

**DETAILED FLORA, FAUNA, HYDROLOGY
AND CULTURAL HERITAGE STUDY
OF
MACKAY PORT AUTHORITY WESTERN LANDS
AND AMSA LAND**

DRAFT REPORT SUMMARY

Prepared for:

MACKAY PORT AUTHORITY

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CONTENTS

1.0	INTRODUCTION	1
2.0	PORT PLANNING	3
3.0	GEOMORPHOLOGY AND SOILS	4
4.0	HYDROLOGY	7
5.0	VEGETATION	8
6.0	FAUNA AND FAUNA HABITAT	12
7.0	REGIONAL ECOSYSTEMS	14
8.0	CULTURAL HERITAGE	19
9.0	OVERVIEW OF ENVIRONMENTAL VALUES	20
10.0	PROPOSED DEVELOPMENT	22
11.0	OPTIONS AND IMPACTS	24
12.0	MITIGATION STRATEGIES	33
13.0	APPROVALS	37
14.0	REFERENCES	39
15.0	ABBREVIATIONS AND GLOSSARY	39

1.0 INTRODUCTION

This study is concerned with the following lands that are owned by, or in the process of being acquired by, the Mackay Port Authority (see Figure 1.1):

- Lot 1 on RP748350. This land is known as the 'western Port lands' and has a total area of 185.9 ha. It is owned under freehold title by the Port Authority and designated as Strategic Port Land under the 1999 Seaport Land Use Plan. The northern and western sides of this land are shown as buffer areas while the balance of the site (approximately 103 ha) is allocated for future port uses.
- Lot 1 on RP736466. This land is known as the AMSA land and has a total area of 14.7 ha. It is owned under freehold title by the Australian Maritime Safety Authority (AMSA) and is in the process of being acquired by the Port Authority. Under the 1999 Seaport Land Use Plan it is designated as Future Strategic Port Land.

The terms of reference for the study require that a detailed scientific report be produced on the flora, fauna, hydrology and cultural heritage of the western Port lands and the AMSA land.

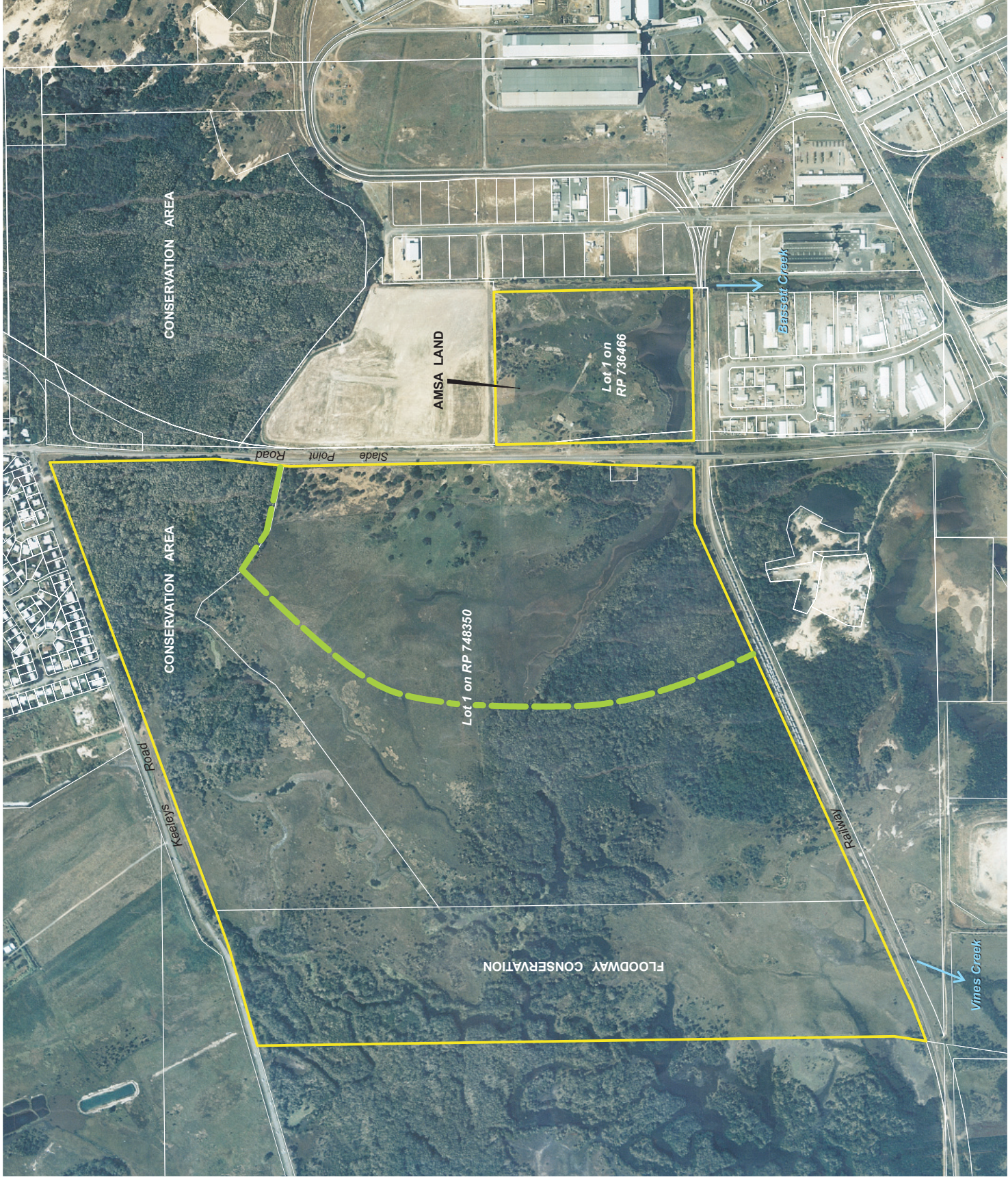
The report is to include an assessment of environmental values and to identify likely impacts of placing fill on parts of the subject lands that are proposed for development. As appropriate, mitigation strategies and development alternatives are to be considered.

Preparation of this report has relied upon:

- a variety of previous reports and maps dealing with geology, coastal geomorphology, vegetation, flooding, bird sightings, estuarine habitats and regional ecosystems,
- air photo interpretation dating back as far as 1947,
- new surveys of soils, vegetation, fauna and cultural heritage,
- acid sulfate soil assessments,
- hydrological and flood modelling, and
- discussions with officers from the Environmental Protection Agency, Dept. of Natural Resources and Mines, Qld Fisheries Service, Qld. Herbarium, Mackay City Council and Mackay Port Authority.

The report has been prepared by the following organisations and individuals:

- Environment Science and Services – environmental planning and ecology,
- Biodiversity Assessment and Management – zoology,
- Mr. James Elsol – botany,



LEGEND

- Study Area
- Catchment divide



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PROJECT **WESTERN PORT LANDS**

STUDY AREA

DRAWN	D.J.P.	REV	
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- Mr. Rod Dawney – geology and coastal geomorphology,
- Gilbert and Sutherland – soils and acid sulfate soils,
- Lawson and Treloar – hydrology and flood modelling, and
- Central Queensland Cultural Heritage Management – cultural heritage assessment.

The study team has been assisted by a Reference Group comprising representatives from government agencies and community organisations.

2.0 PORT PLANNING

The Mackay Port Authority is a statutory government-owned corporation within the meaning of the *Government Owned Corporations Act 1993*. The Port Authority is accountable to its two shareholding Ministers – the Minister for Transport and the Treasurer.

The Mackay Port Authority plans its strategic direction in consultation with the shareholding Ministers, as prescribed in the *Government Owned Corporations Act 1993* and in accordance with the *Transport Infrastructure Act 1994*. The Port Authority has in place a well-established planning process that is used to identify strategic port lands, establish strategic directions, assess development proposals and undertake environmental management. The following three planning and management documents are of particular relevance to the study lands:

▪ **Seaport Land Use Plan**

The Seaport Land Use Plan is a statutory document prepared under the provisions of the *Transport Infrastructure Act 1994*. The Land Use Plan identifies strategic port lands and the current and proposed uses of that land. A port authority must not use strategic port land in a way that is inconsistent with its current land use plan, other than with the approval of the Minister for Transport. In so far as the western Port lands are concerned, the northern and western sides of the property (approximately 40% of the total area) are shown as 'Buffers' to be used for floodway, conservation and buffer purposes – the balance of the property is designated for future 'Port Use'. The AMSA site is designated as 'Future Strategic Land'.

▪ **Port Development Plan**

The Port Development Plan is a strategic planning document that identifies likely short, medium and long term development of the Port. The 1999 Port Development Plan has been prepared to a planning horizon of 2025 and foreshadows substantial growth in the Port and associated industries over this period. Parts of the western Port lands and all of the AMSA land are designated for future development.

▪ **Management Plan for Conservation Areas**

The Port Development Plan also identifies areas that should not be developed by virtue of their high conservation value, flood mitigation role and/or their buffering role. A management plan for these areas was completed in 1996. Within the western Port lands, there are 3 conservation areas that collectively make up the 'Buffer' shown on the northern and western sides of the property in the Seaport Land Use Plan. These 3 areas are:

- an area of dense *Melaleuca leucadendra* woodland in the north-eastern corner of the property.
- an area of mixed melaleuca woodland and grassland along the western boundary of the property that forms an important flood pathway during flood events in the Pioneer River, and
- an area adjacent to Keeleys Road that links the above 2 areas and provides important habitat for a range of waterbirds.

Collectively, these 3 areas that are designated and managed as conservation areas provide long-term protection to those parts of the subject lands that have the highest conservation values. They also help to preserve an existing wetland habitat link that extends from the Pioneer River north to Slade Point.

3.0 GEOMORPHOLOGY AND SOILS

The subject lands are in the central part of a 5km wide belt of Quaternary coastal deposits north of the current mouth of the Pioneer River. The area is dominated by estuarine deposits with smaller areas of older preserved beach ridge deposits.

Interpretation of geological mapping and aerial photography has enabled the likely evolution of the coastline north of the Pioneer River to be determined. As shown in Figure 3.1, approximately 50,000 years ago, the outcropping bedrock at Mt. Bassett and Slade Point were islands. Over time, prograding coastal deposits have infilled the waters around these 'islands' and changed the course of the main estuarine channel of the Pioneer River. This has resulted in the characteristic coastal landform of estuarine deposits and older beach ridge deposits that exist today. Up until the early 1900s, there was a tidal creek immediately north of the Port.

