meet WQO's, with the exception of the samples at the mouth of Bells Creek. Nitrogen is also potentially an issue in Bells Creek with concentrations exceeding WQO's. These results don't capture seasonality or tidal trends however.
Stockland has initiated a 'baseline' ambient and event based monitoring programme on the Caloundra South site, which has been ongoing since May 2008. This monitoring program has been designed to establish catchment flow and water quality characteristics within the Project Area, and it is intended that this study will ultimately assist in addressing the Pumicestone Passage WQO's. To date monitoring has shown that Bells Creek North recorded mean TSS (Total Suspended Solids), TP (Total Phosphorus) and TN (Total Nitrogen) levels that are lower than expected within typical forested or urbanised catchments but above the Queensland Water Quality Guidelines. Lamerough Creek consistently recorded poorer results due to the urban land uses within its catchment.

The Caloundra South Consolidated Water Report (**Appendix D; Section 2**) details existing water quality and predicts potential changes to water quality for Pumicestone Passage and Bells Creek.

Statistical analyses of available water quality data is summarised below:

- Salinity throughout the Passage varies, with the lowest salinities experienced in the middle and northern portions. There would appear to have been lower typical salinities and far greater variations in salinity levels over the last 2 to 3 years, reflective of increased rainfall.
- Like salinity, pH levels seem to have been lower and more varied in the last 2 to 3 years. pH levels indicate that there are no obvious manifestations of actual acid sulfate soil conditions in the catchment.
- The majority of Dissolved Oxygen (DO) levels are typically quite high, with occasional occurrences of low DO in the central reaches of the Passage that coincide with lower salinity levels. Most of the Passage is naturally lower than the EPP (water) objectives for the 20th, 50th and 80th percentiles. DO levels have also been lower in the last two to three years.
- Turbidity levels in the sections of Pumicestone Passage adjacent to the site currently exceed the objectives of the EPP (Water) for the 20th, 50th and 80th percentiles.
- Much of the northern and central part of Pumicestone Passage are exhibiting total nitrogen levels higher than the EPP (Water) objectives. There would appear to be a correlation between elevated total nitrogen levels and reduced salinities, indicating a link between catchment runoff and estuarine nutrient concentrations. There appears to be higher levels of total nitrogen in the last two to three years.
- The sections of Pumicestone Passage closest to Caloundra South are largely compliant with the EPP (water) objectives for Total Phosphorous.
- Chlorophyll a levels are greater than the EPP (Water) objectives, with elevated concentrations particularly in the central and northern regions of Pumicestone Passage. There does not appear to have been a major change in Chlorophyll a levels in the last two to three years.

Flooding
Flooding on the site can occur as a result of two different sets of circumstances (refer to Caloundra South Consolidated Water Report, **Appendix D; Section 2.9**). In a cyclonic event, an elevated ocean level (storm surge) may occur because of high velocity winds and low atmospheric pressure. In a 100 year ARI event, sections of the most easterly part of the site will be affected by storm surge penetrating into Pumicestone Passage. During severe rainfall events, areas along the creek lines, extending to the western boundary of the site, are currently inundated by flood waters from the catchment.

Groundwater

The Project Area has been subject to hydrogeological investigations since 2000, and a routine monitoring program has been undertaken to observe groundwater levels and quality in a network of observation bores across the site since April 2002 (**Appendix D; Section 3**). The site has been subject to a series of major land use changes over time and these have significantly influenced the hydrology of the site and groundwater levels. At the present time, the site is substantially cleared and there are relatively extensive shallow groundwater levels due to a reduction in evapotranspirative water losses from vegetation. A generalised groundwater level decline was observed between 2009 and early 2010 associated with a period of relative drought; groundwater levels have since risen, as has the average rainfall.

The results of the recent detailed investigations and groundwater modelling undertaken by RPS (**Appendix D; Section 3.4**) conclude:

- Most fresh groundwater enters the Project Area from the west in the form of precipitation or recharge from the surrounding bedrock hills.
- Alluvial channels (exposed and buried) and an alluvial delta provide a significant conduit for shallow groundwater flow within the Project Area.
- There is interconnection of the narrow unconfined alluvial channels with a broad, semi-confined alluvial delta in the low-lying area in the east. These alluvial channels have incised the weathered sandstone bedrock and are in-filled with alluvium.
- Recharging groundwater flows down-gradient to the east across Caloundra South.
- Aquifers within the sandstone bedrock are hydrologically unconnected to the overlying alluvial aquifers due to a thick laterite weathering cover.
- The unconfined watertable along the east of the plain typically occurs within 1 metre of the surface, hosted within marine sands and clays. Ground penetrating radar data suggests the presence of shallow groundwater typically within 0 to 2 m of the surface and some areas of perched groundwater within the laterite profiles.
- Residence times for groundwater ranges from several to 18 months for groundwater within the alluvial channels and hundreds of years for groundwater held in the mixed clay layers of the laterite
- The alluvial delta discharges the bulk of fresh groundwater from the central plain into the coastal and estuarine aquifers to the east. Groundwater quality at the site is complex and influenced by both the host aquifer and the landscape position of the aquifer, but is typically quite saline and has a relatively low pH (mean range of 4.65 to 7.10).
- Groundwater elevation on site appears to be closely linked to rainfall.
- Groundwater level and land use data suggest a link between rising groundwater levels and clearance of vegetation.
- The quality of the shallow groundwater is quite good, although nutrient levels and dissolved iron concentrations are slightly elevated. There is a low incidence of organically complexed iron in the shallow groundwater.
- Groundwater levels are currently generally high due to the site being devoid of vegetation.

Acid Sulfate Soils

An Acid Sulfate Soil investigation has been undertaken for the proposed works, and an Integrated Management Plan has been prepared (**Appendix F)**. If development activities were to lower groundwater levels where ASS's are present, oxidisable sulphur in newly exposed or newly unsaturated soils will begin to oxidise. It is this oxidation process that generates acidity hazards and environmental risks. These risks extend to dry excavations in ASS and to transient or permanent dewatering of large areas of sulfidic soils via (for example) the deepening of flood mitigation basins or drains. In the aquatic environment, it is not so much the lowered pH of waters that pose the actual environmental hazards, rather it is the dissolved heavy metals (e.g. aluminium and ferric ions), whose concentrations tend to increase with decreasing pH. Unmanaged disturbance of ASS, producing 'exportable' acidity has lead to numerous fish kills, especially on Australia's eastern shores; they lead in turn to more fundamental hazards, which comprise the destruction, or permanent changes to local aquatic ecosystems. This has been clearly recognized in *State Planning Policy (SPP) 2/02 Planning and Managing Development Involving Acid Sulfate Soils and Guideline*, which the development will be assessed against.

Where ASS occur on the eastern seaboard, they almost always occur at elevations below 5m AHD, and

particularly below 0m AHD; exceptions are localised and rare. Risks are reduced where development occurs at higher elevations. With this in mind, development at Caloundra South will mostly be limited to elevations above 5m AHD. For those areas below 5m AHD, excavation will be restricted to placement of infrastructure or top soil removal and placement of fill. Wherever possible, infrastructure will be located to avoid disturbance to ASS. This may still present a reduced level of ASS risk for volumes of excavated material below 5m AHD.

Recreational Use
The southern beaches of Caloundra, Bribie Island and Pumicestone Passage provide for a range of nature-based and outdoor activities, which are enjoyed by Sunshine Coast residents, South East Queensland residents and tourists.

Its popularity as a recreational destination can be attributed to the variety of natural settings it provides – all of which rely on a healthy ecosystem and habitat. Popular activities include recreational water based activities (i.e. fishing, boating and jet skis), bushwalking and camping.

Pumicestone Passage is part of the Moreton Bay Marine Park, managed by the Queensland Department of Environment and Natural Resources. Under the existing *Marine Parks (Moreton Bay) Zoning Plan 2008* **(Appendix A, Figure 3.1c**)*;* the majority of Pumicestone Passage is within the 'Conservation' zone. Boating, line fishing, trolling, crabbing, bait gathering and netting, and limited spear fishing are permitted, in accordance with the zoning plan. Areas south and north of the mouth of Bells Creek are zoned as 'Marine National Park'. Restrictions are in place on recreational uses in these areas, prohibiting fishing, but allowing boating. These areas are also a 'Go Slow' zone, to minimise the risk of motorised vessels striking turtles or dugongs. Motorised water sports, including water skiing and jet skis are also prohibited in these areas.

While restrictions are in place for how people use areas within Pumicestone Passage and neighbouring Bribie Island, the coastline of the passage is largely accessible to the public for a variety of activities. There are numerous public boat ramps providing direct or close access to Pumicestone Passage. Boating remains one of the more popular and established recreation activities within the Pumicestone region.

Many of the activities that occur within the passage are passive in nature, however concerns have been raised about the impact of engine-powered activities in particular (fishing, boating and jet-skis) disturbing marine life including nesting migratory birds.

Additional impacts from recreational usage of Pumicestone passage can include:

- Erosion of creek banks and shoreline, due to wave wash due to correct or incorrect mooring/ launching
- potential increased risk of boat strikes on native fauna
- pollution, litter and waste from boating and or human activities in or near the waterway
- Noise from motorised craft

Stockland is committed to working with State and local authorities to develop better management strategies for the recreational use of the passage.

Nature and extent of likely impact

Potential impacts to wetland environments typically arising from urban development result from changes to the hydrological regime and changes to surface water quality.

Changes to Surface Water Quality
Existing threats to the ecological values of Pumicestone Passage are largely attributed to declining water quality within contributing catchments caused by clearing of vegetation, aquaculture, chicken farming, expanding urban development and increasing recreational use (Pumicestone Passage Advisory Taskforce: 2007). As noted in Section 3.1 (c), water quality in Pumicestone Passage regularly exceeds Water Quality Objectives for most parameters.

Under the EPBC Act, potential impacts are assessed together with consideration of their likelihood and significance. Caloundra South consists of approximately 2,400 ha (24km^2) of land within the 789km^2 catchment of Pumicestone Passage, forming just 3% of the entire catchment. Water quality in Pumicestone Passage is therefore unlikely to be significantly influenced by changes directly associated with Caloundra South. The site does however form a large part of the Bells Creek catchment, and it could be hypothesised that the Project could have more influence on water quality within Bells Creek, which forms part of the Ramsar wetland.

Given the scale of Caloundra South, there is a potential risk that the development of Caloundra South could contribute to further deterioration in surface water quality in Pumicestone Passage during and after construction, if appropriate design and operational mitigation measures are not implemented. Potential unmitigated risks include,

but are not limited to, erosion and downstream sedimentation of waterways from movement of soil during construction, disturbance of acid sulfate soils and long-term deterioration in water quality from an increase in nutrients and other pollutants discharging as stormwater runoff.

In order to assess the likelihood and significance of these potential impacts, an integrated modelling framework has been applied to assess the following key processes:

- Whole of catchment flows and pollutant loads
- Whole of Pumicestone Passage estuarine flows and water quality levels
- Whole of development stormwater quantity and quality modelling
- Lot scale water balance modelling

This approach was considered to be the best available for assessing potential impacts on water quality for the development. It is based on frameworks developed and used by the eWater CRC and the SEQ Healthy Waterways Partnership, which have a strong track record and pedigree of application in the South East Queensland region. Calibration and validation of all elements the modelling framework has been undertaken and there is a satisfactory agreement between the recorded EHMP data and the receiving water quality model results within Pumicestone Passage itself.

In order to assess the significance of potential surface water quality impacts due to site development, a portion of the site has been chosen for water quality modelling purposes only based on a conceptual layout of development (**Appendix D; Sections 2.4, 2.5 and 2.6**). This area includes a potential and realistic mix of residential lots, industrial areas, a school, retirement village, parkland and conservation space. The area was then scaled up to the rest of Caloundra South to allow an assessment of the entire site. Whilst this conceptual layout may change spatially as more detailed master planning is undertaken, it is considered to be a representative sample of how development at Caloundra South could occur.

The water quality modelling predicts water quality for the key parameters of Phosphorous, Nitrogen, Turbidity, Salinity and Chlorophyll *a* at three downstream locations within the Ramsar wetland (Upper Bells Creek, Middle Bells Creek and EHMP site 1311), under a variety of scenarios. These scenarios include:

- Scenario 1: Development 'Business as Usual';
- Scenario 2: Development with best practice stormwater treatment
- Scenario 3: Development with advanced stormwater treatment, roofwater capture and reuse and additional bioretention measures (proposed scenario for Caloundra South)

A cumulative assessment (Scenario 4) that reviews the impact of the development (based on Scenario 3) in conjunction with future urban development within the catchment has also been undertaken.

Water quality modelling undertaken for the representative portion of the site has shown that without treatment, the proposed development would result in a significant increase in stormwater pollutant loads, relative to the existing site.

With the application of the advanced water treatment measures proposed in Scenario 3, however, (as outlined in **Section 4**), results of the modelling indicate there will be 'no worsening' in pollutant loads discharged from the site (relative to existing conditions) as a result of development. The predicted annual pollutant loads show a reduction compared to the unmitigated scenario (i.e. business as usual) and the existing site.

The results of the integrated modelling (for advanced stormwater treatment with roofwater capture and reuse) which predicts impacts on water quality levels in Pumicestone Passage and Bells Creek once Caloundra South is fully developed and operational are as follows:

- Total Nitrogen concentrations within Pumicestone Passage are predicted to be reduced, effectively improving water quality levels. It is predicted that there will also be a reduction in annual median total nitrogen in Bells Creek, having a positive impact on water quality levels in this waterway, depending on incident rainfall.
- Within the Passage, modelling predicts that annual median total phosphorus levels are the same as base conditions (for three out of the four years modelled) or only slightly elevated. The degree of such elevation is well within the range of natural variability in Pumicestone Passage, and as such, effectively constitutes 'no change'. Within Bells Creek however, there is an increased in predicted concentrations over existing conditions. This is unlikely to be of concern, as (a) concentrations are still below WQO's and (b) phosphorous is recognised in SEQ as not being the controlling nutrient in estuarine systems.
- Changes in annual median turbidity levels in Pumicestone Passage immediately adjacent to Caloundra South

are minimal, within natural variabilities and would be virtually undetectable. It should be noted that existing turbidity levels already exceed relevant water quality objectives. Turbidity levels within Bells Creek are predicted not to result in exceedance of WQO's and there will be minimal change from undeveloped conditions.