Geological and landform information can also be used to describe 'land zones'. As noted by Sattler and Williams (1999), the geomorphic differences between land zones result in marked differences in the structure and function of their associated regional ecosystems. The geological and soils investigations confirm the presence of Land Zone 1 (marine tidal clay

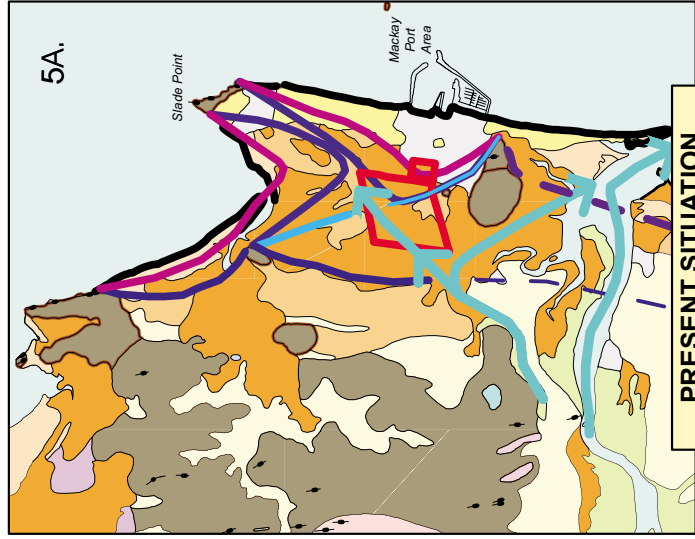
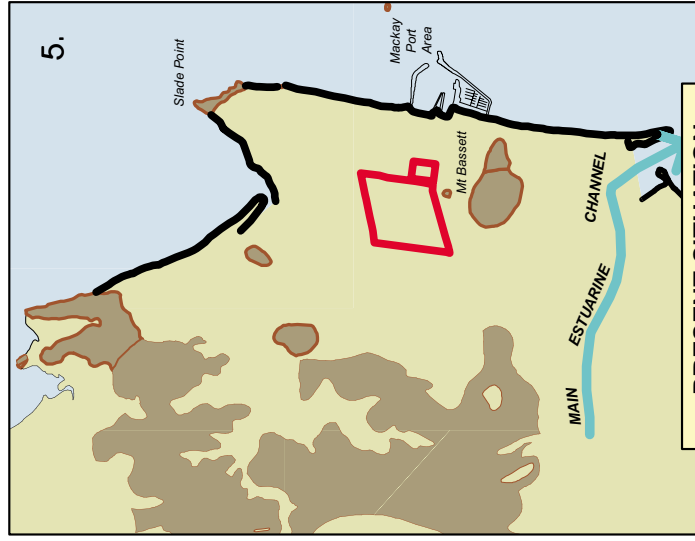
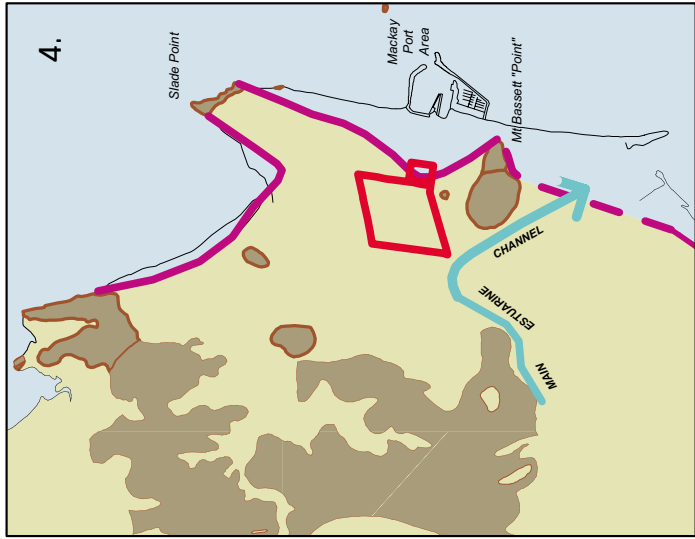
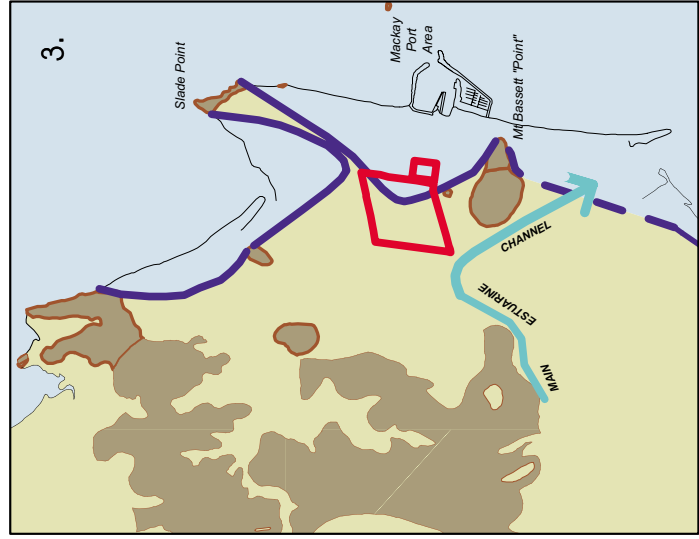
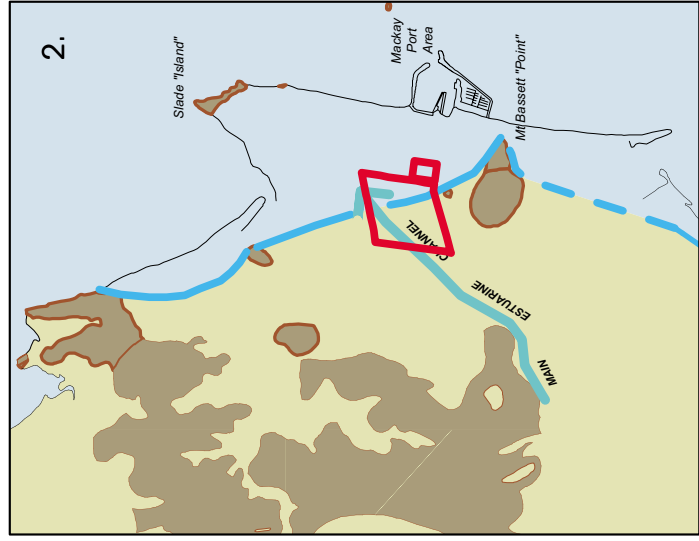
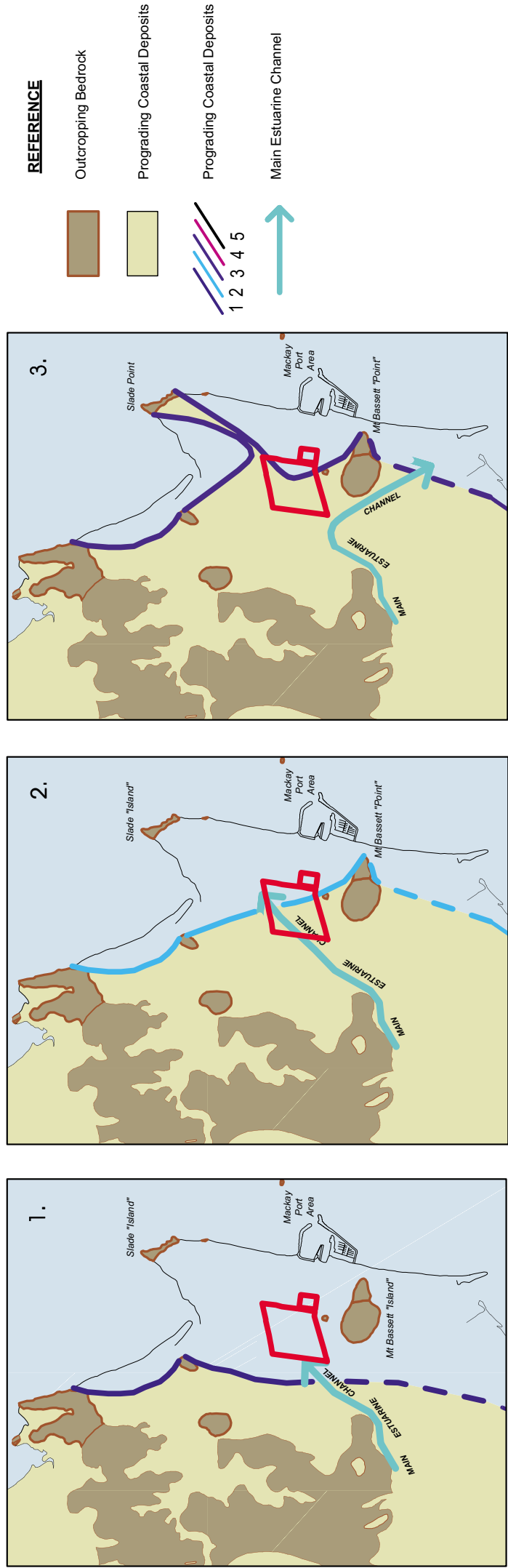


FIGURE 3.1

COASTLINE EVOLUTION

COMPILED FROM
PLEISTOCENE BEACH RIDGES
R.L. Dawney - Feb. 2002

plains) and Land Zone 2 (coastal sand dunes and swales) on the study lands. This finding is consistent with the Key to the Land Zones of Queensland presented in Accad et al (2001).

Soil surveys undertaken during November 2001 confirm the presence of soils consistent with a Quaternary coastal depositional environment. The following major soil types occur on the subject lands:

- Anthroposols which are associated with the areas of fill immediately adjacent to the Mackay-Slade Point Road on both the AMSA site and within the western Port lands. These soils result from the placement of fill at some time in the past. These soils consisted of dark brown to dull yellowish brown medium-coarse sand to loamy material.
- Tenosols which stretch north from the southern boundary of the western Port lands. These soils indicate beach ridge deposits and consist of greyish yellow medium sandy loam overlying a greyish yellow brown clayey medium to coarse sand.
- Hydrosols which cover the majority of the site which is low lying and relatively level. These soils consist in general of a thin layer of black to brownish loam underlain by a black to brownish grey coarse sandy clay loam to silty medium clay.

Soil salinity readings of the hydrosols suggest a history of periodic tidal inundation with levels of salinity higher than would typically be associated with a freshwater wetland ecosystem. A number of boreholes returned high to very high salinity in surface soil layers. These soils would not sustain the growth of anything other than salt tolerant species. Soil testing indicates that surface horizons were deposited under estuarine conditions.

The acid sulfate soil assessment of in-situ soils has revealed either low level actual acid sulfate soil or organic acidity. Based on the nature of the soil, the lack of jarosite, the slight reaction intensity and low peak reaction temperatures during screening and the lack of visible pyrite during microscopic examination, it is considered that much of the existing acidity is due to the presence of organic acids.

These results may be attributed to the geomorphology of the site and the recent changes to the hydrology. Any potential acid sulfate soils would be attributed to marine derived sediments which would have been deposited in the low energy, infrequently tidally inundated coastal floodplain/saltmarsh where the accumulation of iron rich silts, sands and clays, and the presence of sulfate from seawater would have been ideal for the formation of pyrite.

Recent (past 60 years) changes to the hydrology of the site has resulted in the near exclusion of tidal inundation (particularly in the Bassett Creek catchment), except during exceptional storms and flooding. As such, the deposition of marine derived sediments has been very severely reduced and with the exposure of surface soils to oxygen, any previously deposited

potential acid sulfate soils would have slowly oxidized and much of the acidity would have leached away. The water table being just below the ground level for much of the year would have resulted in slower oxidation and leaching in the subsoils.

4.0 HYDROLOGY

The majority of the study area is less than 4 metres (AHD) in elevation. On the AMSA site, there is a low ridge on the northwestern corner. The site drains to an existing lagoon on the southern boundary. This lagoon drains into an open stormwater channel that was previously the headwaters of Bassett Creek.

On the western Port lands, there is a low, indistinct north-south ridge that divides the site into two catchments. The eastern catchment drains into a lagoon in the south-eastern corner of the site and then in turn into the lagoon on the southern boundary of the AMSA land. The western catchment drains towards the south-west and into Vines Creek.

During the wet season there is standing water over low-lying parts of the western Port lands. During the dry season, the site mostly dries with the exception of the lagoons and areas subject to tidal inundation. During prolonged dry periods, both lagoons tend to dry out although the lagoon on the AMSA land is subject to greater tidal influence.

The western Port lands provide significant storage and flow attenuation for existing local runoff. For parts of the year, ground water levels are near or above the surface, and in the wet season ponded water may remain over the site for several months.

The hydrology of the study lands has been substantially modified over the past 60 years or so. With the exception of the AMSA land and areas near the Slade Point Road, the topography of the study lands has remained largely unchanged. What have changed substantially are the drainage inflows and outflows to and from the study lands. These changes include:

- major restrictions on the inflow of saltwater along tidal creeks, largely resulting from adjacent road and rail construction, and
- inflows of freshwater that are more concentrated by way of piped stormwater outfalls from adjacent urban and industrial areas.