- Chlorophyll a levels in Pumicestone Passage show a slight increase in annual median levels in some years, and slight decrease in others, with an overall trend of 'no change'. Modelled concentrations in Bells Creek are below WQO's, but do increase slightly due to slightly reduced catchment inflows.
- Changes to salinity levels in both Pumicestone Passage (in areas adjacent to the outlet of Bells Creek) and Bells Creek are predicted due to a greater influx of freshwater. The degree of change is significantly reduced however with proposed mitigation measures including roof water capture and reuse and substantial stormwater infiltration and is considered to be within the range of natural variability.
- There is a potential to increase pH levels in the downstream groundwater dominated wetlands, as (a) the wetlands have a typical pH of around 5.1 and (b) surface run-off from the site is expected to have a typical pH of between 5.5 and 6.0, which may be slightly higher than that currently occurring from the site (which appears to be of the order of pH 5.2). The potential for such impacts is considered to be minimal, as:
    - site stormwater run-off will be captured, reused and treated, thereby minimising potential changes to pH levels in stormwater run-off from the site
    - upstream catchment run-off will not change in quantity or quality, which will dilute any changes in stormwater quality from the Caloundra South site
    - catchment run-off will only impact the adjacent wetlands under flood conditions, and hence pH levels in these wetlands will be predominantly controlled by a shallow groundwater levels
    - shallow groundwater levels are not predicted to change following site development, and as such associated pH levels in these groundwaters should also not change.

Flooding

A Flood Risk Management Strategy has been undertaken by BMT WBM to define the flooding characteristics of the site, determine broad-scale flood impacts and develop strategies to mitigate any potential flood impacts. (**Appendix D; Section 2.9**) Computer-based hydrologic and hydraulic models of the site, including Lamerough and Bells Creeks, were set up to compare peak flood levels for the ultimate development scenario against the pre-development case under three existing flood magnitudes (5, 50 and 100 year ARI flood events), with additional assessments taking consideration of climate change by allowing for an 0.8m potential sea level rise by 2100 and increased rainfall intensities of 20%.

The impacts of the proposed development were assessed by comparing modelled peak flood levels for the ultimate development case with the pre-development case. Without mitigation, the proposed development will adversely impact on the flood risk of surrounding areas. The modelling predicts that the potential impact of the development on downstream areas can be mitigated through the implementation of a series of flood mitigation measures, as described in **Section 4.**

Changes to Hydrological Regime

Wetlands are dependent on water levels, and so hydrological changes can greatly influence the nature and function of wetlands, including the type of plant and animal species within them. Urban development is often associated with an increase in impervious surfaces, which result in an increase in the volume and velocity of surface flows and a decrease in groundwater infiltration. Urbanisation can also result in a change in the duration and frequency of inundation within a wetland. For example, in a natural catchment the water from small rainfall events would be infiltrated into the ground where it is absorbed by soils and vegetation (which then releases it into the atmosphere again via evapotranspiration). Hence, in times of low rainfall (winter – spring) water often does not reach the wetland. The wetland relies on these dry times to trigger the plants to reproduce and grow. In an urbanised catchment (where imperviousness is greatly increased) water from small rainfall events becomes surface run off and is directed off-site and into the wetlands, hence, the wetland does not experience the necessary dry period. Extended wet periods can cause dieback of wetland vegetation (in both freshwater and estuarine systems).

Preliminary drainage works will be required on site to lower the watertable to facilitate construction. In the longer term a series of surface drains are proposed which will control groundwater flow in the shallow groundwater system. Groundwater modelling of the proposed development by RPS (**Appendix D; Section 3.6 and 3.7**) indicates that generally, the development would have a minor increased discharge of groundwater to surface drainage from the current state. Discharge of groundwater seepage from the development would not result in appreciable diminution of groundwater levels under existing areas of native vegetation or the existing wetlands within the Project Area or beyond. Groundwater levels to the east of the site under areas of native vegetation will

in general still be higher than they would have been under a long-term situation where Caloundra South was substantially covered by pine plantation. The Project Area has previously been subject to significant fluctuations in land uses and groundwater levels over time which suggest the existing wetland areas in the eastern part of the site which buffer the Ramsar Wetland and support significant fauna species are resilient to some level of variation. Groundwater at the site is currently unnaturally elevated due to a lack of vegetated cover.

Currently, there is no use of groundwater on the Project Area, and only limited use on surrounding land. Stockland do not propose to use groundwater either during the construction or operational phase of the proposed development.

It is also expected that there will be some change in the volume of surface water flows from the proposed development. Surface water flows from the site have changed significantly however in recent years with changes in vegetative cover of the site. The site water balance will be carefully managed via measures such as rainwater tanks, stormwater harvesting and stormwater infiltration which will assist in controlling stormwater volumes discharged from site. Modelling has predicted that with these measures there will still be some minor residual impact on salinity levels within Bells Creek.

Changes to Groundwater Quality
Whilst a deeper aquifer does exist beneath the site, it is predominantly the shallower groundwater that may potentially be impacted by development. The current quality of the shallow groundwater is relatively good, although there is some slightly elevated nutrient and dissolved iron values. RPS has assessed the potential impacts on the shallow groundwater (**Appendix D; Section 3.7**).

Due to the presence of shallow groundwater levels, the presence of shallow sandy soils and a significant rainfall climate, Caloundra South (and downstream areas) would be vulnerable to potential groundwater contamination. Potential sources of contamination include excessive fertiliser and pesticide applications to landscaped areas and contamination from spills and leaks from industrial sources. However, land uses proposed for Caloundra South do not include heavy industry. Where light industry and enterprise areas are proposed protective measures (as outlined in **Section 4**) will be applied to greatly reduce the possibility of contaminants leaking in to the groundwater occurring. Controls to limit the use of potentially harmful pesticides and fertilisers will also be put in place within open space areas. In addition, the surface water treatment systems proposed will partially address nutrient input to the shallow groundwater as there tends to be significant discharge of shallow groundwater to the surface drainage network.

Disturbance of Acid Sulfate Soils
To confirm the level of risk posed by the presence of Acid Sulfate Soils, a series of 28 boreholes were drilled along the 5 and 6m contours, to depths of 6-7m (or drill refusal). A total of 164 samples were taken from Vibracore samples along the 5m contour and were tested using the Chromium Reducible Sulfur Method (S_{cr}) and Titratable Actual Acidity (TAA) test method suite in accordance with the Queensland Acid Sulfate Soil Laboratory Methods Guidelines. With the exception of three samples, all values were below the action criteria of 0.03% oxidisable Sulfur recommended in the Queensland Acid Sulfate Soil Management Guidelines. Of the three exceptions, the highest recorded oxidisable Sulfur value was just 0.04%. A total of 185 samples were taken along the 6m contour and were similarly tested. All samples returned values below the action criteria of 0.03%. This indicates that there is only very localised oxidisable sulphide that might be encountered during works, and hence no 'new' acidity is expected to be generated via possible exposure and oxidisation of soils.

In regards to actual or remnant acidity, all 349 samples range from 0 to a maximum of 0.34% equivalent Sulfur, with an average of just 0.09%. These values (S_{kci}) are considered low or negligible, and are likely to indicate that the majority of soils to be disturbed during development are of low or insignificant risk to the receiving environment if appropriate management occurs.

Should the groundwater be lowered for construction purposes, it is not anticipated acidity levels will change as only in-situ ASS are present and no new acidity will be generated through oxygen ingress into soils that were originally saturated.

Overall, the proposed development is considered not to pose a significant risk to the Ramsar Wetland as a result of disturbance of acid sulfate soils.

Lyngbya
Concern has been expressed that land use change on the Caloundra South site may contribute to or cause *Lyngbya majuscula* (Lyngbya) blooms in Pumicestone Passage, or further afield. This is not predicted to occur for several key reasons, as outlined below:

- Lyngbya blooms initiate from seedstock present in estuarine or marine sediments. As there have been no known historical occurrences of Lyngbya blooms in the northern reaches of Pumicestone Passage, no

such stock should be present and as such no potential should exist for blooms to occur;

- Scientific research has shown that the Lyngbya blooms which do occur in Deception Bay and some of the more southerly portions of Pumicestone Passage require catchment runoff to be highly coloured/humic (or stated more correctly to contain elevated levels of coloured dissolved organic matter (CDOM)) in nature and to also contain high levels of dissolved or bioavailable iron. All stormwater event monitoring data collected to date on the Caloundra South site, extending over a two year period, has shown no occurrence of highly coloured or humic waters. Such waters are required to enable bio available or dissolved iron to not oxidise, wherein it is no longer readily available to initiate and support Lyngbya blooms. As such, one of the key triggers of Lyngbya blooms is not present on the Caloundra South site, further supporting an assertion of no potential for bloom formation. Data collected to date by RPS also does not show excessive levels of bioavailable iron in site runoff, removing a second potential trigger;
- Lygbya is often believed to be associated with the presence of active acid sulphate soil material, again there are no significant deposits of such material on the Caloundra South site removing another potential causative mechanism; and
- Finally, in regard to any potential for influencing existing blooms in Deception Bay, there is a strong net northerly flow in Pumicestone Passage which will ensure that no runoff from the Caloundra South site can physically reach Deception Bay.

Given all of the above, there is no reasonable likelihood of *Lyngbya majuscula* blooms occurring in the northern reaches of Pumicestone Passage as a result of development of Caloundra South, and there is also no expectation that development of the site could affect existing blooms elsewhere in the region.

Changes to Recreational Usage

Population growth projections documented in the South East Queensland Plan (2009) suggests that the total South East Queensland region, extending from the Sunshine Coast to the Gold Coast and west to Toowoomba, will grow by 1.6 million over the next twenty years, from 2.8 million to 4.4 million. This growth is spread across the entire region. The Sunshine Coast sub-region is anticipated to grow from 295,000 residents in 2006 to 497,000 residents by 2031. Caloundra South is proposed to accommodate 50,000 of these 202,000 additional residents on the Sunshine Coast, which represents 24% of the population growth, or 10% of the total resident population of the Sunshine Coast by 2031. Residents from the Brisbane and Moreton Bay sub-region also conceivably will access and gain recreational benefits from Pumicestone Passage. Therefore the combined population of the Sunshine Coast, Moreton Bay and Brisbane sub-regions, needs to be included when considering recreational access and pressures on Moreton Bay, and the Pumicestone Passage. As of 2006, the combined population of these northern sub-regions was 1.6 million, and is expected to grow to 2.2 million by 2031. This growth of 600,000, across the three northern sub-regions is expected to result in increased demand on infrastructure, open space and recreational facilities and amenities. The proposed population of Caloundra South of 50,000 accounts for 2% of the total population of the northern sub-regions by 2031. It is acknowledged that the additional population accommodated in Caloundra South will result in some pressures on the Pumicestone Passage as a result of recreational demand, however this issue needs to be addressed in the wider context, as it will not be just the residents of Caloundra South driving growth in recreational demand and activity.

There is currently no direct access to the Passage from the site, although Bells Creek Road at the southern border of Caloundra South does provide access to Bells Creek. A small informal boat ramp is located at the end of Bells Creek road, approximately 1km from the site boundary. The nearest formal boat ramp (with parking for approximately 20 boats) from which residents could access the Passage is located along Roys Road, a 5km drive from the site. There are no plans to upgrade these facilities or provide additional access to the Passage from Caloundra South.

Management measures to control increased usage, are the jurisdiction of a number of entities, primarily the

Queensland Department of Environment and Natural Resources, who implement the *Marine Parks (Moreton Bay) Zoning Plan 2008*. Certainly, Pumicestone Passage will continue to experience a growth in recreational usage which if uncontrolled, will impact on its natural values. Stockland is committed to working with state and local authorities to develop better management strategies for the recreational use of the passage.

Summary

The significance of an impact on a Ramsar wetland is measured against five criteria (from the *EPBC Act Policy Statement 1.1 – Significant Impact Guidelines*). **Table 3.1a** describes the potential impacts on the Ramsar wetland. Given that the potential impacts are indirect (rather than direct) the most relevant significance criteria for the project relate to hydrology and water quality. Mitigation is discussed in more detail in **Section 4**.

Table 3.1a Wetland Significance Criteria

Significance Criteria	Potential Construction Impact	Potential Operational Impact
Areas of the wetland being destroyed or substantially modified	No construction works or removal of vegetation will occur within or directly adjacent to the Ramsar wetland. Any potential indirect impacts relating to hydrology and water quality will be avoided or reduced as discussed below in this table.	The development would not occur directly within the Ramsar wetland and hence would not directly destroy or modify the structure of the wetland. Any potential indirect impacts relating to hydrology and water quality will be avoided or reduced as discussed below in this table.
A substantial and measurable change in the hydrological regime of the wetland (e.g. volume, timing, duration and frequency of surface and groundwater flows)	There will be no activities undertaken within the Ramsar wetland. In the Project Area, the construction process at various times could require changes to surface water flows (redirection / retention of flow) which may have limited temporary downstream impacts. There will also be some localised drainage of groundwater within the Project Area to allow construction to occur in areas with a high water table. Runoff from rainfall will be retained on site in temporary detention basins prior to their controlled release to maintain the hydrological regime. As construction would be staged, any changes would be minor in nature and are unlikely to constitute a substantial and measurable change.	*Surface Water* Surface water flows from the site have changed significantly in recent years with changes to the vegetative cover. The volume of surface water flows from the site will again change post development when compared to the existing site. Modelling shows that the residual impact of these changes in flow will result in slight changes to the salinity regime of Pumicestone Passage and Bells Creek. These changes to salinity, whilst measureable, are considered to be within the range of natural variability. The timing and frequency of flows will be carefully managed through measures such as stormwater storage, harvesting and stormwater infiltration to groundwater. There will also be slight changes to other water quality indicators, with an actual improvement in total nitrogen levels. *Groundwater* Groundwater levels at the site have fluctuated significantly over the years with land use alterations, perhaps indicating that the wetland areas within the site which buffer the Ramsar wetlands are resilient to some level of change. Whilst it is expected that the average depth to groundwater in the eastern section of the site will be measurably increased, recharge is still appreciably greater than when the site was covered in pine. Stockland are not proposing any extraction of groundwater for operational purposes.
The habitat or lifecycle of native species being seriously affected	Any potential impact to habitat or lifecycle of native species during construction would be a result of alterations to hydrology (discussed above in this table) and/or deterioration in water quality; however stringent controls will be in place to prevent this occurring. Furthermore, construction (other than some infrastructure) will not	Any potential impact to habitat or lifecycle of native species would be a result of alterations to hydrology (discussed above in this table) and/or deterioration in water quality, which is discussed below in this table. As described above, there is predicted to be a small change to the hydrology of areas immediately downstream of the site.