Under large Pioneer River flood events, breakouts of flow occur into the study lands, with flow from Vines Creek crossing the railway and flowing, in a general northerly direction through the site, across Keeleys Road and ultimately north to McCready's Creek and into Slade Bay. Extensive areas of Mackay including the harbour and Slade Point areas were flooded in 1918, 1958 and 1970. Ullman and Nolan (February 1974) suggest that the 1918 and 1958 floods have a return period of one in 30 years, in terms of river flows. They recommended a 1 in 100 year design flood of some 30% more flow than these historic events, coincident with a storm

tide level of 4.53m AHD. This event was estimated to produce of breakout flow of some 850m³/s overland from Bassett Basin, north through Vines Creek, across the Harbour railway, through the area between Slade Point Road and Andergrove (including the Western Lands Site), across Keeleys Road and north to McCready's Creek.

A full two dimensional flood model has been used to estimate flood flows, depth and extent of inundation between the Pioneer River in the south and McCready's Creek in the north. The model was run for the Ullman and Nolan 1 in 100-year design flood with a breakout flow of 850m³/sec overland from Bassett Basin to McCready's Creek and with a tailwater level in McCready's Creek of 4.53m. The modelled flood event produced combined tide and flood levels of 5.63m AHD at the southern boundary of the subject land (Harbour Railway) and 4.58m AHD at the northern boundary of the subject land (Keeleys Road). These levels are greater than the highest recorded flood level on the western Port lands of 4.3m AHD in 1958. The flood flow patterns arising from the 1 in 100 year design flood are shown in Figure 4.1.

The flood modelling has also demonstrated that the existing floodway reserve on the western side of the western Port lands is largely ineffective due to the fact that remnant dunes on the northern side of Keeleys Road act to block flood flows. The primary flow path for major Pioneer River floods through the area is to the north-east, crossing Keeleys Road primarily in a 250 metre wide gap adjacent to the existing Slade Point residential area.

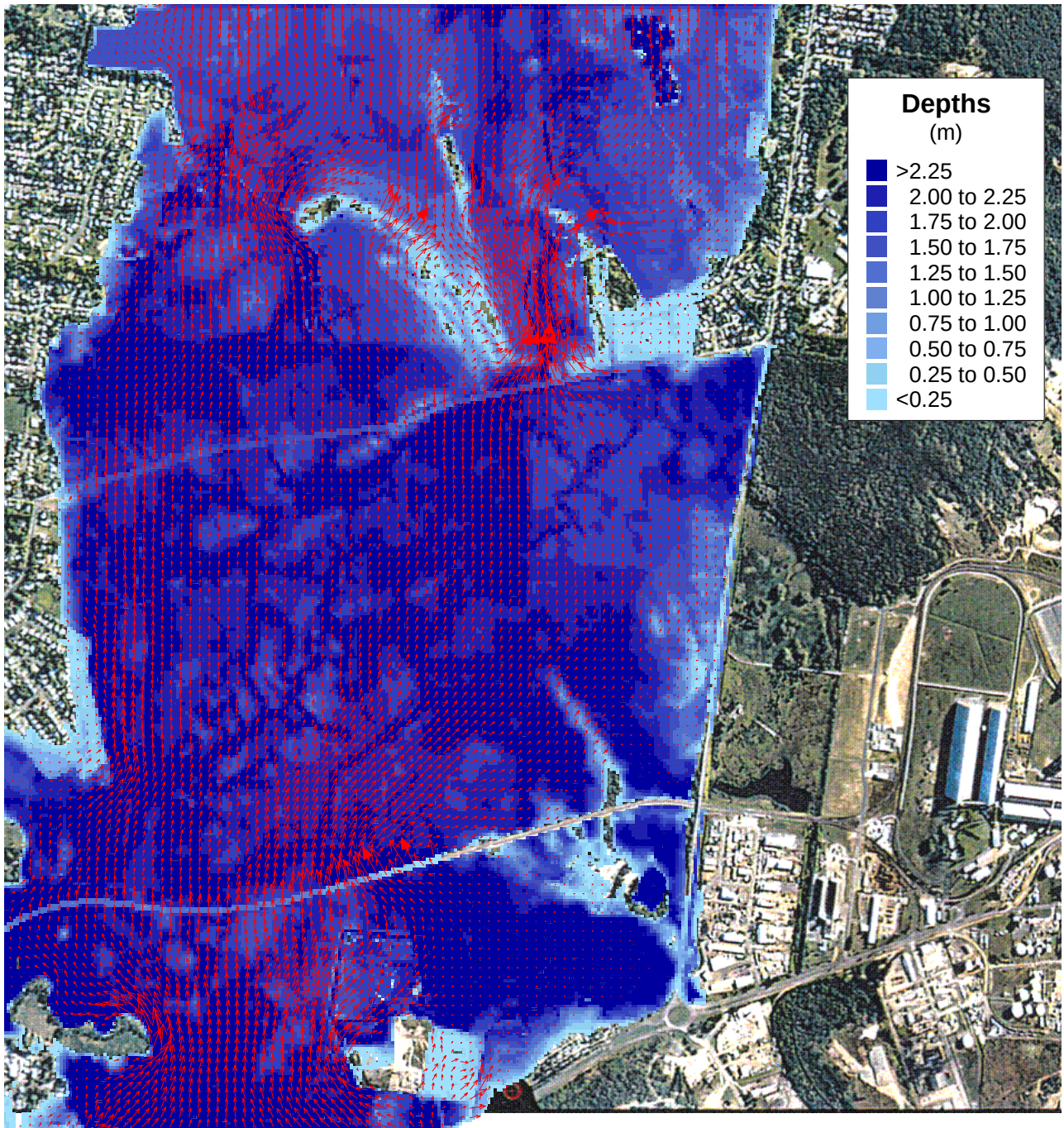
Surface water samples were collected to measure surface water salinity following a substantial rainfall event in January 2002. The test results showed:

- high salinity readings in the lagoon areas and in the drainage channel on the eastern side of the AMSA land,
- salinity levels in the grasslands/sedgeland of the Bassett Creek catchment that are mostly in excess of levels that are required for the protection of freshwater ecosystems, and
- lower salinity levels of surface waters on Land Zone 2 (quaternary coastal dunes, degraded dunes and swales).

5.0 VEGETATION

A detailed vegetation survey was undertaken in July 2001 to provide quantitative botanical data and vegetation mapping at a scale of 1:4,000. Time-series aerial photography dating back to 1947 was used to analyse changes in the vegetation over the past 55 years.

Existing information sources were also utilised. These sources included the Qld. Herbarium database (HERBRECS), vegetation mapping undertaken by the Qld Herbarium, the Mackay City Vegetation Management Plan and mangrove studies undertaken by the Dept. of Primary Industries.



→ 1.0 m/s

0 0.25 0.5
kilometres

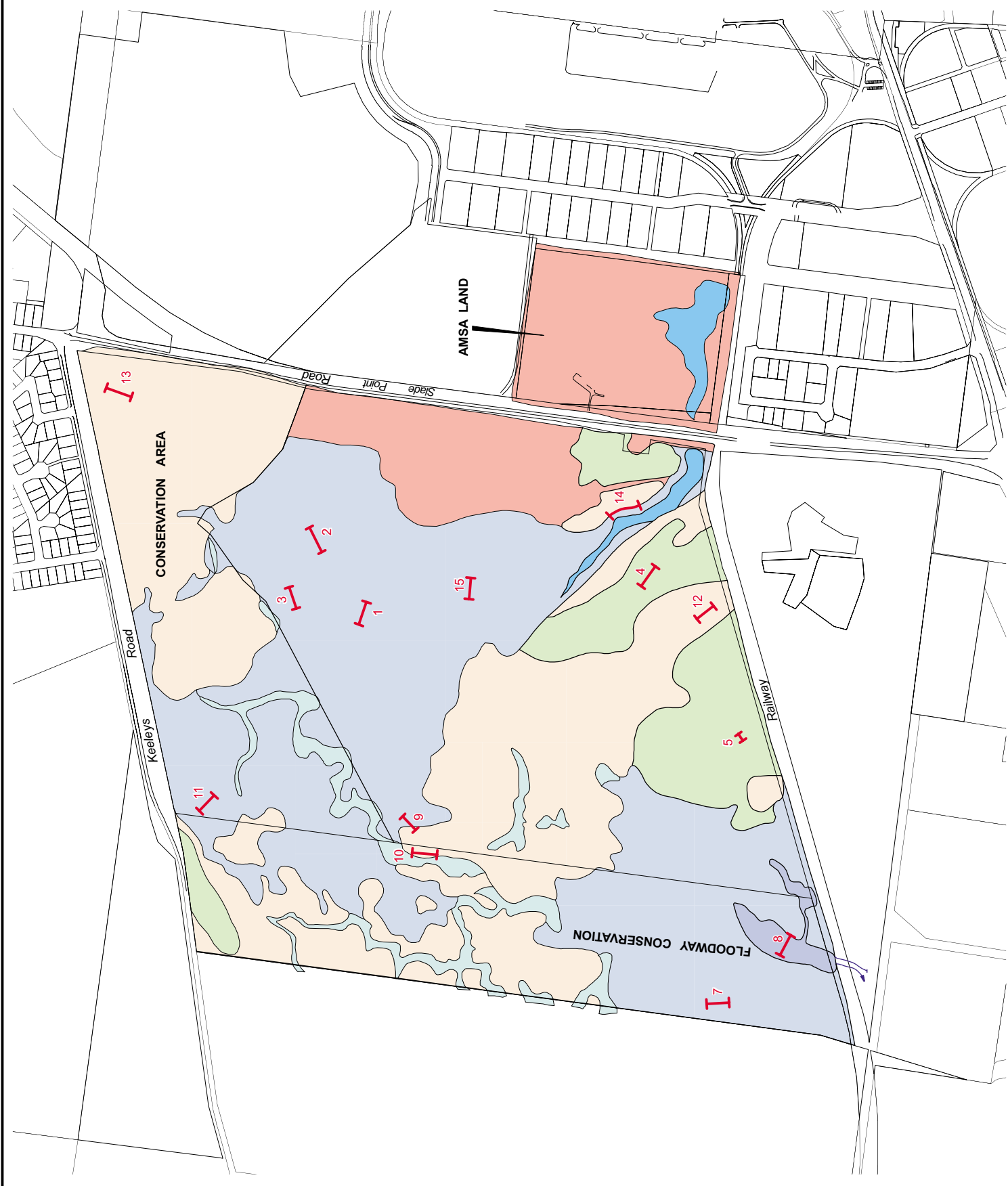
The plant communities that currently occur on the study lands are shown in Figure 5.1. On the western Port lands, 6 different 'natural' plant communities were identified (see Table 1). On the AMSA land, the vegetation is predominantly a grassland of native and exotic species including blue couch, red Natal grass, guinea grass and para grass. Native and exotic trees have been planted around the buildings and water couch is the predominant grass around the lagoon edge.

TABLE 1: PLANT COMMUNITIES ON WESTERN PORT LANDS

ELEVATION RANGE	PLANT COMMUNITY (Source: Elsol)	COMMENT
5 – 3 m	Moreton Bay Ash forests	On beach ridges – the highest ground with sandy soil mostly above flood height
3 – 2 m	Paperbark open forest	In swales – low-lying seasonally inundated clay soils
± 2 m	Grasslands and sedgeland	Extensive low-lying seasonally inundated clays. Inundated by a mixture of saltwater and freshwater depending on tides, season and flooding. Lower than the paperbark areas. Marine saltmarsh species commonly present. Some clumps of blady grass.
Typically less than 1 m	Drainage lines of seasonally free water and sedgeland types	Low lying channels draining the site. Most evident within the grasslands and sedgelands and some Paperbark areas.
	Estuarine areas – mangroves, saltmarshes and mudflats	Inundated by some tides. Vegetation affected by marine salt.
	Lagoon	Areas of permanent free brackish water draining the site. Tidal and marine influences have been restricted by the construction of adjacent roads and railway line.

The estuarine grassland and sedgeland are important habitat for *Schoenoplectus littoralis*, *Paspalum distichum*, *Fimbristylis ferruginea* and *Elaeocharis spiralis* which are largely restricted to this ecosystem. The *Melaleuca leucadenda* open forest in large swamps is unusual and is of local conservation significance. It is also habitat for the fern *Blechnum indicum* which is locally rare.