Significance Criteria	Potential Construction Impact	Potential Operational Impact
	occur in the conservation areas, providing a buffer to the Ramsar wetland. No direct or indirect impact on the habitat or lifecycle of a native species during construction is anticipated.	Whilst there may be indirect impacts on habitat through hydrological changes, they are not expected to be extensive or significant. It is acknowledged that native species (including migratory birds) within Pumicestone Passage are likely to be put under increasing pressure as a result of indirect increased use for recreational purposes fuelled by population growth both on the Sunshine Coast and within the wider South East Queensland region. There is no direct access to the Passage from Caloundra South however, and measures to control recreational use is a broader issue that should be addressed by local/state authorities and other stakeholders for an integrated policy approach to be achieved. Stockland is committed to working with the authorities to develop better management strategies for the recreational use of the passage.
A substantial and measurable change in the water quality of the wetland (e.g. salinity, pollutants, nutrients and water temperature), which may adversely impact on biodiversity, ecological integrity, social amenity or human health.	There will be no construction activities undertaken within the Ramsar wetland. A detailed Erosion & Sediment Control Plan (E&SCP) will be prepared for Caloundra South that details stringent controls and monitoring. Works will be staged such that any potential impact will be minor in scale and localised. With these measures in place and close monitoring, construction is not anticipated to have an impact on the quality of surface water within the Ramsar Wetland. Further detail on erosion and sediment control for the project appears in **Section 4.** Acid Sulfate Soils (ASS) are also known to occur in the Project Area where it is below 5m AHD; a series of tests have been carried out along the 5 and 6m contours which indicate there is only very low localised levels of remnant acidity which pose a low or insignificant risk that can be readily managed with standard treatment practices. The proposed Land Use Plan has placed minimal development within areas that are at risk of containing ASS and a change to groundwater levels is not predicted to have an impact as soils display residual acidity only. It is intended that an ASS Management Plan will be developed for the Project Area to be consistent with *State Planning Policy (SPP) 2/02 Planning and Managing Development Involving Acid Sulfate Soils and Guideline.* Some of the suggested mitigation measures appear in more	*Surface Water* The surface water quality modelling does show that even with extensive application of water sensitive urban design measures, there will be some slight localised alteration of water quality within Bells Creek and Pumicestone Passage, although these changes are either positive (a reduction in total nitrogen) or minimally elevated above existing water quality, whilst still meeting WQO's. Although these changes are measurable, they are not substantial and are considered to be consistent with the natural variability of the Ramsar Wetland. *Groundwater* With appropriate control measures, including the exclusion of heavy industry from the Project Area, potential impacts on the existing groundwater quality are not expected to be substantial or measurable. It is considered unlikely that activities within the Project Area would contribute to Lyngbya blooms.

Significance Criteria	Potential Construction Impact	Potential Operational Impact
	detail in **Section 4**.	
An invasive species that is harmful to the ecological character of the wetland becoming established, or an existing invasive species spreading.	There will be no activities undertaken within the Ramsar wetland. The construction process will not result in the intentional introduction of an invasive species. An Environmental Management Plan (EMP) will be prepared for Caloundra South and will incorporate such measures as vehicle wash down and treatment of weeds prior to vegetation removal to prevent seeding before disturbance. The proposed conservation area provides an additional buffer between construction works and Bells Creek/Pumicestone Passage. Further detail appears in **Section 4.**	There will be no activities undertaken within the Ramsar wetland. The development would not result in the intentional introduction of an invasive species that would be harmful to the ecological integrity of the wetland. Without appropriate management, the development has the potential to unintentionally introduce invasive species through landscaping that could spread to the wetland. To manage this risk, it is intended that landscaping undertaken by Stockland will utilise predominantly native species. Refer to **Section 4** for more detail.

Mitigation measures to be implemented for the project are discussed further in **Section 4**.

3.1 (d) Listed threatened species and ecological communities

Description

The EPBC Act Online Protected Matters Search Tool (**Appendix G**),last accessed in June 2011, identified a total of 12 threatened flora species listed as Endangered or Vulnerable as potentially occurring on the Project Area. Fifteen (15) terrestrial vertebrate species, represented by 6 bird species, 2 frogs, 1 reptile and 6 mammal species were also identified as potentially being at Caloundra South. This database is partially predictive, and may not provide verified observations or records. To this end, habitat preferences for these species were investigated in order to highlight the possibility of their occurrence and define areas where, if potentially present, they are likely to occur within the Project Area.

Field inspections were conducted at the end of summer in mid February 2009 and in October and November 2010 (**Appendices H,I and J**). These field inspections were intended to supplement and update previous reports and field investigations conducted in summer and winter periods of 1999. The target species for the Project Area that were identified from database searches and previous investigations were considered to be more readily surveyed in warmer / wetter months of the year (i.e. February), rather than during the cooler periods.

Habitats were assessed in 2009 with respect to their relative significance for the target flora and fauna species.

There were 9 habitat types noted within the Project Area, which are listed below and shown in **Appendix A, Figure 3.1d**:

1. Cleared areas supporting rank grasses and Pine (*Pinus elliotti*) – 1,949 ha
2. Paperbark (*Melaleuca sp.*) & Forest Red Gum (*Eucalyptus tereticornis*) riparian habitats – 124 ha
3. Wallum – 38 ha
4. Lowland Rainforest (RE12.3.1) – 1.2 ha
5. Blackbutt (*Eucalyptus pilularis*) open forest – 28 ha
6. Reed dominated drainage lines – 93 ha
7. Paperbark (*Melaleuca quinquenervia*) dominated swamp – 100 ha
8. Heath – 7 ha
9. Paperbark (*Melaleuca quinquenervia*) and Pine (*Pinus sp*.) regrowth – 5 ha

During the field surveys in 2009 and 2010 two EPBC Act listed threatened species were identified within the Project Area. A single Grey Headed Flying Fox (*Pteropus poliocephalus*) was observed flying over the Project Area in 2009 (see **Table 3.1b** for more detail). Wallum Sedgefrogs (*Litoria olongburensis*) were recorded in the north eastern corner of the site in the most recent 2010 surveys after a significant period of rain (**Appendices E**).

Nature and extent of likely impact

As stated above, two EPBC-threatened species were identified in the Project Area, and there are some areas of habitat that would be considered suitable to support further threatened species.

The suitability of the Project Area for listed threatened species is discussed in **Table 3.1b** along with the potential for the development to impact these species. Mitigation of impacts is detailed in **Section 4**.

Table 3.1b: EPBC Act listed species possibly occurring within the locality[1]

Species	EPBC Act Status	Habitat Preference	Likelihood of Occurrence
Flora			
Attenuate Wattle *Acacia attenuata*	V	High rainfall areas on the coastal lowland sand plains of southeast Queensland.	This species was not located in the Project Area; however, appropriate habitat was located (Habitats 2, 3, 6 & 7). Areas of native habitat will be retained within the development (with the exception of some infrastructure crossings) as per **Section 4**.
Dwarf Heath Casuarina *Allocasuarina defungens*	E	The Dwarf Heath Casuarina is found in coastal areas of wet to dry, dense, low, closed heath growing on Pleistocene marine aeolian soils. A few populations occur in coastal clay heath on bedrock soils, and on hinterland sandstone. It is confined to the north coast of NSW, between Raymond Terrace and Port Macquarie.	Although it is likely that suitable habitat exists to the east of the Project Area, it is not within the known range for the species. It is not expected to occur.
Heart-leaved Bosistoa *Bosistoa selwynii*	V	Occurs on deep basaltic soils.	Not expected to occur, as no suitable habitat present.
Three-leaved Bosistoa *Bosistoa transversa*	V	Three-leaved Bosistoa grows in wet sclerophyll forest, dry sclerophyll forest and rainforest up to 300 m in altitude.	Not expected to occur, as no suitable habitat present.
Miniature Moss-orchid *Bulbophyllum globuliforme*	V	Grows on Hoop Pines (*Araucaria cunninghamii)* in upland subtropical rainforest	Not expected to occur, as no suitable habitats present.
Stinking Cryptocarya *Cryptocarya foetida*	V	Found in littoral rainforest, usually on sandy soils, but mature trees are also known on basalt soils	Not expected to occur, as only very low quality habitat present.
Swamp Stringybark *Eucalyptus conglomerata*	E	Edge of wallum areas where forests take over.	Low possibility to occur in ecotonal area between habitat 3 and 7 in the north-eastern corner of the Project Area. All areas of native habitat for this species will be retained within the development as per **Section 4**.
Small-fruited Queensland Nut *Macadamia ternifolia*	V	Complex notophyll vine forest, simple notophyll vine forest and in simple microphyll-notophyll vine forest with emergent Araucaria and Argyrodendron species.	Unlikely to be present, as only very low quality habitat present. All areas of native habitat for this species will be retained within the development as per **Section 4**.
Lesser Swamp orchid *Phaius australis*	E	Swampy grassland or swampy forest including rainforest, eucalypt or paperbark forest, mostly in coastal areas	This species was not located in the Project Area, however, appropriate habitats are 2, 3, 6 & 7. It is considered likely to occur because it occurs locally. Areas of

Species	EPBC Act Status	Habitat Preference	Likelihood of Occurrence
			native habitat will be retained within the development (with the exception of some infrastructure crossings) as per **Section 4**.
Mt Berryman Phebalium *Phebalium distans*	CE	This species has a very confined distribution and is always found in semi-evergreen vine thicket on red volcanic soils or communities adjacent to this vegetation type.	Not expected to occur, as no suitable habitat present.
Wallum Leek *Prasophyllum wallum*	V	Open dry heath	This species was not located on Project Area; however, appropriate habitat was located (Habitat 3 and 8). This species is considered likely to occur because it occurs locally. All areas of native habitat for this species will be retained within the development as per **Section 4**.
Minute Orchid *Taeniophyllum muelleri*	V	Littoral rainforest, subtropical rainforest, wet sclerophyll forests and riparian (stream-side)	Not expected to occur, as no suitable habitat present.
Glossy Spice Bush *Triunia robusta*	E	The main habitat is notophyll vine forest, or mixed tall open forest developing a rainforest understorey in the absence of fire	Not expected to occur, as no suitable habitat present.
Fauna			
Regent Honeyeater *Anthochaera phrygia*	E	It is an uncommon winter visitor to Queensland. Most records occur on the western slopes of the Great Dividing Range with few on the east coast. They occur in response to winter flowering *E. tereticornis*.	No suitable habitat for this species within the Project Area. It is considered highly unlikely to occur.
Coxen's Fig-parrot *Cyclopsitta diophthalma coxeni*	E	Coxen's Fig-parrots are typically found in lowland and highland rainforests with abundant figs. However, the species may also be attracted to large figs within sub-littoral mixed scrub, riparian corridors in woodland, open woodland and cleared land.	While some suitable habitat occurs within narrow corridors of riparian rainforest along creeklines within Caloundra South, the species is extremely uncommon in south-east Queensland and is considered unlikely to occur.
Red Goshawk *Erythrotriorchis radiatus*	V	Red Goshawks inhabit a variety of habitats, but are more common in open eucalypt woodland.	The scarcity of this species within the local area and the fragmented nature of the habitat suggest that it is unlikely to occur.
Swift Parrot *Lathamus discolor*	E	The Swift Parrot is an uncommon visitor to south-east Queensland. Records occur during the cooler months when small groups may be found feeding on winter flowering trees (e.g. *Eucalyptus tereticornis*).	There is a single recent record of this species being observed in the vicinity of the Project Area. The habitat available on the site is marginal as there is no open eucalypt forest.
Australian Painted Snipe *Rostratula australis*	V	Australian Painted Snipe is a secretive, cryptic, crepuscular species that occurs in terrestrial shallow wetlands, both ephemeral and permanent, usually freshwater but occasionally brackish. It also	This species was not located within the Project Area; however, there is appropriate habitat (Habitats 3, 6, 7 & 8). The potential to occur is low. The majority of areas of native habitat

Species	EPBC Act Status	Habitat Preference	Likelihood of Occurrence
		uses inundated grasslands, saltmarsh, dams, rice crops, sewage farms and bore drains.	will be retained within the development as per **Section 4**.
Black-breasted Button-quail *Turnix melanogaster*	V	Predominantly recorded from closed dry rainforest and vine thickets with abundant leaf-litter. However, occasionally recorded from scrubs including brigalow, belah, bottletree thickets and in dry eucalypt forests where there is a dense understorey such as lantana and grass groundcover. Along the Fraser and Cooloola Coast the species has also been recorded in coastal scrubs with low soil moisture and dense shrubs.	Little suitable habitat for this species occurs within Caloundra South. No obvious signs of their presence (i.e. platelets) were observed and the species is considered unlikely to occur.
Wallum Sedgefrog *Litoria olongburensis*	V	This species is one of the 'acid' or 'wallum' frogs that inhabit wetlands with low pH water on low nutrient soils (usually sands) of coastal lowlands. Vegetation within inhabited areas varies and can include heathland, *Melaleuca*, sedgeland, and *Banksia* woodland.	Wallum Sedgefrog has been located in the north eastern Project Area during targeted surveys. Wallum Sedgefrog Habitat will be mostly retained and enhanced through additional habitat creation.
Giant Barred Frog *Mixophyes iteratus*	E	This species prefers the edges of deep, slow-flowing creeks with overhanging banks in riverine rainforest or wet sclerophyll forests. They are most common in areas that are relatively undisturbed.	There are no local records of this species and there is little suitable habitat on the Project Area. It is considered unlikely to occur.
Large Pied Bat *Chalinolobus dwyeri*	V	The Large Pied Bat inhabits both wet and dry sclerophyll forests, although most records occur in dry forests, particularly those with ecotones to wet forests.	In SE Queensland, records have been in mountainous country with few in lowlands. There are no local records in verifiable databases. Not expected as no suitable habitats present.
Northern Quoll *Dasyurus hallucatus*	E	The northern quoll occurs open dry sclerophyll forest and woodland. They are most abundant in hilly or rocky areas close to permanent water. Quolls are likely to disappear in areas where less than 50-70% woodland remains within a 4km radius.	The extent of current disturbance on and surrounding the Project Area is likely to exclude the Northern Quoll, which is sensitive to anthropogenic impacts.
Spotted-tailed Quoll *Dasyurus maculatus maculatus*	E	Spotted-tailed Quolls occur in a wide variety of habitats including rainforests, wet and dry sclerophyll forests, coastal heath, scrub and sometimes Red Gum forests along inland rivers. They are found from sea-level to sub-alpine regions where they shelter in rock caves and hollow logs or trees, with basking sites usually nearby.	Most records of the species occur in areas with highly suitable habitat (such as rocky areas) or contiguous forest that allows the species to avoid threatening pressures (e.g. introduced predators). The species has not been recorded within the local area in verifiable databases. There is no suitable habitat within the Project Area and the species is considered unlikely to occur.