However, the vegetation surveys have not revealed any plants or plant communities that are listed as being of special conservation significance under Queensland or Commonwealth legislation. Vegetation on the AMSA land and previously filled parts of the western Port lands are highly modified. On the balance of the western Port lands, there are areas that have been disturbed by horses, cattle and feral pigs. Some parts of the Moreton Bay ash forests and the paperbark open forests are heavily colonised by weed species.



LEGEND

- Moreton Bay Ash forest
- Paperbark open forest
- Grassland and sedgeland
- Saltmarsh
- Drainage lines
- Lagoon
- Disturbed
- Vegetation Transect
- Study Area



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WESTERN PORT LANDS

TITLE

PLANT COMMUNITIES

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Oct. 2001

JOB NUMBER

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FIGURE

5.1

6.0 FAUNA AND FAUNA HABITAT

The 6 major habitat types on the western Port lands are paperbark open forest, Moreton Bay ash forest, grassland/sedgeland, estuarine communities, lagoon and disturbed. On the AMSA site, the only habitats are lagoon and disturbed.

Despite the fragmentation of habitat in the general coastal area north of the Pioneer River, the western Port lands still form an integral part of a wetlands habitat link running from Bassett Basin to Slade Point. This corridor commences with the estuarine habitat in Vines Creek, runs northwards through the melaleuca habitat of the floodway reserve, turns eastwards across the melaleuca and grassland/sedgeland habitat on the western Port lands, links with melaleuca habitat on the eastern side of the Slade Point Road and runs northwards through lagoonal and melaleuca habitat towards Slade Point.

A dry season fauna survey was undertaken over 5 nights and 5 days during May 2001 using the approved EPA methodology. The survey used a variety of trapping and observational methods and included 800 trap-nights of effort.

A wet season fauna survey was undertaken over 5 nights and 5 days during January 2002. The methodology approved by the EPA was again employed but with a greater emphasis on amphibians and migratory birds. This survey included 950 trap-nights of effort.

In total, 14 mammals, 134 birds, 14 reptiles and 10 frogs were recorded during the dry season and wet season surveys.

Of the species recorded, 16 are of conservation significance. These species, together with their primary habitat and conservation status, are listed in Table 2. In summary:

- One species (Grey-headed Flying Fox) is scheduled as 'Vulnerable' under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999*. The species is listed as 'Common Wildlife' under Queensland's *Nature Conservation (Wildlife) Regulation 1994*.
- One species (Rufous Owl) is scheduled 'Vulnerable' under Queensland's *Nature Conservation (Wildlife) Regulation 1994*.
- Three species (Black-necked Stork, Grey Goshawk and Lewin's Rail) are scheduled 'Rare' under Queensland's *Nature Conservation (Wildlife) Regulation 1994*.
- One species (Short-beaked Echidna) is scheduled 'Common Wildlife' under Queensland's *Nature Conservation (Wildlife) Regulation 1994* but also is a 'special cultural' species under that legislation.

- Ten are migratory species and/or marine species (Great Egret, Cattle Egret, Glossy Ibis, Marsh Sandpiper, Common Greenshank, Caspian Tern, Rainbow Bee-eater, Spectacled Monarch, Rufous Fantail and Magpie Goose) for the purposes of the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999*. All these species are scheduled as 'Common Wildlife' under Queensland's *Nature Conservation (Wildlife) Regulation 1994* but also qualify as 'special cultural' species under the Regulation (except for Magpie Goose).

TABLE 2: SPECIES OF SPECIAL CONSERVATION SIGNIFICANCE

COMMON NAME	SCIENTIFIC NAME	HABITAT	CONSERVATION STATUS	
			Comm. Legislation	Qld. Legislation
Great Egret	<i>Ardea alba</i>	Wetlands	M	C, Q
Cattle Egret	<i>Ardea ibis</i>	Wetlands, grasslands	M	C, Q
Glossy Ibis	<i>Plegadis falcinellus</i>	Wetlands	M	C, Q
Marsh Sandpiper	<i>Tringa stagnatilis</i>	Wetlands	M	C, Q
Common Greenshank	<i>Tringa nebularia</i>	Wetlands	M	C, Q
Caspian Tern	<i>Sterna caspia</i>	Large waterbodies	M	C, Q
Rainbow Bee-eater	<i>Merops ornatus</i>	Most terrestrial habitats	M	C, Q
Spectacled Monarch	<i>Monarcha trivirgata</i>	Thickly wooded areas	M, S	C, Q
Rufous Fantail	<i>Rhipidura rufifrons</i>	Thickly wooded areas	M, S	C, Q
Short-beaked Echidna	<i>Tachyglossus aculeatus</i>	Most terrestrial habitats	-	C, Q
Magpie Goose	<i>Anseranas semipalmata</i>	Wetlands	S	C
Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	Wetlands	-	R
Grey Goshawk	<i>Accipiter novaehollandiae</i>	Wet forest, watercourses	-	R
Rufous Owl	<i>Ninox rufa</i>	Wet forest, swamp woodlands	-	V
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	Most treed habitats	V	-
Lewin's Rail	<i>Rallus pectoralis</i>	Wetlands	-	R

Conservation Status abbreviations are as follows for the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999*: **M** = Migratory bird (listed on the Japan-Australia Migratory Bird Agreement, China-Australia Migratory Bird Agreement, and/or Bonn Convention, Schedule 2); **S** = Marine protected species; **V** = Vulnerable. For Queensland's *Nature Conservation (Wildlife) Regulation 1994*, **V** = Vulnerable, **R** = Rare, **Q** = Special Cultural Significance, **C** = Common wildlife.

The combined dry season and wet season fauna surveys have also revealed that:

- There are no roosts for the Grey-headed Flying-fox on the study lands.
- Despite extensive call-playback sessions and searching, the Rufous Owl was not recorded during the wet season survey. Its presence during the dry season survey may have been due to the common presence of three species of flying-foxes feeding on the flowers of melaleucas – fruit bats are known to be a major component of the owl's diet. In suitable habitat, Rufous Owls have foraging ranges of between 400 and 800 ha with nests 3-4 kilometres apart (Schodde and Mason, 1980).
- None of the following species of particular interest to the EPA were recorded – Northern Quoll, False Water-rat, Rusty Monitor or Beach Thick-knee.
- Although 10 species of frogs were recorded breeding on the study lands, their distribution across the area was uneven and patchily clustered. The differing salinity levels throughout the study lands are apparently responsible for creating a mosaic of unsuitable breeding habitat for frogs.
- The number of species of migratory waders is low with only two species recorded from the study lands (Common Greenshank and Marsh Sandpiper). This appears to be due to the paucity of exposed mudbanks and flats for feeding.

7.0 REGIONAL ECOSYSTEMS

A regional ecosystem is defined in the *Vegetation Management Act 1999* as 'a vegetation community in a bioregion that is consistently associated with a particular combination of geology, landform and soil'.

Regional ecosystems are important in the context of the western Port lands and the AMSA land because they are the primary basis upon which:

- biodiversity planning is undertaken in Queensland, and
- permit applications for vegetation clearing under the *Vegetation Management Act 1999* are assessed.

Regional ecosystems are intended to provide an integrated approach to biodiversity planning that is derived from landscapes, geology, landforms and vegetation. The ecological relationships that underpin regional ecosystem classification and mapping over the study lands are shown in Table 3.

TABLE 3: ECOLOGICAL RELATIONSHIPS

GEOLOGY (Source: Exploration & Geological Survey DNRM)	LAND ZONE (Source: Dawney)	SOIL TYPE (Source: Gilbert & Sutherland)	ELEVATION RANGE	PLANT COMMUNITY (Source: Elsol)
Holocene Estuarine Deposits (Quaternary)	Land Zone 2 Coastal dunes and swales	Tenosol	3 – 5 m	Moreton Bay Ash forests (on beach)
		Hydrosol – seasonally water logged	2 – 3 m	Paperbark open forest (in swales)
	Land Zone 1 Marine deposits	Hydrosol – inundated by mixture of saltwater and freshwater depending on tides and season	± 2 m	Estuarine grasslands and sedgeland
			Typically less than 1 m	Drainage lines of seasonally free water and sedgeland types
				Saltmarsh
				Ephemeral 'lagoon' (brackish)

Over the past 18 months, the Environmental Protection Agency and the Dept. of Natural Resources and Mines have made several revisions and amendments to regional ecosystem descriptions, classifications and mapping in the coastal area between Slade Point and the Pioneer River estuary. The latest revision to the official 1:100 000 Regional Ecosystems map over this area was made in March 2002.

Regional ecosystems that are mapped on the study lands are listed in Table 4. A summary description and status of individual regional ecosystems is provided in Table 5. A summary of total areas of each regional ecosystem in the Proserpine-Sarina Lowlands sub-region is provided in Table 6.

It should be noted that there are some inherent difficulties in mapping regional ecosystems over the grassland/sedgeland parts of the study lands due to drainage changes that have occurred through past construction of roads, the railway line and other works. These works have combined to restrict natural tidal pathways and decrease the salinity of surface waters on parts of the grasslands and sedgelands to the west of the Slade Point Road.

TABLE 4: REGIONAL ECOSYSTEMS ON THE STUDY LANDS

RE POLYGON	PROPORTIONS	STATUS	APPROXIMATE AREA (ha)
8.1.4 / 8.1.1	90/10	Dominant Remnant of Concern Regional Ecosystem	4.5
8.1.4 / 8.1.3	90/10	Dominant Remnant of Concern Regional Ecosystem	3.2
8.1.2	-	Remnant not of Concern Regional Ecosystem	2.9
8.1.4 / 8.1.4x1	60/40	Dominant Remnant of Concern Regional Ecosystem	1.7
8.2.7b / 8.1.4x1	80/20	Dominant Remnant of Concern Regional Ecosystem	36.3
8.1.3 / 8.3.12 / 8.1.4	40/35/25	Sub-dominant Remnant Endangered Regional Ecosystem	60.3
8.2.6a	-	Dominant Remnant of Concern Regional Ecosystem	9.7
8.2.7b	-	Dominant Remnant of Concern Regional Ecosystem	23.3
8.2.6a / 8.2.7b	90/10	Dominant Remnant of Concern Regional Ecosystem	7.8
8.2.7b / 8.2.6a	60/40	Dominant Remnant of Concern Regional Ecosystem	3.1
8.1.4 / 8.1.1 / 8.3.12	50/30/20	Sub-dominant Remnant Endangered Regional Ecosystem	25.0
Disturbed	-	-	24.2
TOTAL	-	-	202 ha

Source: Queensland Herbarium, March 2002

Notes re coding of Regional Ecosystems

The regional ecosystems have a three-part number (Sattler and Williams, 1999):

- the first number is the bioregion;
- the second number is the geomorphic category or land zone that the ecosystem falls within (eg all regional ecosystems occurring on basalts are grouped);
- the third number is the ecosystem number, and relates to the dominant vegetation.

Variations to Regional Ecosystem numbering are recorded as follows (Neldner et al, 1999):

- 8.2.6a is an 'association' or 'land type' that occurs within 8.2.6. At a larger scale would be mapped as a separate land type. Probably has a distinct suite of species or geographically restricted.
- 8.1.4x1 is a unit that does not match at all well and it is probably a new regional ecosystem. Even though the dominant species are different, functionally it may have something more in common with 8.1.4 than other REs.