Species	EPBC Act Status	Habitat Preference	Likelihood of Occurrence
Long-nosed Potoroo *Potorous tridactylus tridactylus*	V	Most records occur in areas where there are large intact expanses of remnant wet and dry sclerophyll forest. Susceptible to feral animal predation, in fragmented habitat.	There is a single recent record within the vicinity of the Project Area. However, there is no suitable habitat within the Project Area and the species is considered unlikely to occur.
Grey-headed Flying Fox *Pteropus poliocephalus*	V	Two habitat characteristics are important for Grey-headed Flying-foxes - foraging resources and roosting sites. As the species is a canopy-feeding frugivore and nectarivore, it utilises vegetation including rainforests, open eucalypt forests, woodlands, paperbark swamps and banksia woodlands. Roosts are commonly within dense vegetation close to water, primarily rainforest patches, stands of paperbark, mangroves or riparian vegetation, but colonies may use exotic vegetation in urban areas.	An individual was sighted flying over the Project Area. There are no camps within the Project Area with the closest known camp located approximately 30km west in the Sunshine Coast hinterland. The remnant vegetation and larger individual trees have value as food resources in the local landscape. This species may be an occasional visitor to the vegetated waterways on the Project Area in response to flowering events, which include habitats 2, 4, 5, 7 and 9. Areas of native habitat for this species will be retained in the development (with the exception of some infrastructure crossings) as per **Section 4**.
Water Mouse *Xeromys myoides*	V	It requires relatively large areas of intertidal flats over which to forage, together with suitable adjacent areas for nest sites. Home ranges of around 0.7 ha have been recorded and individuals are known to cover distances of up to 2.9 km within these areas. Food for this species primarily consists of marine crustaceans, bivalves and other invertebrates.	The species is unlikely to occur within the Project Area.
Three-toed Snake-tooth Skink *Coeranoscincus reticulatus*	V	Inhabits subtropical rainforest and nearby wet sclerophyll forests. Most records occur in montane rainforest on dark soils, although the species is also known to inhabit rainforests within the Cooloola and Fraser Island Sandmass.	There are no local records of this species and the Project Area is located outside of its typical distribution (i.e. upland areas or the Cooloola Sandmass). It is therefore considered unlikely to occur.
Oxleyan Pygmy Perch *Nannoperca oxleyana* Honey Blue-eye *Pseudomugil mellis*	E/V	These species are only found in swamps, dune lakes and streams in coastal 'wallum' heath habitat. It prefers acidic waters with abundant aquatic vegetation with sandy or mud substrate.	A targeted search for these species was undertaken in October 2010, however no specimens were located. It is expected the main waterbodies associated with the southern and northern branch of Bells Creek provide potential habitat for this species (Habitat 2). Areas of habitat for these species will be retained and enhanced within the development as per **Section 4**.

Note:

1. Based on the results of the EPBC Act Online Protected Matters Search Tool.
2. CE – Critically endangered, E – Endangered, V – Vulnerable, R – Rare

3. Information on habitat requirements from Biodiversity Assessment and Methodology (2009).

Significance of Potential Impacts

Of the 29 threatened species indicated in the search, 9 were considered as potentially occurring on the Project Area, with only the Grey-headed Flying Fox and the Wallum Sedgefrog recorded during surveys. An individual Grey-headed Flying Fox was sighted flying over the Project Area. There are no Grey-headed Flying Fox camps within the Project Area with the closest known camp located approximately 30km west in the Sunshine Coast hinterland. The remnant vegetation and larger individual trees have value as food resources in the local landscape. This species may be an occasional visitor to the site but there is no significant population or suitable habitat within the Project Area. The following discussion of potential impacts to threatened species therefore focuses mostly on the Wallum Sedgefrog.

Caloundra South has been designed to maintain the existing native habitat values within the recognised regional ecosystems and conservation areas in the Project Area. It should be noted however that infrastructure corridors (including roads, rail and other services) of a sizeable width may cross conservation areas although the intent is to keep impacts to a minimum. Refer to **Section 4** for more detail on mitigation measures, particularly for infrastructure corridors. The *EPBC Act Significant Impact Guidelines* provides criteria for determining if an action will have a significant impact on Threatened Species, as described in **Table 3.1c** below. The likelihood of this impact occurring is also outlined.

Table 3.1c Threatened Species Significance Criteria

Significance Criteria	Potential Operational Impact
Lead to a long term decrease in the size of the population	Surveys have noted a population of Wallum Sedgefrog inhabiting the north eastern wetlands within the Project Area. These potential habitat areas for the Wallum Sedgefrog will mostly be retained within the proposed development with additional buffering provided. Wallum Sedgefrog were found in a small manmade drainage channel on one occasion; this drainage channel is not considered to be core habitat for the Wallum Sedefrog and is likely to be removed for development purposes. Equivalent compensatory habitat will be provided within the Project Area through the creation of additional wetlands as part of the surface water treatment measures. There is some potential this population could suffer a localised long term decline from a change in hydrology, surface water quality or be subject to road kill from vehicle traffic, unless appropriate mitigation measures are taken. The final location and size of road and water quality infrastructure is not yet finalised; habitat for the Wallum Sedgefrog (Habitats 3 and 7) would seek to be avoided wherever possible, or if not possible, mitigation measures will be provided, including consideration of compensatory wetland habitat areas within the Project Area. Hydrology and surface water changes will be minimised so that the habitat continues to provide water conditions suitable for Wallum Sedgefrogs. Refer to **Section 4** for further information. Similarly, a change in water quality (particularly pH) or hydrology within freshwater areas of Bells Creek north and south could impact on potential habitat for EPBC-listed native fish (although no fish have been located to date on the site). As described in **Table 3.1a,** whilst some minor changes to the hydrology or water quality of these habitat areas is anticipated, these are not considered greater than those changes the site has already undergone through the removal of pine vegetative cover. A number of precautionary mitigation measures are proposed in addition to habitat retention to avoid or reduce this impact, refer to **Section 4**. Overall, whilst there may be a short term impact related to construction, it is unlikely there will be a long term impact on the Wallum Sedgefrog population. It is more likely the overall area of habitat will be increased with additional planting and wetland creation as part of the stormwater treatment measures.
Reduce the area of occupancy	A notable population of Wallum Sedgefrog is found within the Project Area; however potential habitat for threatened species is being retained

Significance Criteria	Potential Operational Impact
	(with the possible exception of areas affected by infrastructure crossings i.e. infrastructure for roads, rail and other services and the small drainage artificial drainage channel parallel to Lamerough Creek) and buffered to provide additional protection. Where the area of occupancy is reduced by infrastructure corridors, offset options within the Project Area will be explored in a Fauna Management Plan. Overall, there is expected to be an increased area of occupancy within the Project Area in the long term due to additional planting and wetlands creation.
Fragment an existing population	Caloundra South contains several waterway corridors, which are locally significant movement corridors. The eastern area of the site also contains habitat for the Wallum Sedgefrog. A vegetated buffer and additional planting will be provided to the corridors and Wallum Sedgefrog habitat, thus habitat connectivity is maintained and potentially strengthened. Connections to populations beyond the project boundary will not be fragmented by the proposed development. Any waterway/wetland crossings would be managed in such a way that connectivity would not be significantly impacted. It is proposed to install fencing and/or other fauna friendly measures that will allow frog movement, whilst limiting road kill. Therefore the proposed project is not expected to fragment an existing population. It should be noted that until the most recent survey (October 2010) following a significant period of rain, previous fauna surveys over a ten year period had failed to locate the Wallum Sedgefrog. This reinforces the importance of maintaining and increasing the width of riparian corridors to facilitate fauna movement in response to climate variability.
Adversely affect critical habitat	The Project Area has been largely cleared and the development footprint will be contained within this cleared area. The regional ecosystems indicated as potentially providing habitat value to threatened species (as per **Table 3.1c**) will be retained and rehabilitated. Any infrastructure crossings will be managed in such a way that connectivity is not significantly impacted. It is unlikely that critical habitat will be removed, however if crossings necessitate removal, this will be offset at another location within the site. Overall, whilst there may be a short term adverse impact to critical habitat, in the long term there would not be a significant impact, with a net gain in critical habitat.
Disrupt the breeding cycle of a population	The regional ecosystems representing actual or potential habitat or breeding sites for threatened species will be retained and enhanced through the additional planting of buffers utilising native species. Whilst there may be some temporary disruption during construction, it is not anticipated there will be a long term impact on the breeding cycle of frogs. The north eastern area where the Wallum Sedgefrog has been identified for protection will be retained and buffered from the impacts of development.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Project Area has been largely cleared and the development footprint will be contained within this cleared area. The regional ecosystems indicated as providing habitat value to threatened species (as per **Table 3.1c**) will be retained, rehabilitated and maintained. Uncontrolled access to Wallum Sedgefrog habitat will be limited. The proposed project is not expected to contribute to a reduction in habitat availability or quality, or subsequent decline of this species.
Result in invasive species that are harmful	Invasive species will not be introduced deliberately, however infrastructure corridors can be avenues for the spread of weed species. To minimise the chance of weeds being introduced, a Weed and Pest Management Plan for Caloundra South will be completed prior to works and will include measures to ensure wash down of vehicles entering and exiting the Project Area and regular maintenance and weed control

Significance Criteria	Potential Operational Impact
	during operation (**Section 4**). The strengthening of buffers to core conservation areas with native species will also assist in reducing this impact. The introduction of the exotic mosquito fish (*Gambusia holbrooki*) may pose a threat to the Wallum Sedgefrog and essential habitat for native fish. The maintenance of water quality (particularly pH) and retention of habitat should reduce the potential for their introduction.
Introduce disease	To minimise the chance of disease being introduced, a Weed and Pest Management Plan for Caloundra South will be completed prior to works and will include measures to ensure wash down of vehicles entering and exiting the Project Area (**Section 4**).
Interfere with the recovery of the species	The Project Area has been largely cleared and the development footprint will be contained within this cleared area that is not considered suitable habitat for any threatened species. The potential development is likely to create additional habitat for threatened species through a net gain in vegetation. A Fauna Management Plan would be prepared for the proposed project that considers and responds to the available Wallum Sedgefrog Recovery Plan. The proposed project is not expected to interfere with the recovery of this species.

3.1 (e) Listed migratory species

Description

The EPBC Act Online Protected Matters Search Tool identified a total of 9 terrestrial migratory birds[3] and 12 migratory wetland birds (**Appendix G, H**) as potentially occurring in the Project Area. This database is partially predictive, and may not provide verified observations or records. To this end, habitat preferences for these species were investigated in order to highlight the possibility of their occurrence and define areas where, if potentially present, they are likely to occur within the Project Area. A further three migratory bird species were identified on the Birds Australia New Atlas database search for the Project Area.

Field inspections were conducted at the end of summer in mid February 2009 and spring 2010. These field inspections were intended to supplement and update previous reports and field investigations conducted in summer and winter periods of 1999. The 2010 surveys also reported on the presence of migratory wader bird species downstream of the project site within Pumicestone Passage. The target species for the Project Area that were identified from database searches[4] and previous investigations were considered to be more readily surveyed in warmer / wetter months of the year (i.e. February), rather than during the cooler periods. During the 1999, 2009 and 2010 field surveys five EPBC Act migratory species were identified in the Project Area. These species are:

- Rainbow Bee-eater (*Merops ornatus*);
- Black-faced Monarch (*Monarcha melanopsis*);
- Rufous Fantail (*Rhipidura rufifrons*);
- Cattle Egret (*Ardea ibis*); and
- Latham's Snipe (*Gallinago hardwickii*).

These species are abundant and widespread within the local area and region. No populations of these birds within the Project site are likely to represent a significant portion of the species population.

There were an additional five species that have been noted locally and some suitable habitat occurs in the Project Area:

- Spectacled Monarch (*Monarcha trivirgatus*);
- Great Egret (*Ardea alba*);
- Painted Snipe (*Rostratula benghalensis s. lat*);

[3] The Coxen's Fig Parrot and Regent Honeyeater are also listed as a Threatened species and have been discussed in Section 3.1d.

[4] Please note surveys were undertaken on database searches conducted in February 2009 for the whole of Caloundra South. Searches have been updated and targeted at Caloundra Downs North for the purpose of this report.

- Australian Reed Warbler (*Acrocephalus australis*); and
- Glossy Ibis (*Plegadis falcinellus*).

It is noted that of the ten migratory species that may potentially utilise the site, six of the species listed above are associated with rank grasslands like those in some areas of the Project Area (Cattle Egret, Great Egret, Latham's Snipe, Australian Reed Warbler, Glossy Ibis and Painted Snipe). The other species (Rainbow Bee-eater, Black-faced Monarch, Spectacled Monarch and Rufous Fantail) are associated with riparian corridors, such as Lamerough Creek and Bells Creek (north and south).

There is a known roost site for migratory wader birds at the junction of Bells Creek and Pumicestone Passage (approximately 5km east of the site), although it is considered a smaller roost site than others in the passage.

Nature and extent of likely impact

Migratory species of the families Scolopacidae (snipe, godwits, curlews, sandpipers, stints and allies), Charadriidae (plovers, dotterels and allies) and Laridae (gulls, terns and allies) are generally restricted to coastal habitats including estuarine, sand and mudflat habitats. Although they may be located on large inland waterbodies, almost no suitable/potential habitats occur within Caloundra South and these species were not observed utilising the site during recent surveys.

Given the types of habitat available, the suitability of the Project Area for listed migratory species is discussed in **Table 3.1d** with the potential for the development to impact these species.