TABLE 5: REGIONAL ECOSYSTEM STATUS

REGIONAL ECOSYSTEM		STATUS UNDER VEGETATION MANAGEMENT REGULATION 2000
CODE	DESCRIPTION	
8.1.1	Mangrove vegetation of marine clay plains and estuaries	Not of concern
8.1.2	Samphire open forbland to isolated clumps of forbs on saltpans and plains adjacent to mangroves	Not of concern
8.1.3	<i>Sporobolus virginicus</i> (saltwater couch) grassland on marine sediments	Of concern
8.1.4	<i>Paspalum</i> spp. (water couches) and <i>Fimbristylis ferruginea</i> (rush) estuarine sedgeland/grassland. Includes areas of deep open water with clumps of <i>Schoenoplectus littoralis</i> (clubrush) ± <i>Eleocharis dulcis</i> (bulkuru)	Of concern
8.1.4x1	<i>Melaleuca leucadendra</i> (weeping tea tree) and/or <i>M. sp. aff. viridiflora</i> (undescribed taxon related to broad leaf tea tree) and/or <i>Eucalyptus tereticornis</i> (blue gum) and/or mangrove spp. woodland to open forest with a ground stratum of grasses and sedges including <i>Sporobolus virginicus</i>	Of concern
8.2.6a	<i>Corymbia tessellaris</i> (Moreton Bay Ash) ± <i>Acacia leptocarpa</i> (wattle) ± <i>Banksia integrifolia</i> (coast banksia) ± <i>Melaleuca dealbata</i> (blue tea tree) ± beach scrub species open forest on coastal dunes	Of concern
8.2.7b	<i>Melaleuca leucadendra</i> (weeping tea tree) open forest in near-coastal swamps, dune swales and behind parabolic dunes	Of concern
8.3.12	Alluvial plains native grassland	Endangered

Note: The following definitions apply under the *Vegetation Management Act 1999*:

- **not of concern regional ecosystem** means a regional ecosystem that is prescribed under a regulation and has more than 30% of its pre-clearing extent remaining and the remnant vegetation remaining is more than 10 000 ha.
- **of concern regional ecosystem** means a regional ecosystem that is prescribed under a regulation and has either –
 - (a) 10% to 30% of its pre-clearing extent remaining; or
 - (b) more than 30% of its pre-clearing extent remaining and the remnant vegetation remaining is less than 10 000 ha.
- **endangered regional ecosystem** means a regional ecosystem that is prescribed under a regulation and has either –
 - (a) less than 10% of its pre-clearing extent remaining; or
 - (b) 10% to 30% of its pre-clearing extent remaining and the remnant vegetation remaining is less than 10 000 ha.

**TABLE 6: 1999 REGIONAL ECOSYSTEM AREAS
PROSERPINE TO SARINA LOWLANDS SUB-REGION**

REGIONAL ECOSYSTEM	FREEHOLD (ha)	LEASEHOLD (ha)	NATIONAL PARK (ha)	OTHER RESERVE (ha)	TOTAL (ha)
8.1.1	16,547	10,482	1,,796	787	29,612
8.1.2	4,830	2,404	1,365	35	8,634
8.1.3	2,067	1,274	11	63	3,415
8.1.4	1,496	371	20	8	1,895
8.2.6	1,806	1,120	826	179	3,931
8.2.7	785	93	104	53	1,035
8.3.12	1,376	2,682	-	14	4,072

Source: Accad et al (2001)

The drainage changes, together with grazing pressures and burning, have resulted in some vegetation changes. In particular, there has been some colonisation by green couch (*Cynodon dactylon*) and, in some places, patches of blady grass (*Imperata cylindrica*).

The end result is a combination of geology, landform, soil and vegetation over parts of the grassland/sedgeland that does not 'fit' well with any of the regional ecosystems that are described in the *Vegetation Management Regulation 2000*.

The response of the Queensland Herbarium has been to redefine the criteria for Regional Ecosystem 8.3.12 so that it can be applied to the situation found on the western Port lands (and other similar areas in the Proserpine-Sarina Lowlands that have been bunded to prevent salt water inundation).

It is the view of the study team that the mapping of Regional Ecosystem 8.3.12 (either alone or in combination with other regional ecosystems) over parts of the grasslands/sedgelands is inappropriate and inconsistent with the definition of a 'regional ecosystem' contained in the *Vegetation Management Act 1999* for the following reasons:

- Regional ecosystem 8.3.12 requires the occurrence of Land Zone 3 on the study lands – it does not occur,
- the results of the soil testing and surface water quality testing confirm the brackish and estuarine characteristics of low-lying parts of the study lands, and
- the plant indicator species used by the Qld. Herbarium to classify R.E. 8.3.12 are common and widespread in coastal Queensland and all are listed in 'Weeds of Queensland' (Kleinschmidt and Johnson, 1977).

8.0 CULTURAL HERITAGE

A cultural heritage assessment of the study lands was undertaken to identify values and any necessary management strategies. Because the study lands are held in freehold tenure, there were no Native Title issues to consider. Nevertheless, it is still important to identify and document any cultural values that are associated with the study lands.

In undertaking the cultural heritage assessment, contact was initially made with Traditional Owner groups, the Central Queensland Land Council and all signatories to the amalgamated Native Title claim that is being prepared for the broader Mackay area. Interest in the study lands was expressed by four parties and it was agreed that representatives of all parties would take part in the assessment. It was also agreed that representatives from Central Queensland Cultural Heritage Management would provide technical advice on the cultural heritage assessment and provide assistance in coordinating and submitting the permit application.

The study lands were surveyed over a 2-day period from 22-23 April 2002. The results from the survey revealed no items of cultural or historical significance as defined under Queensland or Commonwealth legislation, although there were heavy visibility constraints. However, the generally low-lying and swampy conditions found across much of the study lands reduce the value of this area being a preferred camping location, and therefore we might not expect there to be large amounts of cultural material in this area in any case.

Some bush foods (including figs, prickly pear, bush passionfruit and a white fruit on a vine), and plants used for soap and medicinal purposes were, however, present on the western side of the Slade Point Road. The main concentrations of these bush foods and medicines were located in the northeast corner and in the south. The concentration in the north corner (the heavier of the two concentrations) is in a section of the land noted as a designated Conservation Area. It should also be noted that Traditional Owners regularly hunted and collected 'bush tucker' in this area in the recent past, and still procure traditional food resources in the general vicinity now.

Maintenance of access to these resources should be investigated and steps taken to guarantee such access into the future. It may also be appropriate to make provision for monitoring of the study area as and when any clearing of the site commences to ensure that the non-discovery of cultural material (specifically Items of the Queensland Estate) is not solely due to the conditions of limited surface visibility experienced at the time the field investigations took place. The above arrangements should be formally agreed between the Traditional Owners and the Mackay Port Authority in the form of a Cultural Heritage Management Plan negotiated between these parties prior to any development of the study area commencing.

9.0 OVERVIEW OF ENVIRONMENTAL VALUES

Previous studies have shown that the dune and wetland system on the coastal plain between Slade Point and the Pioneer River is not repeated anywhere else in the Proserpine to Sarina Lowlands sub-region. Collectively, this section of coastal plain is an area of high biodiversity, with many plant associations of regional significance. It possesses:

- a package of ecological values associated with vegetation communities, wildlife habitat, biodiversity and landforms,
- a package of social-related values associated with recreation, education and scenic amenity,
- a package of economic values associated with fisheries productivity and nature-based tourism,
- public safety values associated with the role of the area as a flood retardation basin, and
- cultural heritage values.

An indication of the relative significance of these different values is provided in Table 7. The contribution that the study lands as a whole make to the overall values of the coastal plain between Slade Point and the Pioneer River is shown in Table 8.

**TABLE 7: SIGNIFICANCE OF VALUES: COASTAL PLAIN
BETWEEN SLADE POINT AND PIONEER RIVER**

VALUES	SIGNIFICANCE OF VALUES
Ecological values	Of local and regional significance
Fisheries values	Of local to regional significance
Scenic values	Of local significance
Recreation and tourism values	Of local significance
Flood retardation values	Of local significance
Educational values	Of local to regional significance
Cultural heritage values	At least of local significance

TABLE 8: CONTRIBUTION OF STUDY LANDS TO BROADER ENVIRONMENTAL VALUES

VALUE CATEGORY	KEY POINTS	CONTRIBUTION TO BROADER ENVIRONMENTAL VALUES
Ecological values	• A diverse range of coastal plant communities in a relatively small area • Melaleuca, Moreton Bay ash and grassland/sedgeland communities that are representative of plant communities that were once much more widespread in the Mackay area and in the region. • Most plant communities have been modified by grazing, feral pigs, drainage changes and introduced weeds • No records of rare or threatened species • presence of 'of concern' regional ecosystems • possible presence of sub-dominant 'endangered' regional ecosystem • A diverse range of coastal habitat types in a relatively small area • Representative areas of habitat types that were once much more widespread in the Mackay area and in the region. • Habitat for a variety of wetland and/or migratory species including Brolgas, Ibis, Jabiru, Spoonbills, Stilts, Magpie Geese and various species of ducks • Habitat for the Vulnerable Rufous Owl • Habitat for the Rare Black-necked Stork and Grey Goshawk • Relatively poor frog habitat • Not a special node of fauna diversity • Integral part of a wetland habitat link between Bassett Basin and Slade Point • Disturbance of habitat by feral pigs and grazing animals	A significant contribution to botanical values A less significant contribution to fauna values
Flood retardation values	• Part of the Pioneer River floodplain and part of a flood pathway from the Pioneer River to McCready's Creek • A natural retention basin during high rainfall events	A significant contribution
Scenic values	• A remnant 'natural' area in an expanding industrialised part of Mackay City • Generally flat but with a variety of vegetation types	A significant contribution
Recreation, education and tourism values	• A variety of plant communities and habitat types in a relatively small area • Close to Mackay and potentially easily accessible • High probability of viewing plants and/or animals of interest • Not generally available for public access	Probably a relatively minor contribution
Fisheries productivity values	• Estuarine areas are habitat for a variety of commercial and recreational species including barramundi, bream, mangrove jack and mud crabs • Freshwater/brackish ponds on study lands provide barramundi habitat at certain life-cycle stages • Relatively healthy estuarine plant communities in an increasingly stressed estuarine system	A significant contribution
Cultural heritage values	• Study lands include a range of traditional foods and medicinal plants • No remains or artefacts found • Surveys have only been undertaken over Port lands.	Possibly a significant contribution

While the study lands as a whole make a significant contribution to the values of the coastal plain between Slade Point and the Pioneer River, it is necessary to note that the most important areas of environmental value are protected from development under the Port Authority's Seaport Land Use Plan. Furthermore, the balance of the study lands (i.e. the potential development area), has varying environmental values. It is possible to subdivide the potential development area into the following 3 separate areas with increasing environmental values:

1. AMSA land – this area has been extensively modified and has extremely limited environmental values.
2. The eastern catchment of the western Port lands. This area drains to the south-east and into the Bassett Creek drain via the AMSA land. Parts of this area have been cleared and filled and it has been extensively grazed. It forms the headwaters of a catchment that has been extensively modified by existing Port development.
3. The western catchment of the western Port lands. This area drains to the south-west into Vines Creek. Although the Vines Creek catchment has been extensively modified by urban development and a major waste disposal facility, the section of the catchment within the study lands is relatively intact and provides productive fisheries habitat.

10.0 PROPOSED DEVELOPMENT

The final nature of any development on the AMSA site or the western Port lands is still to be determined. This study is only concerned with the placement of fill that would be a forerunner to any future development.

Under the 1999 Seaport Land Use Plan, development could potentially occur on all of the AMSA site (approx. 15 ha) and approximately 55% (103 ha) of the western Port lands. The balance of the western Port lands is designated for protection as conservation area, drainage reserve or rehabilitation buffer.

Filling of potential development areas is likely to be sourced from dredging works in Mackay Harbour and from other sand reserves within the Port area. The material to be excavated from the Harbour is likely to be predominantly clay; whereas fine, free draining sand will be the main secondary fill source. There is evidence of some tributyltin (TBT) and polynuclear aromatic hydrocarbon (PAH) contamination in the near surface sediments in the Harbour. One option under consideration is to dredge the near surface (contaminated) sediments for disposal at sea prior to dredging the deeper and cleaner sediments for use as landfill. Harbour dredging and the disposal of dredged materials are dealt with in the Port Authority's Long Term Dredge Spoil Management Strategy.