Table 3.1d: EPBC Act listed migratory species possibly occurring within the locality[1]

Species	Habitat Preference	Likelihood of Occurrence
Terrestrial		
White-bellied Sea Eagle *Haliaeetus leucogaster*	This large raptor is found in tropical and temperate maritime habitats, terrestrial wetlands, coastal areas and offshore islands. The species also ranges far inland over large rivers and wetlands. They prefer to forage over freshwater swamps lakes reservoirs and billabongs.	There are database records for this species in the area and it may utilise Habitats 2 and 7 in the Project Area, although the low abundance of large trees will mean roosting is extremely unlikely. All areas of native habitat for the species will be retained within the development (with the exception of some infrastructure crossings) as per **Section 4**.
Osprey* *Pandion haliaetus*	This species feeds on fish in rivers, lakes, estuaries and inshore waters. Breeding pairs require nesting sites near suitable foraging areas. Nesting sites include tall trees and artificial structures like power poles and towers.	There are records for this species in the area and it may utilise Habitats 2 and 7 in the Project Area, although the low abundance of large trees will mean roosting is extremely unlikely. All areas of native habitat for the species will be retained within the development (with the exception of some infrastructure crossings) as per **Section 4**.
White-throated Needletail *Hirundapus caudacutus*	White-throated Needletail is a regular visitor to a variety of habitat types (including urban areas) in south-east Queensland. It does not rely on terrestrial habitats, but roosts in tree hollows.	The species is an aerial forager and it has been recorded in the locality. It could be expected to occur within Habitats 2, 3, 4 & 7. The low abundance of hollow-bearing trees means roosting is unlikely. All areas of native habitat for the species will be retained within the development (with the exception of some infrastructure crossings) as per **Section 4**.
Rainbow Bee-eater *Merops ornatus*	The Rainbow Bee-eater usually inhabits open or lightly timbered landscapes including agricultural land. It is also known to occur over forested areas where it can utilise large, emergent branches above the canopy.	Rainbow Bee-eaters were observed within Habitats 1 and 7 of the Project Area and are common within the local area. Breeding is generally associated with the banks of waterways, i.e. habitats 2, 7 and 9 (to a lesser degree). Areas of native habitat (2 and 7) will be retained within the development (with the exception of some infrastructure

Species	Habitat Preference	Likelihood of Occurrence
		crossings) as per **Section 4**.
Black-faced Monarch *Monarcha melanopsis*	Usually found in rainforests or wet sclerophyll forests, but may also be located in dry forests, particularly those associated with gullies. The species often occurs in pairs that together defend small territories.	The Black-faced Monarch is common within the locality and was observed within Habitats 2, 4, 5, 7 and 9 of the Project Area. Areas of native habitat (2, 4, 5 and 7) will be retained within the development (with the exception of some infrastructure crossings) as per **Section 4**.
Spectacled Monarch *Monarcha trivirgatus*	The Spectacled Monarch inhabits dense rainforests and wet sclerophyll forests although it may be occasionally located in mangroves.	The species is common within south-east Queensland and the local area. It has been recorded in the locality and is likely to occur in habitats 2, 4, 5, 7 and 9. Areas of native habitat (2, 4, 5 and 7) will be retained within the development (with the exception of some infrastructure crossings) as per **Section 4**.
Satin Flycatcher *Myiagra cyanoleuca*	Satin Flycatcher inhabits a wide variety of habitats, but is very uncommon in south-east Queensland and many records are mis-identifications of Leaden Flycatchers.	No confirmed records have been noted through inspection of verifiable databases. It is therefore considered unlikely that the species would occur.
Rufous Fantail *Rhipidura rufifrons*	In south-east Queensland, the Rufous Fantail inhabits dense moist rainforests and wet sclerophyll forests. It often occurs in pairs that together defend small territories.	Rufous Fantails are common within the locality. It is relatively abundant within suitable habitats (Habitats 2, 4, 5, 7 and 9) within the Project Area. Areas of native habitat (2, 4, 5 and 7) will be retained within the development (with the exception of some infrastructure crossings) as per **Section 4**.
Wetland		
Glossy Ibis* *Plegadis falcinellus*	Glossy Ibis prefer terrestrial freshwater wetlands with abundant aquatic vegetation. It is generally observed as single individuals or small groups.	There is one database record for this species in the area. There is some suitable habitat within the Project Area in Habitat 6; however the surrounding vegetation is generally unsuitable. Habitat 6 generally occurs within the development footprint, but this type of habitat will be recreated within the development as per **Section 4**.
Great Egret *Ardea alba*	Great Egrets occur in a range of wet habitats, including permanent and ephemeral freshwater, brackish or saline water and even wet pasture or mudflats. The species is most often observed feeding individually in shallow water. Nesting occurs in mixed-species colonies in large trees over permanent water.	No rookeries are located within the Project Area. There is some suitable habitat within the Project Area in Habitat 6, however surrounding vegetation is generally unsuitable. There is considered to be a moderate potential to occur. Habitat 6 generally occurs within the development footprint, but this type of habitat will be recreated within the development as per **Section 4**.
Cattle Egret *Ardea ibis*	Cattle Egrets are extremely abundant and widespread. The species has benefited from grazing and irrigation and has dramatically expanded its range within Australia.	This species was observed during field surveys. Suitable habitat is generally restricted to the grazing pastures and reedy drainage lines (Habitat 1 & 6). These habitats generally occur in the development footprint, but will be recreated as per **Section 4**.
Latham's Snipe	Freshwater wetlands on or near the coast, generally among dense cover.	This species was observed during the field survey. Suitable habitat is Habitat

Species	Habitat Preference	Likelihood of Occurrence
Gallinago hardwickii	They also use crops and pasture.	1, 6 and 7. Areas of native habitat (Habitat 7) will be retained within the development as per **Section 4**.
Australian Reed-warbler* *Acrocephalus australis*	The Australian Reed-Warbler is typified by its affinity with reeds, rushes and sedges, in and adjacent to most wetland types.	It has been recorded in the area previously. Suitable habitat includes Habitats 1 and 6. These habitats occur in the development footprint, but will be recreated as per **Section 4**.

Note - * denotes a record from Birds Australia New Atlas database. Information on habitat requirements from Biodiversity Assessment and Methodology (2009).

The significance of an impact on a migratory species is measured against three criteria listed below in **Table 3.1e**. As no notable populations of migratory species were noted in the Project Area, any potential indirect impacts are related to hydrological and water quality issues within the Pumicestone Passage.

Table 3.1e Migratory Species Significance Criteria

Significance Criteria	Potential Operational Impacts
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.	The Project Area is not identified as an important habitat for migratory species and surveys did not locate any notable populations of migratory species within the Project Area. The catchments in the Project Area are associated with a Ramsar wetland (Pumicestone Passage) to the east of the Project Area, which is important habitat for migratory species. The nearest roosting site is some distance from the site. Modelling at Site 1311 (in close proximity to the roost site) does not show a significant change in water quality as a result of the development. Integrated stormwater management measures have been modelled and designed to ensure that the stormwater management of Caloundra South meets the water quality and hydrological parameters defined by relevant legislation and results in no substantial impact on downstream wetlands. Therefore the proposed project should not result in substantial modification, destruction or isolation of important habitat for a migratory species. Refer to **Section 4** for more detail.
Significance Criteria	**Potential Operational Impacts**
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.	The Project Area is not identified as an important habitat for migratory species and surveys did not locate any notable populations of migratory species within the Project Area. Invasive species will not be deliberately introduced to the Project Area. However, to minimise the chance of invasive species being introduced, an Environmental Management Plan (EMP) will be developed for Caloundra South once the development layout and design is finalised. The EMP will include measures that will ensure wash down of vehicles entering and exiting the Project Area, regular maintenance of vegetated areas and weed control. Further detail appears in (**Section 4**). The EMP and associated measures will be targeted to minimise the potential for invasive species to adversely affect downstream wetlands and migratory species habitat areas.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	The Project Area is not identified as an important habitat for migratory species. Areas of native habitat associated with wetlands and waterways will be retained and protected on site. Those areas likely to be occasionally utilised by migratory birds that are not native habitat (i.e. reedy drainage lines and cleared grass areas) which lie in the development footprint will be recreated on site within some open space areas as per **Section 4.** The proposed project is not expected to seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species.

3.1 (f) Commonwealth marine area

(If the action is in the Commonwealth marine area, complete 3.2(c) instead. This section is for actions taken outside the Commonwealth marine area that may have impacts on that area.)

Description

There are no Commonwealth Marine Areas within or adjacent to the Project Area.

Nature and extent of likely impact

N/A

3.1 (g) Commonwealth land

(If the action is on Commonwealth land, complete 3.2(d) instead. This section is for actions taken outside Commonwealth land that may have impacts on that land.)

Description

There are no Commonwealth lands within or adjacent to the Project Area.

Nature and extent of likely impact

N/A

3.1 (h) The Great Barrier Reef Marine Park

Description

The project site is not within or adjacent to the Great Barrier Reef Marine Park.

Nature and extent of likely impact

N/A

3.2 Nuclear actions, actions taken by the Commonwealth (or Commonwealth agency), actions taken in a Commonwealth marine area, actions taken on Commonwealth land, or actions taken in the Great Barrier Reef Marine Park

You must describe the nature and extent of likely impacts (both direct & indirect) on the whole environment if your project:

- is a nuclear action;
- will be taken by the Commonwealth or a Commonwealth agency;
- will be taken in a Commonwealth marine area;
- will be taken on Commonwealth land; or
- will be taken in the Great Barrier Reef marine Park.

Your assessment of impacts should refer to the *Significant Impact Guidelines 1.2 - Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies* and specifically address impacts on:

- ecosystems and their constituent parts, including people and communities;
- natural and physical resources;
- the qualities and characteristics of locations, places and areas;
- the heritage values of places; and
- the social, economic and cultural aspects of the above things.

3.2 (a)	**Is the proposed action a nuclear action?**	**X**	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment		

3.2 (b)	**Is the proposed action to be taken by the Commonwealth or a Commonwealth agency?**	**X**	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment		

3.2 (c)	**Is the proposed action to be taken in a Commonwealth marine area?**	**X**	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(h))		

3.2 (d)	**Is the proposed action to be taken on Commonwealth land?**	**X**	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(i))		

3.2 (e)	**Is the proposed action to be taken in the Great Barrier Reef Marine Park?**	**X**	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(j))		

3.3 Other important features of the environment

3.3 (a) Flora and fauna

Flora

In the vegetation and fauna surveying undertaken in 1999 (LAMR, Caloundra Downs II Informal Land Use Investigation), it was estimated that only 20-60% of native flora species remain in the Project Area. Of the 318 native species remaining, 210 were found only in the remnant vegetation, which occurs on less than 15% of the Project Area. Wallum covers less than 2% of the Project Area but supports 113 native species and a patch of Blackbutt forest located in the north-east near Lamerough Creek supports 74 species, including 28 endemic species. Site investigations in 1999 and 2010 located two flora species listed under the *Nature Conservation Act 1992* (NC Act) (**Appendix A, Figure 3.3a**).The habitat where these species were noted will be within the Conservation Area.

Fauna

The Caloundra Downs II Informal Land Use Study, conducted in 1999, found fauna across the Project Area to be of low diversity and occurrence. This can be attributed to the extensive agricultural and silvicultural history, which has resulted in patchiness of remnant vegetation and a lack of significant vegetated corridors. The faunal groups most affected by the disturbance appeared to be reptiles (11 native species) and mammals (11 native species). Of the vegetation communities remaining, the riparian *Melaleuca sp.* complexes are the most important as they cover a comparably large area and most significant fauna species are related to these areas.

Site investigations conducted in February 2009 and October/November 2010 were targeted on significant species and located Wallum Froglet, Wallum Rocketfrog and Wallum Sedgefrog in the east of Caloundra South in association with the Paperbark swamp and Wallum habitats. The Wallum Froglet and Wallum Rocketfrog are listed as vulnerable under Queensland's *Nature Conservation Act 1992* (NC Act). The Wallum Sedgefrog is listed as Vulnerable under both the EPBC and NC Acts. Targeted wallum frog surveys in 2010 have noted that the Wallum Froglet is abundant and widespread across the site, particularly in open modified habitats. The Wallum Rocketfrog was also recorded in a number of locations in the northern portion of the site in highly modified landscapes. The Wallum Sedgefrog was recorded in the north eastern area of the project site in both remnant and non-remnant habitats in areas with a dominant sedge understory. No other significant species under the NC Act were located in the 2009 and 2010 surveys. Significant fauna under EPBC Act is discussed in **Section 3.1**.**Appendix A**, **Figure 3.3b** shows database records and survey results for EPBC Act listed fauna on the Project Area.

3.3 (b) Hydrology, including water flows

The condition of the catchments and the health of the waterways and groundwater are discussed in detail in **Section 3.1c**.

3.3 (c) Soil and Vegetation characteristics

The published soil mapping of the area indicated the presence of extensive alluvium across the site with the exception of hills and ridgelines. The alluvium is described as consisting of clay, silt and gravel. Podzolic soils with sandy A horizons are widespread, with some gleying of soils in the east due to waterlogging**. Appendix D; Section 3.3,** provides further detail.

3.3 (d) Outstanding natural features

There are no outstanding natural features in the Project Area, however, it is within the catchments of Bells and Lamerough Creeks which discharge into Pumicestone Passage as discussed in **Section 3.1c**.

3.3 (e) Remnant native vegetation

Field surveys have identified nine habitats in the Project Area, some of which represent regrowth or degraded vegetation and others which include regional ecosystems that are representative of vegetation communities that have been substantially reduced throughout SEQ due to coastal development. The vegetation communities within the Project Area align with eight Regional Ecosystems (RE's) under the Queensland Herbarium's mapping system. **Table 3.3b** lists the RE's which have been mapped by the Queensland Herbarium within the Project Area. Whilst vegetation surveys largely concur with the location of the regional ecosystems on site, the distribution of remnant[5] vegetation is actually less than that depicted in the Queensland Herbarium mapping. A Property Map of Assessable Vegetation (PMAV) has been undertaken to confirm the extent of remnant vegetation on the Project Area. The regional ecosystems and PMAV are shown in **Appendix A**, **Figure 3.3a**.

[5] Defined under *Vegetation Management Act 1999* as being a recognisable regional ecosystem with 50% mature canopy cover and 70% mature canopy height.

Table 3.3a: Regional Ecosystems within the Project Area

RE Code	Status	Description
12.3.1	Endangered	Notophyll Vine forest
12.3.4*	Not of concern	*Melaleuca quinquenervia* and *Eucalyptus robusta* (paper bark and swamp mahogany) open forest
12.3.5	Of concern	*Melaleuca quinquenervia* (paperbark) open forest
12.3.6	Not of concern	*Melaleuca quinquenervia*. *Eucalyptus tereticornis* and *Lophostemon suaveolens* (paper bark, forest red gum and swamp box) open forest
12.3.8*	Of concern	Swamps with *Cyperus spp., Schoenoplectus spp*. and *Eleocharis spp*
12.3.13*	Of concern	Closed heathland (*Melaleuca thymifolia, Banksia robur, Xanthorrhoea fulva, Hakea actites*, *Leptospermum spp.* and *Baeckea frutescens*) on seasonally waterlogged alluvial plains
12.3.14*	Of concern	*Banksia aemula* woodland
12.9-10.14	Not of concern	*Eucalyptus pilularis* (blackbutt) open forest

* indicates a threshold RE

3.3 (f) Gradient (or depth range if action is to be taken in a marine area)

The western part of the site reaches elevations of 65m AHD, sloping gradually down to the coastal plain in the east which has an elevation of 1.5m AHD. The site appears as gradually undulating.

3.3 (g) Current state of the environment

Caloundra South has been heavily degraded by previous land uses, mainly forestry practices. Approximately 85% of the native vegetation has been cleared and as a consequence the Project Area hydrology has been significantly altered, weeds are prevalent, remnant vegetation is fragmented and fire regimes changed. Cleared areas are dominated by slashed grassland which is not capable of providing high quality habitat to support native species of flora and fauna in its present condition. Exotic pasture grass species are dominant in these cleared areas. The long history of disturbance has also had an impact on the quality of native remnant vegetation remaining. These areas are also experiencing significant weed incursion and feral animals including cats, hares, foxes, dogs and cane toads have been observed in the area.

3.3 (h) Commonwealth Heritage Places or other places recognised as having heritage values

The Glass House Mountains are approximately 15km to the south-west of the Project Area. They are iconic to the state of Queensland as well as to the Sunshine Coast area. Several of the mountains are now protected in the Glass House Mountains National Park. The Glass House Mountains can be seen as far away as the Scenic Rim on the Queensland and New South Wales Border and the immediate view field is estimated to be an area close to 25kms by 40kms including views from the ocean off parts of the southern Sunshine Coast. The mountains can be viewed in their wider setting from Mary Cairncross Park and Mount Beerburrum and Wild Horse Mountain. From the lookouts panoramic views can be experienced of the family of mountains with their massive jagged peaks arising from an extensive plain with forested foothill reserves, agricultural land, small village roads, highways and coastal urban developments.

An impact assessment and recommendations are included in **Section 3.1(b)** of this referral.

3.3 (i) Indigenous heritage values

Caloundra South is located in the traditional country of the Gubbi Gubbi people, who registered a Native Title Claim which included the Project Area. A Cultural Heritage Survey (CHS) was undertaken by Davies Heritage Consultants Pty Ltd in association with the Gubbi Gubbi in November 2007 (Ganggala: 2007 and Davies: 2007). The study involved:

- A field survey with Stockland, the Gubbi Gubbi and an Archaeologist (Davies Heritage Consultants);
- Research into known sensitive sites, including a search of the Aboriginal Cultural Heritage Register;
- Preparation of a predictive model to select the most likely locations for cultural heritage items;

- A detailed ground surface survey along transects chosen through the predictive model;
- An assessment of the significance of any sites/places located; and
- Recommendation of mitigation and management options for any sites/places located.

The CHS found that the Project Area has been highly disturbed through vegetation clearance and agricultural activities; therefore evidence of aboriginal occupation is likely to have been disturbed. A Cultural Heritage Management Plan (CHMP) was prepared in association with the Gubbi Gubbi and the majority of archaeological material has since been removed from the Project Area for preservation purposes by the Gubbi Gubbi. One portion of the site, the southern bank of Lamerough Creek, is still known to potentially contain archaeological material. Despite being located with the proposed Conservation Area, this area will be subject to monitoring by the Gubbi Gubbi as per the CHMP.

3.3 (j) Other important or unique values of the environment

A portion of the Project Area, associated with the waterways, is listed in the Queensland Department of Environment and Resource Management's Directory of Important Wetlands. These wetlands are not nominated on the National Directory of Important Wetlands.

There is a large area of wetland directly east of the Project Area that is proposed for conservation. This area of vegetation contributes to a bioregional corridor running north to south along the coastline known as the Pumicestone Passage Major Bioregional Corridor. The waterways (running east to west) in the Project Area connect the Pumicestone Passage Major Bioregional Corridor with Beerburrum State Forest and the Eastern Wildlife Corridor. The Eastern Wildlife Corridor is also known as the Alps to Atherton Corridor and it is an inter-governmental agreement between NSW, Queensland and Victoria that aims to encourage conservation of habitat areas for wildlife movement along the east coast of Australia.

These features are shown in **Appendix A, Figure 3.3c.**

3.3 (k) Tenure of the action area (eg freehold, leasehold)

The Project Area is Freehold tenure.

3.3 (l) Existing land / marine uses of area

Caloundra South was cleared of the last stands of pine plantation in December 2009, and is currently partially leased for cattle grazing. Property maintenance includes stump removal (chopper rolling of areas cleared of pine), slashing within cleared areas and occasional controlled burning to reduce bushfire risk.

3.3 (m) Any proposed land / marine uses of area

It is proposed that the Project Area be developed as a mixed use development, incorporating residential, business and conservation areas as outlined in **Section 2.1** of this referral.

4 Measures to avoid or reduce impacts

As part of this application, significant investigations have been undertaken to understand the potential impacts of the development on the natural environment and whether these could be managed. A representative area of the site has been modelled in detail so that potential impacts could be clearly understood, enabling strategies to avoid or reduce potential impacts to be formed. From the outset, the Development Scheme and infrastructure planning for Caloundra South has been informed by, and responds to, environmental constraints. The mitigation methodologies will be further developed within various management plans at the detailed design phase.

From **Section 3**, detailed investigations for the proposed development have indicated that it is not considered to have a significant impact on Matters of National Environmental Significance (MNES) once mitigation measures are in place. These mitigation measures involve design, construction and operational controls that will require vigilant management and monitoring. Measures that will be implemented are provided in detail below.

Threatened and Migratory Species Habitat

The most effective mitigation measure to manage threatened and migratory species within the Project Area is to retain, manage and enhance areas of habitat where the species are known to occur. The majority of threatened and migratory species that are likely to be utilising the Project Area are associated with four habitat types within the Project Area, namely:

- Habitat 2 - Paperbark (*Melaleuca* sp.) and Forest Red Gum (*Eucalyptus tereticornis*) riparian habitats
- Habitat 3 – Wallum
- Habitat 6 - Reed dominated drainage lines
- Habitat 7 - Paperbark (*Melaleuca* sp.) dominated swamp

The three creeklines within the site are considered to be essential habitat for both the Oxleyan Pygmy Perch and the Honey Blue-eye (EPBC Act listed species), although these species were not located on site during targeted surveys. South Bells Creek also supports the One-gilled Swamp Eel and Ebony Gudgeon which are not listed as significant species under the EPBC or NCA Acts, but have limited recordings in south-east Queensland.

The habitat types that will be retained (with the exception of necessary infrastructure crossings for infrastructure) within Conservation Areas at Caloundra South are Habitats 2, 3, 4, 5, 7 & 8, which are all native vegetation communities. Additionally all vegetation along creeklines will be retained (except for infrastructure crossings) and supplemented by additional buffer planting. Infrastructure crossings will be minimised and located in the areas of least environmental value. Habitat types that are the result of disturbance on the Project Area (Habitats 1, 6 & 9) will fall within the development footprint.

The available area of each of the natural habitat types (Habitats 2, 3, 4, 5, 7 & 8) will be increased considerably through rehabilitation and natural regeneration within Conservation and Open Space Areas at Caloundra South. In some cases this will more than double the area of currently available habitat (e.g. wallum and heath). A detailed rehabilitation strategy will be developed outlining weed management, appropriate buffers to core conservation areas, planting strategies and additional protection measures. The total area of revegetation / natural regeneration within Conservation and Open Space areas planned for Caloundra South is approximately 740 ha. The area of extant natural habitat (Habitats 2, 3, 4, 5, 7 & 8) is approximately 300 ha.

A total of 16 of the 21 threatened and migratory EPBC species noted in the EPBC Protected Matters search are associated with the paperbark (*Melaleuca sp*.) vegetation occurring along the waterways (i.e. Habitat 2) and the swamp in the east of the site (Habitat 7). These areas are also mapped as remnant vegetation under the Queensland *Vegetation Management Act, 1999*. Pumicestone Passage, downstream of the site provides roosting and feeding opportunities for a large population of migratory wader birds. The Wallum Leek is represented in Wallum and Heath habitats (Habitat 3 & 8). These habitats will be retained and enhanced within the Project Area. The Cattle Egret, Australian Reed Warbler, Great Egret and Glossy Ibis are associated with non-remnant communities, mostly along reedy drainage lines (Habitat 6), but also rank grasslands (Habitat 1). It is intended that this type of habitat will be recreated in the Project Area. The Wallum Sedgefrog is largely associated with drainage lines with wallum species and paperbark swamp (Habitats 6 and 7). Areas of existing habitat where the Wallum Sedgefrog has been identified will be retained and additional buffering provided. If infrastructure corridors are placed through Wallum Sedgefrog habitat (unlikely), this vegetation type will be offset at another location within the site.

The following strategies will be implemented to maintain and enhance essential habitat to support the threatened and migratory species occurring or potentially occurring in the Project Area.

- Protect and manage mapped vegetation in the Project Area, in accordance with the approved Property Map of Assessable Vegetation (PMAV) and DERM's remnant vegetation mapping.
- Integrate the large Paperbark (*Melaleuca sp*.) swamp in the east of the Project Area into an Environmental Protection Area, including a buffer around the wetland to assist with management of weeds and bushfire. This habitat type will be expanded through revegetation and recreation of the hydrology typical of ephemeral wetlands that will favour Wallum frogs and terrestrial migratory birds such as the Cattle Egret, Australian Reed Warbler and Glossy Ibis.
- Where practicable, siting of infrastructure crossings for infrastructure within areas that are degraded or have a lower ecological value. Where roads cross waterway crossings, they will be designed to be elevated and continue to allow fauna movement and to protect crossing animals e.g. fauna/frog fencing.
- Protect key areas of regrowth wallum habitat. There is no remnant wallum in the Project Area. The retention of key areas of regrowth would not only cater for EPBC Act listed species, but would also assist in the mitigation of impacts on the State listed Wallum Froglet (*Crinia tinnula*) due to the loss of habitat currently utilised by this species. The primary area for retention is adjacent to the remnant Paperbark (*Melaleuca sp*.) wetlands and Blackbutt mixed open forest in the north and east of the Project Area. Field observations indicate that this area is the most floristically diverse and advanced area of regenerating wallum within the Project Area.
- A landscaping and rehabilitation plan will list native species appropriate for Caloundra South and residents will be provided with a suggested planting list and supporting information regarding weed management.
- Domestic animals (cats and dogs) have been known to cause nuisance to migratory species. Residents will be provided with education / advice on appropriate control methods.
- Existing waterway corridors will be retained and strengthened with additional planting to provide waterway buffers.
- A Fauna Management Plan (focusing on protection of Wallum Frog species) will be prepared.
- Regular and ongoing monitoring of conservation areas will be undertaken.

With these measures in place, the likelihood of significant impacts on EPBC threatened or migratory species as a result of the proposed development occurring is minimal.

Indirectly, the increased population may contribute to increased recreational use of Pumicestone Passage, which provides habitat for migratory species. Management of the Passage is the role of a number of bodies and stakeholders who have the authority to impose restrictions on usage. The main opportunity for Stockland to minimise harmful recreational activities is through education of its residents and restricting the creation of new access opportunities from Caloundra South. In addition, Stockland is committed to playing a role in facilitating and contributing to future strategic planning for the Passage in association with community groups, government and other stakeholders.

Management of Impacts on Wetlands of International Importance (Pumicestone Passage)

Construction Environmental Management

Stockland are committed to implementing best practice environmental controls during construction to avoid or minimise the occurrence of significant environmental impact.

A detailed Construction Environment Management Plan (CEMP) will be prepared for each phase of construction and submitted to the ULDA with detailed design and will include (but not be limited to) the following topics:

- Vegetation & Fauna
- Air / Dust & Noise
- Sediment & Erosion Control
- Acid Sulfate Soils
- Water Quality

A brief outline of each of these topics is now provided with relevance to managing potential impacts on MNES. Detailed information has been provided where information collected to date has allowed for this.

Vegetation & Fauna

This component of the CEMP will focus on protecting areas of vegetation that have been identified for retention during works and managing activities that may pose a risk to the vegetation values on site, for example:

- Areas of vegetation for retention will be clearly delineated on site prior to works.
- Exclusion fencing will protect areas of retained vegetation and there will be no storage of machinery or stockpiling in these areas
- Vehicle wash down upon entry and exit for construction machinery
- A spotter-catcher will be present if clearing of vegetation is required.

Air / Dust & Noise

This component of the CEMP will focus on defining work hours and preventing air pollution and noise pollution that may lead to complaints from surrounding residents, for example:

- Haul roads will be treated to suppress dust.
- Exposed areas will be stabilised immediately

Water Quality& Flooding

It is recognised that sediment and erosion control will be a primary concern for construction, therefore high level principles for construction water quality management and treatment have been prepared (**Appendix D, Section 2.8**) to gain an understanding of the measures required to prevent and minimise impacts on downstream water quality. Measures to be implemented during construction include:

- Construction works will be staged in small parcels so that the area disturbed at any one time will be limited. Once cutting operations are complete in any one section, the area will be stabilised prior to commencement of operations on the following section
- Soil erodability risk mapping will be undertaken to identify those areas of the development footprint which may be more at risk of generating unacceptable levels of sediments during the construction stage. These areas will then be targeted with special care during site works.
- All erosion and sediment controls (such as shake down pads, sediment fences, sediment basins etc. Will be installed prior to any soil disturbance and will remain in place until the area of disturbance is fully stabilised.
- All exposed areas will be stabilised in a timely manner and their extent minimises via the use of appropriate techniques such as mulching, temporary turfing etc.
- All ‘clean’ water from catchments above the works areas will be diverted around areas of disturbance via stabilised flow paths.
- Work in wet weather that could impact water quality will be avoided
- Appropriate erosion and sediment control measures will be implemented along haul roads

- Sediment basins will be installed to capture runoff from disturbed areas; basins will be sized so that suspended solids can be held and treated prior to discharge at a level greater than that required under current state and local government guidance
- Sediment fences will be installed to provide further protection and retention of runoff from disturbed areas. They will be placed along contours and will include overflow weirs to prevent scour and failure of devices.
- All staff will be trained by a suitably qualified person in the requirements of the Site Based Management Plan.
- At all times, a vegetated buffer will be preserved between those parcels of land being developed and those waterway corridors passing through the site
- The principal contractor will be required to implement and report on an erosion and sediment control monitoring regime that will be regularly audited by an independent third party
- Stockland will ensure that when contracting site earthworks and building works, that there are appropriate contractual penalties applied to site contractors in the event of unacceptable runoff contamination to encourage greater diligence.
- Robust event-based monitoring campaigns shall also be initiated downstream of those areas being developed using telemetered turbidity sensors. Should these sensors detect turbidity levels in site runoff which exceeds predefined threshold levels, alarm signals will be sent to Stockland/site construction personnel so they can investigate the cause and undertake appropriate corrective actions.
- Ambient monitoring programs in site waterways will also be conducted as a further quality control for site sediment and erosion control.
- Detailed Erosion and Sediment Control Plans will be developed for each phase of construction works and submitted to the State Government (ULDA) for review and comment prior to any development commencing.