Previously reclamation works by the Port have involved dredging and pumping of material into the proposed reclamation areas, with progressive settlement of discharge water to contain material within the reclamation sites. Filling of the AMSA and western lands sites is likely to be carried out by a combination of dredging and pumping, and trucking operations to carry the sand material.

Proposed finish surface levels of the proposed developed sites are between RL 6.0m and 7.0m AHD, which requires generally 3 to 4 metres of filling over the proposed development areas.

Subject to salinity levels, topsoil may be stripped and stored for re-use prior to filling. The assessment of acid sulfate soils has shown that topsoils have generally low levels of acid producing potential. Testing of potential fill materials from the harbour indicate a low to negligible risk of encountering potential acid producing soils.

Given the relative intactness of the Vines Creek catchment within the study lands and the sensitivity of the estuarine system to nutrients, pollutants and other possible pollutants, it is strongly recommended that direct runoff into this catchment be avoided. This can be achieved on the western Port lands by filling and grading in such a manner that all runoff is directed to the south-east into the Bassett Creek catchment via the existing Port drainage system. The AMSA land already drains into this drainage system.

Given the limited capacity of the existing Port drainage system, it will be necessary to incorporate on-site flow attenuation to avoid local flooding. It is therefore suggested that both the AMSA site and the western Port lands incorporate detention basins within the fill areas. It may also be possible to utilise some of the runoff for groundwater recharge purposes.

An integral part of the proposed development should be the incorporation of a 'treatment train approach' to water quality management. This will involve:

- minimisation of pollutants at source for individual industries,
- direction of site runoff via a grassed swale drainage system with utilisation of gross pollutant traps, and
- enhancement of the detention basins with fringing macrophyte plantings to improve their functionality as nutrient and sediment removal devices – there is also potential for managing the detention basins to provide replacement waterbird habitat.

11.0 OPTIONS AND IMPACTS

(i) Lands west of Slade Point Road

The area of the study lands to the west of the Slade Point Road (Lot 1 on RP748350) is approximately 186 ha. Of this land, approximately 80 ha (43%) are protected from development under the Port Authority's Seaport Land Use Plan. This 80 ha includes:

- the largest and most intact area of melaleuca woodland in the north-eastern section of the western Port land,
- the most intact and accessible area of estuarine grassland and sedgeland adjacent to Keeleys Road and one of the best areas of waterbird habitat on the subject lands, and
- an area of mixed melaleuca woodland and grassland along the western boundary of the western Port lands – this land is designated as a floodway for major flood events in the Pioneer River.

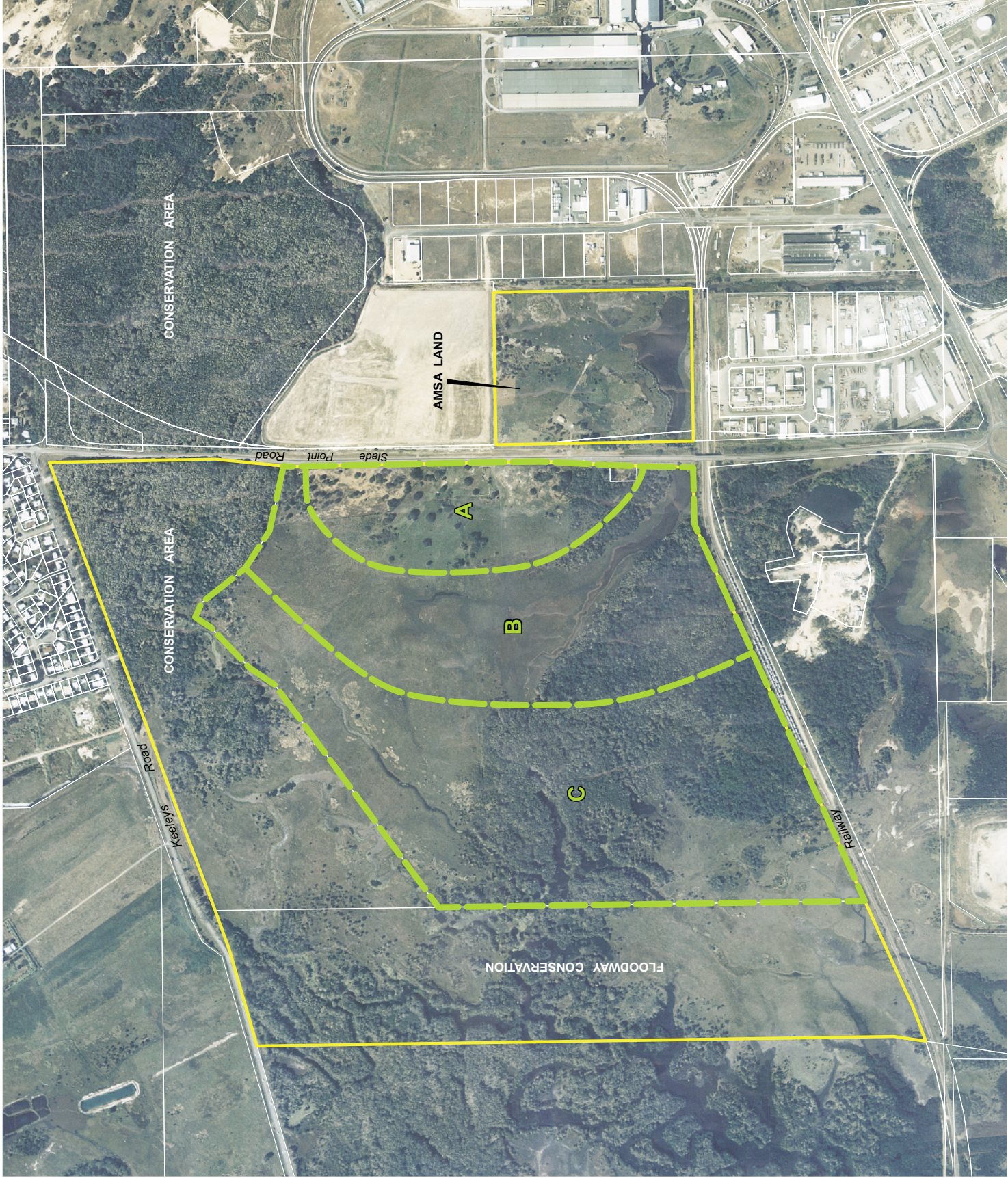
Collectively, these 3 areas that are designated and managed as conservation areas provide long-term protection to those parts of the subject lands that have the highest conservation values. They also help to preserve an existing wetland habitat link that extends from the Pioneer River north to Slade Point.

The balance of approximately 105 ha has environmental and cultural heritage values that are not uniformly distributed. For this reason, three different fill scenarios for lands west of the Slade Point Road have been prepared and assessed.

The fill scenarios are shown in Figure 11.1. They comprise:

- **Scenario 1:** Filling of just the disturbed areas of the western Port lands adjacent to the Slade Point Road. This would provide a development area of approximately 15 ha.
- **Scenario 2:** Filling of the western Port lands as far as the catchment boundary for Vines Creek. This would provide a development area of approximately 50 ha.
- **Scenario 3:** Filling of the western Port lands to the full extent as shown in the 1999 Seaport Land Use Plan. This would provide a development area of approximately 105 ha.

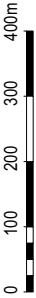
An overall summary of impacts associated with each fill scenario is provided in Table 9.



LEGEND

Study Area

- Scenario 1 = Area A
Scenario 2 = Areas A + B
Scenario 3 = Areas A + B + C



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CLIENT **MACKAY PORT AUTHORITY**

PROJECT **WESTERN PORT LANDS**

TITLE

**FILL SCENARIOS FOR
LANDS WEST OF SLADE
POINT ROAD**

DRAWN: D.J.P.

REV:

DATE: Oct. 2001

JOB NUMBER: 14_454

FIGURE: 11.1

TABLE 9: OVERVIEW OF IMPACTS – WEST OF SLADE POINT ROAD

NATURE OF IMPACT	SCENARIO 1 Disturbed parts of Western Port lands (approx. 15 ha)	SCENARIO 2 Western Port lands to boundary of Vines Creek catchment (approx. 50 ha)	SCENARIO 3 Western Port lands to full extent shown in Land Use Plan (approx. 105 ha)
Impacts on catchments	• All impacts contained in Bassett Creek catchment • Potential for groundwater recharge • No deterioration in water quality • No material effect on groundwater levels or oxidation of acid sulfate soils	• All impacts contained in Bassett Creek catchment • Potential for groundwater recharge • No deterioration in water quality • Minimal risk to groundwater levels or oxidation of acid sulfate soils	• Impacts in both Bassett Creek and Vines Creek catchment • Potential for groundwater recharge • Possible water quality impacts in Vines Creek • Low risk to groundwater levels or oxidation of acid sulfate soils
Impacts on vegetation	• Loss of approx. 3 ha of Moreton Bay ash forest and paperbark open forest • No loss of rare or threatened plant species	• Loss of approx. 20 ha of Moreton Bay ash forest and paperbark open forest • Loss of approx. 15 ha of grassland and sedgeland • No loss of rare or threatened plant species	• Loss of approx. 35 ha of Moreton Bay ash forest and paperbark open forest • Loss of approx. 50 ha of grassland and sedgeland • No loss of rare or threatened plant species
Impacts on wildlife and habitat	• No significant impacts on habitats of conservation significance • No significant impacts on species of conservation significance • Retention of wetland habitat corridor from Pioneer River to Slade Point	• Loss of approx. 20 ha of woodland habitat – this forms part of the habitat for the vulnerable Rufous Owl • Loss of approx. 15 ha of waterbird habitat • Retention of wetland habitat corridor from Pioneer River to Slade Point • Enhancement of lagoon to provide additional waterbird habitat	• Loss of approx. 35 ha of woodland habitat – this forms part of the habitat for the vulnerable Rufous Owl • Loss of approx. 50 ha of waterbird habitat • Impacts on fisheries habitat in Vines Creek catchment • Possible impacts on False Water Rat habitat downstream in Vines Creek • Retention of wetland habitat corridor from Pioneer River to Slade Point • Enhancement of lagoon to provide additional waterbird habitat

continued.....

TABLE 9: OVERVIEW OF IMPACTS – WEST OF SLADE POINT ROAD (CONTINUED)

NATURE OF IMPACT	SCENARIO 1 Disturbed parts of Western Port lands (approx. 15 ha)	SCENARIO 2 Western Port lands to boundary of Vines Creek catchment (approx. 50 ha)	SCENARIO 3 Western Port lands to full extent shown in Land Use Plan (approx. 105 ha)
Impacts on flooding	- No increase in local flooding due to site runoff - No increase in flooding of surrounding areas during 1 in 100 year flood event - No increase in flooding of surrounding areas for a flood event equivalent to the 1958 flood (less severe than the 1 in 100 year flood)	- No increase in local flooding due to site runoff - Changes in flood levels for a 1 in 100 year flood event are estimated as: - an increase in flood levels of no more than 1 cm in Andergrove south of Keeleys Road - a decrease in flood levels of approx. 1 cm at eastern end of Keeleys Road - an increase in flood levels of up to 2 cm on the southern side of the rail line to port - No increase in flooding of residential areas for a flood event equivalent to the 1958 flood (less severe than the 1 in 100 year flood)	- No increase in local flooding due to site runoff - Changes in flood levels for a 1 in 100 year flood event are estimated as: - an increase in flood levels of between 5 and 15 cm in the Andergrove area - an increase in flood levels of approx. 5 cm at the western end of Keeleys Road and decrease of the same amount at the eastern end of Keeleys Road - an increase in flood levels of approx 15 cm on south side of rail line to port - Potentially 12 additional properties affected by inundation during a 1 in 100 year flood event.
Impacts on cultural heritage	- Some minor loss of plants sometimes used as bush foods (eg prickly pear) - Main area of bush foods and medicinal plants protected	- Possible loss of secondary area of bush foods and medicinal plants on southern side of study lands - Main area of bush foods and medicinal plants protected	- Loss of secondary area of bush foods and medicinal plants on southern side of study lands - Main area of bush foods and medicinal plants protected

(ii) AMSA land

The AMSA land is located on the eastern side of Slade Point Road. It has an area of approximately 15 ha and is currently used as a differential Global Positioning System (GPS) facility. As is the case at present, drainage from this area would be directed to Bassett Creek via the existing tidal lagoon. It is proposed that the lagoon be modified to become a retention basin for stormwater and water quality management. The retention basin and surrounds would be designed, constructed and managed to provide waterbird habitat. An overview of impacts on the AMSA land is provided in Table 10.