Acid Sulfate Soils (ASS)
For the development of Caloundra South, areas that may contain ASS (areas below 5m AHD) primarily will not be developed due to flooding constraints and the presence of protected vegetation and significant wetlands. As discussed, the risks to the receiving environment are considered low, and comprise remnant acidity only. Excavation will be largely restricted to areas above the 5m AHD contour.

An ASS Management Plan will be developed for Caloundra South in accordance with the *State Planning Policy (SPP) 2/02 Planning and Managing Development Involving Acid Sulfate Soils and Guideline.* Its main objective will be that there must be no net increase in acidity and dissolved hazardous metal loads to the Passage, over and above that which occurs naturally, or under baseline conditions, on any timescale. Sampling and laboratory testing will be undertaken on a stage by stage basis, prior to earthworks occurring. The ASS Management Plan will include the detailed drilling and testing methodology, based on final earthworks plans that detail cut and fill activities and any linear trenching.

Lime dosing is proposed to treat low-level remnant acidity. Standard finely-ground calcium carbonate or 'aglime' will be used with protocols to ensure sufficient dosing and mixing before use of soil as fill, or backfill for linear trenching. All limed soils will undergo the required verification testing, to ensure that lime dosing and mixing has been correctly carried out. This overall methodology is an established and effective method for management of ASS risks (for both actual and potential acidity). It is the lowest risk management method, most readily implemented by experienced constructors.

Throughout the construction phase, earthworks will be monitored to ensure that unexpected pockets of ASS that might arise are identified and appropriate management measures are implemented and to ensure that the objective of the ASS Management Plan is achieved.

All staged investigations, testing, liming and mixing will conform to the latest applicable ASS management guidelines. In implementing remnant acidity management, an independent ASS specialist will be employed to audit each step of the management procedures, to ensure and document that the applicable risks, no matter how low, are managed

Operational Environmental Management

Once the development is operational the focus of environmental management will largely be the management of hydrology and water quality on the Project Area. Already, a great deal of investigation and planning has been undertaken and embedded into the structure plan to minimise adverse impacts on water quality. Stockland are committed to protecting the health of Pumicestone Passage and are proposing to integrate an advanced WSUD strategy within Caloundra South. Detailed urban stormwater quality modelling has shown

that provision of the proposed WSUD measures outlined below would ensure that water quality objectives set for Pumicestone Passage will be achieved (**Appendix D**).

Management measures for the proposed development include, but are not limited to:

- The establishment of high-pollution risk industries have been precluded
- Light industry, in clusters will be sited away from high groundwater flow regimes, such that in the event of accidental spills, there will be no rapid infiltration to groundwater of any potential contaminants.
- Light industry and enterprise areas will have bunded hardstand areas and interceptor pits to limit the potential for spills of chemicals, fuels or other polluting substances.
- The retention and enhancement of existing remnant vegetation on the Project Area will provide protection to waterway functions;
- Adoption of suitable sewerage reticulation systems to reduce infiltration to and peak flows in the site's sewerage system;
- Every property (residential, commercial and industrial) will have a suitably sized rainwater tank which will be plumbed into the property, thereby reducing demand on potable sources and assisting with stormwater quantity and quality management;
- Buffer areas of an average of 100m will be provided to all major waterways and remnant vegetation within the Project Area to protect water quality, prevent erosion and protect ecological values;
- Provision of permanent water treatment measures (such as gross pollutant traps, swales, bioretention basins and wetlands within the Project Area;
- Water treatment measures will be designed to minimise maintenance requirements;
- Extensive use of bio-retention pods in the streetscape and bio-retention basins within open space areas;
- Constructed wetlands/infiltration basins will be located in major open space corridors to increase evapotranspiration and control flows to waterways/freshwater wetlands;
- Implementation of stormwater detention and reuse within the development footprint to capture rainfall and conserve wet and dry periods within adjacent wetlands and maintain the existing hydrological regime;
- Retention and progressive rehabilitation of native vegetation communities within the Project Area;
- Setting aside an area of approximately 26ha on the Bells Creek south floodplain to provide additional floodwater storage capacity.
- Flood planning levels are to be based on the modelled design peak flood levels with an appropriate allowance for climate change to provide flood immunity now and into the future.
- Installation of additional open drainage channels to assist with flood relief.
- Providing community education programs to occupants on limiting potable water use and managing stormwater quality (e.g. by reducing fertiliser use, not creating gross pollutants etc.)
- An ambient surface water quality monitoring will be initiated in Bells Creek to provide baseline condition data. In addition, an existing stormwater event-based performance monitoring program will be continued within the Project Area to collect further stormwater quantity and quality data. This data will be used as a real time surveillance tool to ensure construction and operational stormwater management measures are operating according to intent.
- Systematic monitoring of groundwater will also be undertaken immediately downstream of industry and enterprise areas to provide early warning in the event of failure of groundwater protection strategies.
- To ensure the site is not contributing to Lyngbya blooms in the Passage, stormwater runoff from the site during and for a period of 2-3 years following development will be periodically monitored for the identified triggers of high dissolved iron In the event, considered extremely unlikely, that such materials are observed, corrective actions would be initiated, including:
    - Identification of where the materials may be coming from and treatment of materials at the source;
    - Aeration of stormwater via rock cascades to support the oxidation of dissolved iron; and
    - The construction of temporary detention systems to facilitate the deposition of iron following oxidation.

Stockland has experience with implementing innovative stormwater management systems in the local area (Bellvista) and it is proposed that this experience will assist in achieving success at Caloundra South. The later stages of Bellvista have been used as exemplars for Water Sensitive Urban Design (WSUD) by the SEQ Healthy Waterways Partnership. Bellvista is referred to as a case study within the Concept Design Guidelines for Water Sensitive Urban Design (Healthy Waterways 2009). The case study refers to the range of 'Best Planning Practices' and 'Best Management Practices' (as recommended by the Concept Design Guidelines) that were employed at Bellvista, including:

- Encouraging water conservation (managing demand);
- Rainwater harvesting through the use of tanks on all individual houses;
- Use of bio-retention systems;
- Use of constructed wetlands;
- Design of a WSUD solution to suit the flat terrain;
- Integration of WSUD into multiple use areas rather than focusing on public open space;
- Integration of WSUD into street layout and streetscapes; and
- Fostering appreciation of WSUD within the community by using waterscapes as public art.

A summary of key potential significant impacts is presented in **Table 4.1** below.

Table 4.1: Key potential significant impacts, proposed mitigation measures and residual impacts after mitigation is applied

Potential Significant Impact	Proposed Mitigation Measure	Residual Impact
Ramsar Wetlands		
Destruction or modification of the wetland	No mitigation required as the wetland will not be directly impacted by the project through the removal or modification of any part of the wetland.	No residual impact
Change to groundwater levels of Ramsar Wetland	There will be some reduction in the groundwater levels at the eastern wetlands within the site that buffer the Ramsar Wetlands. This reduction however, will return groundwater levels closer to their natural level when the site was vegetated.	Whilst it is not expected this will have an impact on the Ramsar Wetland itself, monitoring will be undertaken as a precautionary measure so that a change in the Ramsar wetland composition can be identified and corrective measures applied.
Change to surface water flows (frequency, volume or duration)	Changes to surface water flows will be minimised through stormwater management measures such as stormwater storage, harvesting and stormwater infiltration to groundwater.	Modelling does show a residual impact on the flow regime in Bells Creek; this will result in a minor alteration in salinity levels which is considered within the limits of natural variability.
Deterioration of surface water quality	The area required for the provision of Water Sensitive Urban Design (WSUD) infrastructure will be equivalent to up to 5.5% of the development footprint (i.e. the urbanised area excluding major open space areas). The location of the WSUD infrastructure is not confined to the development footprint.	There will be some (minimal and mostly positive) change in surface water quality within Bells Creek and Pumicestone Passage.
Deterioration of groundwater quality	Heavy industry, a potential source of groundwater contaminants will be excluded from development. Light industry and enterprise areas will be located away from high risk areas and control measures such as bunding will be required.	No residual impact
Introduction of an invasive weed or	A Pest and Weed Management Plan	No residual impact.

Potential Significant Impact	Proposed Mitigation Measure	Residual Impact
pest species	will be prepared for both construction and operation phases. The strengthening of vegetated areas in the east of the site through rehabilitation will improve buffering to the Ramsar wetland from the proposed development.	
Listed Threatened Species		
Decline of the Wallum Sedgefrog population or its habitat	Habitat for Wallum Sedgefrog will be retained on site. Whilst unlikely, there may be some habitat removal associated infrastructure corridors. If this occurs, mitigation measures such as frog fencing and frog-friendly structures will be included in the design of infrastructure. There will be a net gain in Wallum Sedgefrog habitat with additional planting and appropriate wetland areas provided. A Fauna Management Plan will be prepared that provides detailed protection measures.	The population on site, whilst notable, is only a small area of the overall Wallum Sedge frog habitat on the Sunshine Coast. Whilst there may be some localised impact it is not expected to be significant impact on the total population once mitigation measures are applied. Overall, whilst there may be a short term impact related to construction, it is unlikely there will be a long term impact on the Wallum Sedgefrog population. Overall, the total area of available habitat is likely to be increased with additional planting and wetland creation.

5 Conclusion on the likelihood of significant impacts

5.1 Do you THINK your proposed action is a controlled action?

	No, complete section 5.2
X	Yes, complete section 5.3

5.2 Proposed action IS NOT a controlled action.

Specify the key reasons why you think the proposed action is NOT LIKELY to have significant impacts on a matter protected under the EPBC Act.

5.3 Proposed action IS a controlled action

Type 'x' in the box for the matter(s) protected under the EPBC Act that you think are likely to be significantly impacted. (The 'sections' identified below are the relevant sections of the EPBC Act.)

	Matters likely to be impacted
	World Heritage values (sections 12 and 15A)
	National Heritage places (sections 15B and 15C)
X	Wetlands of international importance (sections 16 and 17B)
	Listed threatened species and communities (sections 18 and 18A)
	Listed migratory species (sections 20 and 20A)
	Protection of the environment from nuclear actions (sections 21 and 22A)
	Commonwealth marine environment (sections 23 and 24A)
	Great Barrier Reef Marine Park (sections 24B and 24C)
	Protection of the environment from actions involving Commonwealth land (sections 26 and 27A)
	Protection of the environment from Commonwealth actions (section 28)
	Commonwealth Heritage places overseas (sections 27B and 27C)

To support this referral Stockland has undertaken site investigations and assessments that go beyond that required for this stage of a masterplanned project of this nature. This has been done to demonstrate that a community of this size can be developed and that the proposed project may proceed without posing a significant risk for matters of NES.

As the site is largely cleared of pine, the remaining remnants and the species they contain are of most interest from an MNES perspective as is the Ramsar wetland within Pumicestone Passage to the east.

The wallum sedgefrog is the primary threatened species located on the site and whilst there may be some direct impacts to its habitat, it is not considered that this constitutes a significant impact on the species. In fact given the area proposed for rehabilitation of habitat on site (that will include wallum sedgefrog habitat) it is likely that the species will thrive at Caloundra South.

Stockland is extremely cognisant of the need to demonstrate no significant impacts on Pumicestone Passage. The project does not propose any direct impacts to the Ramsar wetland. Managing indirect impacts from the site has been the focus of studies undertaken into acid sulphate soils, water quality and quantity, flooding and groundwater quality and quantity.

A great deal of focus has also been given to designing water treatment measures that can be effectively implemented to achieve the objective of "no net worsening" of existing water quality in Pumicestone Passage. It

is these large scale integrated planning measures that will have the greatest impact on preventing environmental harm occurring as a result of the proposed development.

The detailed investigations undertaken to date have demonstrated that the proposed project is unlikely to have a significant impact on the Ramsar wetland MNES, either directly or indirectly once mitigation measures are implemented. Minor changes to surface water quality and Wallum Sedgefrog Habitat are predicted to occur once mitigation measures are in place.

However, given the scale of project, and the environmental values of the surrounding area it is acknowledged that very stringent protection measures and ongoing management of development will be required. Whilst a best practice approach to investigations and modelling has been utilised, it does rely on a number of assumptions that may be subject to alteration as detailed design progresses.

For these reasons, this referral has identified that Wetlands of National Importance is the matter likely to be impacted as a result of the development; although it is believed that the combination of management measures, the development staging and ongoing monitoring that has been proposed would be sufficient to ameliorate potential impacts.

6 Environmental record of the responsible party

		Yes	No
6.1	**Does the party taking the action have a satisfactory record of responsible environmental management?**	**Yes**	

Provide details
Stockland is well recognised for its commitment to excellence in sustainability and the delivery of real and tangible sustainability outcomes that are voluntary and beyond compliance. Stockland is a member of the Dow Jones Sustainability Index, FTSE4Good and has been included on the leadership index of the Carbon Disclosure Project. Stockland was category leader in the ACCA sustainability reporting awards 2010 and has also recently received the following sustainability awards:

- Ethical Investor magazine Sustainable Company of the Year 2009
- Recognised at the 2010 World Economic Forum in Davos by inclusion in the Corporate Knights Global 100 Most Sustainable Corporations in the World (ranked 25)
- UDIA WA 2009 - Residential Development over 250 lots Award - 'Newhaven' project for its significant investment in environmental and social sustainability initiatives
- Green Building Council of Australia for Stockland's head office in Sydney - the first refurbished office building in Australia to obtain a Green Building Council of Australia 6-Star Green Star rating and the recently completed 6-Star Green Star GBCA rated property at 2 Victoria Avenue in Perth CBD, and
- Milo Dunphy Award for Sustainable Architecture - Stockland Head Office.
- Member, Dow Jones Sustainability Index 2010-2011 (Rated 2nd most Sustainable Property Organisation Globally)
- National Winner City Switch Award for Energy Efficiency in Office Tenancies
- Goldman Sachs Climate Leadership Index Project 2010
- Green Building Council of Australia Fellowship Award to Managing Director (for leadership in Developing, Owning and Managing Green Buildings and ongoing support to the GBCA)

In Stockland's residential development business they have used stakeholder engagement to inform four sustainability priority areas for consideration in all aspects of their business:

1. Society priorities: Taking a role in contributing to a strong, vibrant, healthy and economically viable society. This includes Stockland's role in housing affordability, economic contribution and job creation,
2. Community development: Acknowledging the soft and hard infrastructure that creates a sustainable community,
3. Climate change and energy: Providing an energy management approach that considers the current and future climate change impact,
4. Natural resources (water and biodiversity): Recognising the importance of the water management approach and reducing impact on biodiversity through developments.