TABLE 10: OVERVIEW OF IMPACTS – AMSA LAND

NATURE OF IMPACT	OVERVIEW OF IMPACTS
Impacts on catchments	• All impacts contained in Bassett Creek catchment • Potential for groundwater recharge • No deterioration in water quality
Impacts on vegetation	• Loss of fringing estuarine vegetation around existing lagoon – to be replaced by enhanced waterbird habitat • No significant impacts on vegetation of conservation significance – small loss of R.E. 8.1.4/8.1.1, but the area in question is highly disturbed
Impacts on wildlife and habitat	• No impacts on habitats of conservation significance • No impacts on species of conservation significance • Retention of wetland habitat corridor from Pioneer River to Slade Point
Impacts on flooding	• No increase in local flooding due to site runoff • No increase in flooding of surrounding areas during a 1 in 100 year flood event or during the equivalent of a 1958 flood event
Impacts on cultural values	• No impacts on known cultural values

(iii) Effects on values

Of fundamental importance in considering any proposals for the placement of fill on the study lands is the effect that this is likely to have on environmental and cultural values associated with the coastal plain between Slade Point and the Pioneer River. An overview of the effects on values is presented below. It assumes that all of the mitigation strategies listed in Section 12.0 are put into effect.

SCENARIO 1 (west of Slade Point Road)

Under this scenario, filling is restricted to areas that have been disturbed by previous filling and/or clearing. All drainage from the filled area would drain to the south-east and flow into Bassett Creek via the AMSA land. Total area of filling is approximately 15 ha or 14 percent of the land designated for development under the Seaport Land Use Plan.

Ecological values

- Little loss, or reduction in ecological values – filling is on previously filled and disturbed land. Loss of approximately 3 ha of Moreton Bay ash forest and paperbark open forest ('of concern' REs 8.2.7b and 8.2.6a) that has regenerated in southern corner of the fill area. Within the Proserpine-Sarina Lowlands sub-region, there are some 1,035 ha of RE 8.2.7 and 3,931 ha of RE 8.2.6 remaining.
- Existing habitat connectivity maintained and enhanced by restoration of Bassett Creek drain (see Section 12.0).

Flood retardation values

- No reduction in the flood retardation values of the coastal plain between Slade Point and the Pioneer River.

Scenic values

- Initial loss of scenic values along part of the Slade Point Road. These scenic values are not particularly high at present. Landscaping and rehabilitation with buffer planting along the roadside has the potential to reduce longer-term impacts and to potentially increase scenic amenity along the Slade Point Road in this area.

Recreation, education and tourism values

- This part of the subject lands does not have high values for these purposes. Provision of access and facilities in designated conservation areas by the Port Authority (see Section 12.0) will lead to an overall enhancement of recreation, education and tourism values on the coastal plain between Slade Point and the Pioneer River.

Fisheries productivity values

- This scenario will not adversely affect fisheries productivity values. In conjunction with connectivity enhancements described in Section 12.0, there will be a nett increase in fisheries productivity in the Pioneer River estuary.

Cultural heritage values

- No material loss of any cultural heritage values.

SCENARIO 2 (west of Slade Point Road)

Under this scenario, filling of lands to the west of the Slade Point Road is extended westwards to the catchment divide between Bassett Creek and Vines Creek. All drainage from the filled area would drain to the south-east and flow into Bassett Creek via a retention basin and the AMSA land. Total area of filling is approximately 50 ha or 48 percent of the land designated for development under the Seaport Land Use Plan.

Ecological values

- Minimal risk to the hydrology and water quality of the study lands provided that stormwater and runoff measures outlined Section 12.0 are put into effect.
- Loss of approximately 20 ha of Moreton Bay ash forest and paperbark open forest ('of concern' REs 8.2.7b and 8.2.6a). Within the Proserpine-Sarina Lowlands sub-region, there are some 1,035 ha of RE 8.2.7 and 3,931 ha of RE 8.2.6 remaining. Substantially larger and more intact examples of these REs are found elsewhere on the coastal plain between Slade Point and the Pioneer River.
- Loss of approx. 15 ha of grassland and sedgeland, comprising 'of concern' REs 8.1.3 and 8.1.4 and disputed 'endangered' RE 8.3.12. Within the Proserpine-Sarina Lowlands sub-region, there are some 3,415 ha of RE 8.1.3, 1,895 ha of RE 8.1.4 and 4,072 ha of RE 8.3.12 remaining. Under this scenario, most of the blady grass (a key indicator species that has been used by the Queensland Herbarium to designate RE 8.3.12) is avoided. Larger and more intact examples of these REs are found elsewhere on the coastal plain between Slade Point and the Pioneer River.
- Loss of approximately 20 ha of habitat for the Vulnerable Rufous Owl. This species has a large home range, and other suitable habitat exists on the coastal plain between Slade Point and the Pioneer River. On its own not a major loss of habitat, but needs to be considered in the context of other habitat losses and the security of habitat in the wider Mackay area.
- Existing habitat connectivity maintained and enhanced by restoration of Bassett Creek drain (see Section 12.0).
- A slight incursion into the area listed on the Register of the National Estate, but no impacts on the values underpinning the listing

Flood retardation values

- No material increase in flooding for either the 1958 or 1 in 100 year flood events. No reduction in the flood retardation values of the coastal plain between Slade Point and the Pioneer River.

Scenic values

- Some loss of scenic amenity along the Slade Point Road, particularly towards the southern end following the removal of the Moreton Bay ash forest and paperbark open forest. Landscaping and rehabilitation with buffer planting along the roadside has the potential to reduce longer-term impacts.

Recreation, education and tourism values

- This part of the subject lands does not have high values for these purposes. Provision of access and facilities in designated conservation areas by the Port Authority (see Section 12.0) will lead to an overall enhancement of recreation, education and tourism values on the coastal plain between Slade Point and the Pioneer River.

Fisheries productivity values

- This scenario will not adversely affect fisheries productivity values. In conjunction with connectivity enhancements described in Section 12.0, there will be a nett increase in fisheries productivity in the Pioneer River estuary.

Cultural heritage values

- Although there may be some loss of plants used as bush foods and for medicinal purposes, the main areas where these plants occur on the study lands will be protected and the overall effects on values is expected to be low.

SCENARIO 3 (west of Slade Point Road)

Under this scenario, filling of lands to the west of the Slade Point Road is extended further westwards to the full extent of development that is provided for under the Seaport Land Use Plan. Filling extends into the Vines Creek catchment. All drainage from the filled area would continue to drain to the south-east and flow into Bassett Creek via a retention basin and the AMSA land. Total area of filling is approximately 105 ha.

Ecological values

- Low risk to the hydrology and water quality of the study lands provided that stormwater and runoff measures outlined Section 12.0 are put into effect.
- Loss of approximately 35 ha of Moreton Bay ash forest and paperbark open forest ('of concern' REs 8.2.7b and 8.2.6a). Within the Proserpine-Sarina Lowlands sub-region, there are some 1,035 ha of RE 8.2.7 and 3,931 ha of RE 8.2.6 remaining. Larger and more intact examples of RE 8.2.7b are found elsewhere on the coastal plain between Slade Point and the Pioneer River, but one of the best remaining examples of RE 8.2.6a in this area would be lost.
- Loss of approx. 50 ha of grassland and sedgeland, comprising 'of concern' REs 8.1.3 and 8.1.4 and disputed 'endangered' RE 8.3.12. Within the Poserpine-Sarina Lowlands sub-

region, there are some 3,415 ha of RE 8.1.3, 1,895 ha of RE 8.1.4 and 4,072 ha of RE 8.3.12 remaining. Under this scenario, areas of blady grass (a key indicator species that has been used by the Queensland Herbarium to designate RE 8.3.12) are removed. Approximately half of the grassland and sedgeland on the coastal plain between Slade Point and the Pioneer River is removed.

- Loss of approximately 35 ha of habitat for the Vulnerable Rufous Owl. This species has a large home range, and other suitable habitat exists on the coastal plain between Slade Point and the Pioneer River. A potentially significant loss of habitat, but needs to be considered in the context of other habitat losses and the security of habitat in the wider Mackay area.
- Existing habitat connectivity maintained and enhanced by restoration of Bassett Creek drain (see Section 12.0).
- A small incursion into the area listed on the Register of the National Estate, but no impacts on the values underpinning the listing

Flood retardation values

- Under this scenario, the flood retardation values of the coastal plain between Slade Point and the Pioneer River would be reduced. During a 1 in 100 year flood event, it has been estimated that the placement of fill could lead to the inundation of an additional 12 properties, mainly in the Andergrove area.

Scenic values

- Some loss of scenic amenity along the Slade Point Road and possibly Keeleys Road, mainly resulting from the removal of the Moreton Bay ash forest and paperbark open forest. Landscaping and rehabilitation with buffer planting along the roadsides has the potential to reduce longer-term impacts.

Recreation, education and tourism values

- This part of the subject lands does not have high values for these purposes. Provision of access and facilities in designated conservation areas by the Port Authority (see Section 12.0) will lead to an overall enhancement of recreation, education and tourism values on the coastal plain between Slade Point and the Pioneer River.

Fisheries productivity values

- This scenario will involve filling in the upper reaches of the Vines Creek estuary. Although parts of the Vines Creek catchment have been substantially modified (eg by urban development and a major solid waste disposal site), the section of the catchment within the study lands is relatively intact and contributes to the overall fisheries productivity of the estuary. Under this scenario, there will be a decrease in fisheries productivity although this may be offset to some extent by the connectivity enhancements described in Section 12.0.

- Further detailed studies will be required to fully assess the impacts on fisheries productivity arising from this scenario.

Cultural heritage values

- Although there may be some loss of plants used as bush foods and for medicinal purposes, the main areas where these plants occur on the study lands will be protected and the overall effects on values is expected to be low.

AMSA LAND

It is not expected that filling of the AMSA land will have any deleterious effects on the environmental and cultural values associated with the coastal plain between Slade Point and the Pioneer River.

12.0 MITIGATION STRATEGIES

The adoption and implementation of mitigation strategies will be an integral part of any future filling and subsequent development of the study lands. The mitigation strategies that are proposed in this report are discussed below under the headings of:

- environmental management plans, and
- environmental offsets.

ENVIRONMENTAL MANAGEMENT PLANS

(i) Property vegetation management plan

A Property Vegetation Management Plan is required to accompany an application for removal of vegetation under the *Vegetation Management Act 1999*. The contents of the Management Plan are set out in the *Vegetation Management Regulation 2000*. It must include:

- the location and extent of the area proposed to be cleared, by reference to easily identifiable fixed points,
- a description of the vegetation proposed to be cleared,
- the location, extent and description of any existing land degradation on the property,
- the action proposed to be taken to prevent the proposed clearing contributing to land degradation,
- the location, extent and description of any remnant vegetation remaining on the property after the proposed clearing, and
- any proposed rehabilitation or restoration of vegetation on the property.

(ii) Acid sulfate management plan for topsoil

Prior to fill being placed on any of the study lands, top soil may be removed and stored for re-use after placement of the fill materials. Tests have revealed that the acid producing potential of the topsoil is low. However, as part of this process, it will be necessary to test, treat and manage the topsoil to avoid any acid runoff. A draft Acid Sulfate Management Plan for the handling of topsoil is contained in the main report.

(iii) Acid sulfate and water quality management plan for placement of fill

Although the acid producing potential of proposed fill materials is low to negligible, it is essential that the values of the downstream Bassett Basin Fish Habitat Area be protected. It will therefore be necessary to implement an environmental management plan for the placement of fill material to ensure that acid runoff is prevented and that sediment does not enter downstream waters.

A draft Acid Sulfate Management Plan for any placement of fill on the study lands is contained in the main report. The purpose of this draft EMP is to identify potential environmental impacts arising from the placement of fill, set out performance criteria and mitigation strategies, establish monitoring and reporting systems and, if an undesirable impact occurs or is likely to occur, the appropriate corrective action.

(iv) Stormwater management plan

A stormwater management plan will need to be developed and implemented following the placement of fill material. This will need to address issues associated with stormwater management prior to and following the development of buildings and infrastructure. The preferred site drainage regime is one where:

- runoff from both the AMSA land and the western Port lands is directed to the Bassett Creek catchment,
- the existing ponded areas are utilised to serve the dual purposes of flood retention basins and wetlands for nutrient and sediment removal prior to discharge into the upper reaches of Bassett Creek (currently a drain), and
- some surface water runoff is utilised for groundwater recharge.

(v) Landscaping and rehabilitation plan

Following the placement of fill, work will need to commence on landscaping and rehabilitation. This will need to address issues of screening, erosion control and local habitat. It will also need to address issues of salinity and the likely rates of leeching of salt from the fill material. The aims of the landscaping and rehabilitation plan will be:

- to protect water quality,
- to protect, as far as possible, local scenic values, and

- to maintain local habitat linkages.

In conjunction with plantings recently undertaken by the Port Authority on the eastern side of the Slade Point Road, landscaping and rehabilitation has the potential to substantially improve scenic amenity and local habitat connectivity along the Slade Point Road.

(vi) Cultural heritage management plan

Prior to any placement of fill on the study lands, a cultural heritage management plan will be negotiated and formally agreed between the Traditional Owners and the Mackay Port Authority. The management plan will address:

- continuing access to traditional resources by Traditional Owners,
- monitoring of any clearing or other works that may lead to the discovery of cultural materials,
- procedures for dealing with the discovery of any human skeletal remains (this is likely to have a low probability),
- measures that might be taken to plant and re-establish any food and medicinal plants that may be lost, and
- interpretive materials that may be appropriate as part of any future public access to Conservation Areas.

ENVIRONMENTAL OFFSETS

(i) Groundwater recharge

The vegetation and habitat of the study lands has adapted to and is dependent upon the maintenance of the existing hydrological regime. It is therefore important that any filling of the study lands does not significantly affect the hydrological regime of surrounding areas.

For this reason, it is proposed that provision be made in any development of site for the installation of infiltration devices to provide for groundwater recharge.

(ii) Waterbird habitat

Any filling of the study lands outside of the existing fill areas will reduce the amount of waterbird habitat between the Pioneer River and Slade Point. To help offset this loss of habitat, it is proposed that the detention basins/wetlands be developed and managed in a way that provides useful waterbird habitat. This may involve, for example, control of water levels, slope of banks, choice of vegetation and the possible incorporation of islands.

(iii) Restoration of Bassett Creek drain

The historical conversion of the upper reaches of Bassett Creek into a drain has severely disrupted the habitat link between the melaleuca woodlands and the Bassett Basin Fish Habitat Area. Preliminary studies commissioned by the Port Authority have indicated that it is feasible to

re-establish mangrove vegetation along this drainage line and therefore restore the habitat link. Such a habitat link is important for fisheries productivity.

(iv) Habitat link under Slade Point Road

Construction of the Slade Point Road was undertaken with little provision for cross-drainage beneath the road. This has meant that the two areas of *Melaleuca leucadendra* woodland on either side of the Slade Point Road near Keeleys Road are effectively separated hydrologically.

Consideration will therefore be given to re-establishing a hydrological connection between these two areas beneath the Slade Point Road. During the wet season, this has the potential to provide for the passage of small fish and other fauna. In conjunction with the restoration of the Bassett Creek drain, it has the potential to substantially increase the upstream nursery area for fish species. During the dry season, there is also potential to provide a safer pathway for small mammals.

(v) Education and ecotourism

Previous studies into the management of the Conservation Areas within the study lands have revealed their potential for ecotourism and education. This potential is currently grossly underutilised through lack of access and necessary facilities. There is considerable potential for the Port Authority (in consultation with the Council, community groups, schools and the regional tourism association) to act as a catalyst and facilitator to encourage appropriate public use and management of at least some of its Conservation Areas. This is a matter that is currently being addressed by the Port Authority.

(vi) Replanting of traditional food and medicinal plants

Although the best areas of traditional food and medicinal plants will remain undisturbed, filling of the proposed development area will remove some traditional food and medicinal plants. In consultation with Traditional Owners, the Port Authority will consider re-establishing replacement plants in Conservation Areas. The potential for utilising traditional food and medicinal plants as an interpretive resource in proposed areas of public access will also be discussed with Traditional Owners.

13.0 APPROVALS

This report contains information that will be utilised by the Mackay Port Authority in preparing proposals for any placement of fill on the study lands. Before any filling can occur, there are a number of approvals that are required from other agencies.

An outline of the approvals that must be obtained by the Port Authority is provided in Figure 13.1. It should be noted that this chart of approvals is indicative only – the specific approvals and approvals processes will depend upon the details and timing of any proposals that are put forward by the Port Authority. All of the necessary approvals are required before any placement of fill can commence.

In considering approvals, there is a range of policy documents that will be taken into account by the responsible agencies. These policy documents include:

- the Queensland State Coastal Management Plan,
- the State Policy for Vegetation Management on Freehold Land,
- the Strategy for the Conservation and Management of Queensland Wetlands,
- the Environmental Protection (Water) Policy,
- the State Planning Policy for Planning and Managing Development Involving Acid Sulfate Soils (currently in draft form),
- the Dept. of Primary Industries' Operational Policies for Fish Habitat Management,
- the administrative Guidelines on Significance prepared under the *Environment Protection and Biodiversity Conservation Act 1999*,
- the State Infrastructure Plan,
- the Whitsunday, Hinterland and Mackay (WHAM) 2015 Regional Plan (currently in draft form), and
- the Queensland Port Network Strategy (in preparation).

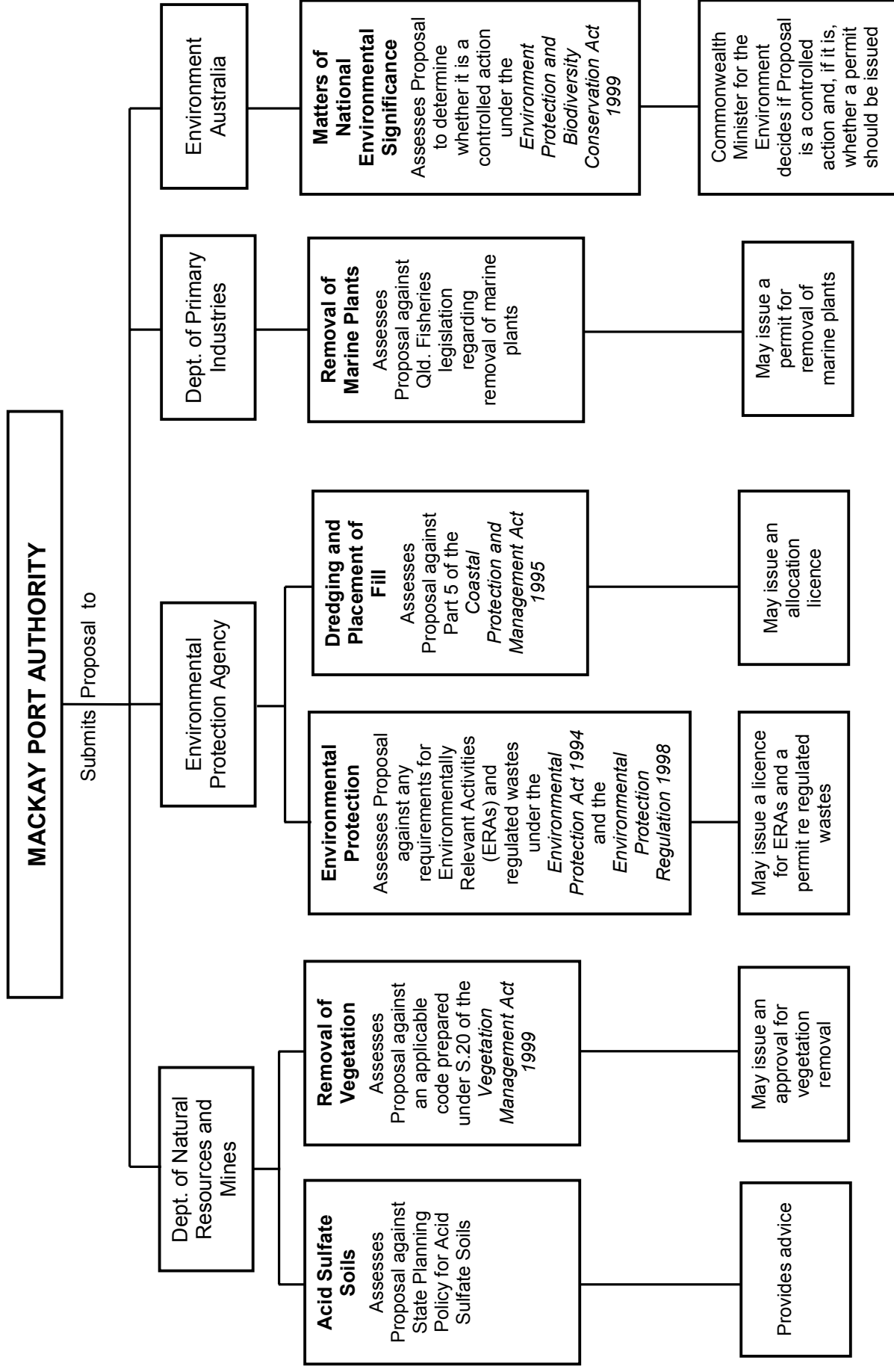


FIGURE 13.1: INDICATIVE APPROVALS CHART

Important note: This approvals chart is indicative only. The actual approvals required will be determined by the specific nature and timing of any proposal put forward by the Mackay Port Authority

14.0 REFERENCES

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- Sattler P.S. and Williams R.D. (1999); The Conservation Status of Queensland Bioregional Ecosystems. Environmental Protection Agency, Qld.
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15.0 ABBREVIATIONS AND GLOSSARY

Acid Sulfate Soils (ASS) – acid sulfate soils are the common name given to naturally occurring sediments and soils containing iron sulfides (principally iron disulfide (commonly known as pyrite), iron monosulfide or their precursors). The exposure of the sulfide in these soils to oxygen (e.g. by drainage or excavation) leads to the generation of sulfuric acid. Note: The term acid sulfate soil generally includes both actual and potential acid sulfate soils. Actual and potential acid sulfate soils are often found in the same soil profile, with actual acid sulfate soils generally overlying potential acid sulfate soil horizons.

AHD - Australian Height Datum – the national reference for height measurement in Australia.

AMSA - Australian Maritime Safety Authority

ARI - Average Return Interval

Jarosite – an acidic pale yellow iron sulfate mineral: $\text{KFe}_3(\text{SO}_4)_2(\text{OH})_6$. Jarosite is a by-product of the acid sulfate soil oxidation process, formed at pH less than 3.7; commonly found precipitated along root channels and other soil surfaces exposed to air.

Pyrite - Pale-bronze or brass-yellow, isometric mineral: FeS_2 ; the most widespread and abundant of the sulfide minerals.

Quaternary - A geological time period extending from 1.8 million years ago to present time; incorporates both the Pleistocene and Holocene epochs.

Regional Ecosystem (RE) - A vegetation community in a bioregion that is consistently associated with a particular combination of geology, landscape and soil.