With reference to the issues outlined within this referral, the areas of biodiversity conservation and water management are considered to embody the most important elements for further discussion with regards to Stockland's environmental history.

Biodiversity
In terms of leading practice in biodiversity, Stockland has shown that it is committed to meeting conservation obligations and to go beyond the mandatory level of requirements in priority areas. This has been illustrated in the following projects:

- 'Brightwater' (a residential development on the Sunshine Coast) –established

46 ha of conservation area on site this project, and involved the largest relocation in the southern hemisphere of sensitive coastal wallum heath land. The $5 million translocation project involves moving 12.2 ha of heath land vegetation from a 215 ha development site to a degraded reserve at the nearby University of the Sunshine Coast campus. The vegetation was moved 'intact', which involves cutting out the vegetation in slabs (with the plant canopy, stems, roots and soil relatively undisturbed) and transporting the slabs to the reserve and reconstructing the heath land. The translocation was completed in 2008 and is undergoing a close monitoring regime run by the university.

- North Shore (a residential development in Townsville) – presented several challenges for management of threatened species, which was achieved through conservation of 330ha for threatened species (i.e. Black-throated Finch & Stripe-tailed Delma), fire management, seed collection for revegetation and conservation and enhancement of on-site river ecosystems to protect receiving waters (i.e. Halifax Bay, Great Barrier Reef).

Water Management

Stockland has developed and implemented world class water management, capture and storage strategies that often go beyond 'best practice' requirements in terms of water management, as illustrated in the list of Queensland projects below:

- 'Pacific Pines' (a residential development in Gaven) – with the help of water management specialists, Stockland developed an aquifer within the development for management of stormwater. The aquifer captures stormwater and enables the irrigating of open space areas in the community while reducing the use of potable water.
- 'Riverstone Crossing' (a residential development in Coomera) – the development incorporated water sensitive urban design (WSUD) elements, such as household rainwater tanks, gross pollutant traps, swales and bio-retention basins to address water quality issues. As potable water use was also an issue at this site, the development incorporated a 1ML RainVault which is a community system used to capture and retain the treated runoff for irrigation.
- 'North Shore' (a residential development in Townsville) – the development will be a first for its innovative use of WSUD in Townsville. WSUD features include: irrigation of open space with treated wastewater, large scale bio-retention systems and flood mitigation designed for cyclonic storm surge and climate change impacts (i.e. water level increases).
- 'Bellvista' (a residential development in Caloundra) – the development is considered an exemplar in WSUD, having integrated WSUD at both the concept planning and detailed design phases. The development is one of the first to utilise a combination of rainwater harvesting, swales and street-based bio-retention to achieve water quality outcomes.

Stockland have also been recognised for their management of water issues on several projects, as shown:

- UN Association of Australia World Environment Day Awards - finalist in the Excellence in Sustainable Water Management for Mernda Villages, which was the first project in Victoria to utilise rain gardens in the streetscape for 'at-source' water treatment and wetlands connected to an aquifer storage and recovery system.
- Numerous awards from Sydney Water and Industry Associations for outstanding water sensitive urban design and management

6.2	**Has either (a) the party proposing to take the action, or (b) if a permit has been applied for in relation to the action, the person making the application - ever been subject to any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources?**		**No**

	If yes, provide details		
6.3	**If the party taking the action is a corporation, will the action be taken in accordance with the corporation's environmental policy and planning framework?** **If yes, provide details of environmental policy and planning framework** Stockland's environmental policy outlines its Corporate objective of seeking to embrace environmental best practice (**Appendix K**).	**Yes**	
6.4	**Has the party taking the action previously referred an action under the EPBC Act, or been responsible for undertaking an action referred under the EPBC Act?** **Provide name of proposal and EPBC reference number (if known)** There are numerous referrals from all over Australia that have been referred under the EPBC Act. Some referrals over the last 2 years are listed: • East Landsdale Residential Development (WA) – 2010/5772 • Residential Development, Craigieburn (VIC) – 2008/4161 • Malcom Creek Bridge & Highlands Residential Development (VIC) – 2008/4125 • Bellvista II (QLD) – 2010/5428 • Truganina Development (VIC) – prepared under DSE strategic assessment framework approved under bilateral agreement	**Yes**	

7 Information sources and attachments

(For the information provided above)

7.1 References

The following datasets were obtained to undertake desktop investigations for the project:

Reference	Reliability	Uncertainties
Aerial photography from Vekta (May 2010)	Accurate at the time of collection.	The aerial photograph represents a snap shot in time of the Project Area.
Biodiversity Planning & Assessment Mapping, EPA v3.4 2005	Relies on accuracy of other databases, i.e. remnant vegetation, WildNet	These relate to origins of databases utilised to compile mapping.
Ecological Health and Monitoring Program (EHMP), Healthy Waterways 2009	Data based on collection of water samples.	N/A
Essential Habitat mapping, Environmental Protection Agency (EPA) v6 2009 with updates	Based on actual records and predictive modelling for some species.	Relies on accuracy of remnant vegetation mapping.
Fish Habitat Areas, DPIF 2009	Based on locations of estuaries.	Predictive data.
Herbrecs, EPA 2009	Locations of vouchered specimens.	Some data points are very dated and may no longer be relevant due to changes in the landscape.
Regional Ecosystem Mapping, Queensland Herbarium v6 2009 with updates	Mapping conducted with aerial photos at a scale of 1:50 000.	Have been addressed through ground-truthing of vegetation mapping.
WetlandsInfo Search, EPA 2009	Regularly updated	N/A
WildNet, EPA 2009	Locations of vouchered specimens and public records.	Accuracy of some records is dependant on the skill of the observer.

For a list of references refer to Table 7.2.

7.2 Reliability and date of information

The development potential of the Project Area has been the topic of investigation by the previous owner, the proponent and local government for over 10 years. There have been numerous environmental and other studies undertaken to date, as summarised in **Table 7.2**.

Some of this data was collected on behalf of Lensworth for the *Caloundra Downs II Informal Land Use Study* in 1999. Supplementary investigations were undertaken by Caloundra City Council in 2000 to contribute information to the Caloundra City Plan and then again in 2005 for the Local Growth Management Strategy.

More recently additional investigations have been undertaken by Stockland to achieve a variety of purposes. Studies include field and desk top investigations to address ecology, surface water quality, ground water quality, flooding, acid sulfate soils, cultural heritage, biting insects and agricultural land quality.

The ecological and water quality surveys that were undertaken in February 2009 and October/November 2010 have informed this referral, as changes in land use combined with natural processes are likely to have altered the environment in the ten (10) years since the original Lensworth surveys. In order to gain a more complete review of the Project Area from an ecological perspective, desktop analysis and field work were undertaken. The primary aims of the field survey were to:

- Evaluate habitats within the Project Area;
- Evaluate downstream habitats that may be impacted; and
- Determine the likelihood of significant species[6] occurring on the Project Area based on local records and the habitat evaluation, particularly Wallum Sedgefrog (*Litoria olongburensis*), Wallum Froglet (*Crinia tinnula*), Wallum Rocketfrog (*Litoria freycineti*), Swamp Stringybark (*Eucalyptus conglomerata*), Swamp Lily (*Phaius sp*.) and Attenuate wattle (*Acacia attenuata*).

[6] Significant species are those listed as *Threatened* under the Queensland *Nature Conservation (Wildlife) Regulation 2006* or *Nature Conservation Act 1992* (NC Act) or Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC).

Table 7.2 Studies undertaken to date

Reference	Reliability	Uncertainties
Arup (2010) Caloundra Downs Visual Assessment (**Appendix E**)	Accurate at the time of collection.	Some information is anecdotal and qualitative.
Aquateco Consulting (2010) Caloundra Downs Aquatic Ecosystem Surveys – Interim Report (**Appendix I**)	Utilises historical reports, site visits and surveys	Based on opportunistic observations, targeted frog survey and habitat assessment.
Biodiversity Assessment and Management (2010) Caloundra Downs Development Area – EPBC Act Listed Flora & Fauna Assessment. (**Apppendix J**)	Accurate at the time of collection.	Based on opportunistic observations, and habitat assessment.
BMT WBM (2010) Caloundra Downs Development: Flood Risk Management Strategy	Accurate at the time of publication.	Based on the assumptions associated with each of the models.
BMT WBM, RPS (2011). Caloundra South Consolidated Water Report (**Appendix D**)	Relies on detailed ground and surface water quality modelling.	Some assumptions made regarding likely future development scenarios.
Brown Consulting (2010) conceptual construction phase water quality management plan, Earthworks phase.	Relies on detailed ground and surface water modelling.	Some assumptions made regarding likely future development scenarios.
Chenoweth (2005) Caloundra South Further Investigation Area Biodiversity Report. Prepared for Caloundra City Council.	Utilises historical records, local knowledge and site visit.	Accurate at the time of collection.
Davies, S (2007) Cultural Heritage Assessment of Indigenous Values of Caloundra Downs II, South East Queensland.	Utilises historical records, local knowledge and site visit.	N/A
Dobos & Associates (2011) Caloundra South Acid Sulfate Soils (ASS) Investigation Report (**Appendix F**)	Utilises recent borehole investigations	Accurate at the time of collection.
Ecosmart Ecology (2010) Wallum Frog and Wader Report (**Appendix H**)	Utilises historical records, local knowledge and site visit.	Accurate at the time of collection.
Ganggala P/L (2008) Cultural Heritage Survey of Caloundra Downs.	Utilises historical records, local knowledge and site visit.	N/A
Golder & Associates (1999) Geology & Soils – Caloundra South	Utilises historical records, local knowledge and site visit.	Accurate at the time of collection.
Hornery Institute (2011) The Social and Community Infrastructure Network for Caloundra South- A Net Regional Benefit Approach (**Appendix C**)	Accurate at the time of publication.	Some assumptions made regarding likely future development scenarios.
Hyder Consulting (1999) Fauna & Habitat Assessment.	Utilises historical records, local knowledge and site visit.	Accurate at the time of collection.
LAMR (1999) Caloundra Downs II Study – Vegetation & Botanical Issues.	Utilises historical records, local knowledge and site visit.	Accurate at the time of collection.
NSR Environmental Consultants P/L (1999) Pumicestone Passage Study – Caloundra Downs Investigation Area.	Utilises historical records, local knowledge and site visit.	Accurate at the time of collection.
Pumicestone Passage Advisory Task Force, 2007. *Pumicestone Passage: Live it, Love it, Protect it.* Published on behalf of Caloundra City Council	Accurate at the time of publication.	Some information is anecdotal and qualitative.

RPS Australia East (2010) Caloundra Downs North: Draft Report on hydrogeological conceptualisation to support groundwater flow model investigations	Accurate at time of publication.	Some assumptions made regarding likely future development scenarios.
RPS Australia East (2011) Caloundra South: Draft report on groundwater impact assessment	Accurate at time of publication.	Some assumptions made regarding likely future development scenarios.
Urbis (2011) Economic Benefit Assessment for Caloundra South (**Appendix B**)	Accurate at time of publication.	Some assumptions made regarding likely future development scenarios.
Water Resources Commission (1992) Pumicestone Passage, its catchment and Bribie Island – Component Study: Integrated Management Strategy.	Accurate at time of publication.	Age of publication may mean some information is out dated.

7.3 Attachments

Indicate the documents you have attached. All attachments must be less than two megabytes (2mb) so they can be published on the Department's website. Attachments larger than two megabytes (2mb) may delay the processing of your referral.

		✓ attached	Title of attachment(s)
You must attach	figures, maps or aerial photographs showing the project locality (section 1)	✓	Various figures named after Sections in which they are referred to.
	figures, maps or aerial photographs showing the location of the project in respect to any matters of national environmental significance or important features of the environments (section 3)	✓	Various figures named after Sections in which they are referred to
If relevant, attach	copies of any state or local government approvals and consent conditions (section 2.5)	N/A	
	copies of any completed assessments to meet state or local government approvals and outcomes of public consultations, if available (section 2.6)	N/A	
	copies of any flora and fauna investigations and surveys (section 3)	✓	
	technical reports relevant to the assessment of impacts on protected matters that support the arguments and conclusions in the referral (section 3 and 4)	✓	
	report(s) on any public consultations undertaken, including with Indigenous stakeholders (section 3)	N/A	

8 Contacts, signatures and declarations

Project title: Caloundra South Master Planned Community

8.1 Person proposing to take action

Name	Marc Maynard Wilkinson
Title	State Planning and Approvals Manager – QLD.
Organisation	Stockland Caloundra Downs Pty Ltd
ACN / ABN (if applicable)	ACN: 068356525/ ABN 068 356 525
Postal address	PO Box 20, Wurtulla QLD 4575
Telephone	(07) 5491 0105
Email	marc.wilkinson@stockland.com.au
Declaration	I declare that the information contained in this form is, to my knowledge, true and not misleading. I agree to be the proponent for this action.
Signature	"By its duly constituted attorney under power of attorney number 712393165 who has not received any notice of revocation of the attorney"
Date	6/6/2011

Name	Marc Maynard Wilkinson
Organisation	Stocklands Bells Creek Pty Ltd
ACN / ABN (if applicable)	ACN: 068699546/ ABN: 078 699 546
Postal address	PO Box 20, Wurtulla QLD 4575
Telephone	(07) 5491 0105
Email	marc.wilkinson@stockland.com.au
Declaration	I declare that the information contained in this form is, to my knowledge, true and not misleading. I agree to be the proponent for this action.
Signature	"By its duly constituted attorney under power of attorney number 712393128 who has not received any notice of revocation of the attorney"
Date	6/6/2011

8.2 Person preparing the referral information (if different from 8.1)

Individual or organisation who has prepared the information contained in this referral form.

Name	Rachel Brazier
Title	Associate
Organisation	Arup Pty Ltd
ACN / ABN (if applicable)	ACN: 000 966 165/ ABN: 18 000 966 165
Postal address	GPO Box 685, Brisbane Q 4001
Telephone	(07) 3023 6000
Email	Rachel.brazier@arup.com
Declaration	I declare that the information contained in this form is, to my knowledge, true and not misleading.

Signature  Date 6/06/2011