4. Burning of underlying peat.

Ella Bay swamp is located approximately six kilometres further south from Wyvuri and is enclosed by the Seymour Range which comprises its catchment. It is bounded on the coast by a beach sand ridge. Although smaller in area than Wyvuri, Ella Bay is similar in character draining through a small estuary. Ella Bay is pristine with negligible development in the catchment and no road access. Access limitations prevent an on-ground assessment of habitat condition for this report and there are no studies on use of the area by fish.

Figure 15: Southern end of Wyvuri Swamp

Ella Bay is a declared national park and although there are no perceived anthropogenic threats monitoring should be undertaken to ensure that invasive plants do not become established and feral animals do not cause environmental harm. Ella Bay could be assessed and used as a benchmark for habitat quality in other similar wetlands.

11.1.5. Johnstone Rivers

The Johnstone catchment stretches from the headwaters between the Russell and Johnstone Rivers south to Maria Creek and is situated in the Queensland wet tropical coast. The upper reaches of the North and South Johnstone Rivers are in the Great Dividing Range in the WTWHA and they are similar in habitat to the upper reaches of the Russell and Mulgrave Rivers. The floodplain is relatively

short and confined, although in major floods the Johnstone River can link to the Moresby River to the south.

The North Johnstone River has been impacted by reduced riparian vegetation in its lower freshwater reaches that will progressively reduce in-stream habitat (Bunn *et al*, 1998) and increased sedimentation resulting in reduced depth of the river bed. The South Johnstone River has been similarly impacted with land clearing increasing sediment loads as evidenced by a large fish kill in the river in February 2004 that was attributed to suffocation by sediment (EPA, 2004).

Figure 16: Sand dam on the South Johnstone River
Photograph © G Vallance

Fish access to in-stream habitat in the South Johnstone is reduced due to a DNRM&E licensed sand dam built annually in the river for water extraction (*figure 16*). This sand dam may also contribute significantly to the available sediment load in the South Johnstone River in early wet season rain events. Three exotic fish species, including tilapia, have been recorded from the Johnstone River (*pers comm*. J Russell).

Apart from in-stream habitat, the only remaining wetland with potential fishery values that drains into the Johnstone River is at the top end of Ninds Creek adjacent to Etty Bay Road (*figure 17*). It is known locally as the Bulkuru Swamp and much of it has been drained and cleared, however it still has some extensive areas of melaleuca and palm vegetation. Drainage has resulted in a reduced

level of permanent water in this wetland and its value to fisheries has been significantly diminished. The area drains under Etty Bay Road through a culvert and there are signs such as iron flocculation and concrete corrosion that are associated with ASS (*figure 18*). Further downstream, there is an outlet for a sewage treatment plant that is a nutrient source for lower reaches of the creek and the Johnstone River. Culverts are barriers to migration in most flow events.

Figure 17: Ninds Creek wetlands south of Innisfail

Other remnant wetlands such as an area near the airport are heavily impacted and cannot presently be considered significant to fishery resources although they serve a role in mitigating water quality impacts from other catchment uses. There is a swampy area in the centre of Innisfail that is badly overrun with pond

apple and has strong signs of acid sulfate soil disturbance. There is an opportunity to develop a large freshwater wetland with connectivity to the North Johnstone River in this degraded area and its location would assist in raising awareness of the benefits of wetlands.

Figure 18: Crossing on Ninds Creek below Bulkuru Swamp showing iron flocculation and concrete corrosion associated with drainage of ASS

Risks or threats to Ninds Creek wetlands (Bulkuru Swamp):

1. Lack of knowledge of the use of this area by fish.
2. Invasive weeds, exotic fish and feral pigs.
3. Further exposure of ASS and ongoing impacts of ASS run-off downstream into the estuary.
4. Further draining for flood mitigation.
5. Impacts from treated effluent release from the sewage treatment plant.

11.1.6. Moresby River to Hull River

This district includes the Moresby River, Liverpool Creek, Maria Creek, Hull River and numerous smaller creeks. The freshwater reaches of the creeks and rivers are badly degraded, with riparian vegetation completely removed in many areas and too narrow or thin to be of value in others. In-stream habitat for fish in this area has been significantly degraded by land clearing and drainage works on the coastal floodplain, resulting in sedimentation and altered hydrology affecting

water courses. Wetlands have been modified by drainage works to benefit agricultural land use within the catchment.

Cowley Beach to the north and south of Liverpool Creek has two significant wetland areas. The shallow black water swamp at Cowley Beach drains north into Mourilyan Harbour (figure 19). It is subject to saltwater intrusion could be as a result of relative sea level change but is more likely due to the dredging and deepening of the mouth of Mourilyan Harbour, resulting in larger volumes of tidal exchange entering the inlet as has occurred at other sites where dredging has been undertaken (MHL, 2002). The use of this wetland above the tidal limit by fishery resources has not been studied.

Figure 19: Cowley Beach wetlands near Mourilyan Harbour

Cowley Beach South wetland has a different character and is characteristic of an ephemeral wetland that appears to be landlocked by beach sand ridges except in heavy rain events. Whilst impacts on this wetland appear minimal from aerial photography, it is likely that the natural landscape would see use by fish restricted to flood events.

Figure 20: Mount Coom wetlands adjacent to the Hull River

The fishery resources of Liverpool Creek, Maria Creek and the Hull River (figure 20) have been assessed with 134 species recorded of which 16 species were recorded in both freshwater and saltwater (Russell and Hales, 1997). There are no significant barriers to fish migration on these waterways although

improved drainage for agriculture is likely to have changed the water velocity in flood events that, in addition to water quality issues, may impact on migration.

The Hull River is primarily estuarine although it has large freshwater areas and off-stream wetlands above tidal influence. The in-stream habitat in the North Hull River and the Hull River catchments are both likely to be significant to fishery resources although catchment impacts have reduced the diversity and extent of habitat available due to sedimentation, nutrient inputs and the loss of dense riparian vegetation. However, in most areas, some riparian vegetation remains and provides large stretches of creeks with habitat for fish. Carmoo Creek and upper reaches of the Hull River have in-stream habitat areas for fish. In flood events the Tully River overflows into the Hull River.

Figure 21: Brackish wetland at Mount Coom adjacent to the Hull River

Remaining areas of low lying ephemeral and permanent wetlands adjacent to tidal areas of the Hull River, particularly around Mount Coom (figure 21), may be important off-stream wetlands of significance to fish in this catchment. While topographical maps show nearly all of this area to be mangroves, there are large areas of melaleuca and bulkuru swamp and some areas of open water above the tidal limit. Anecdotal information reports large numbers of barramundi in this wetland during flood events (pers comm. J Galliano) and during a brief visit to the area numerous fish species including gudgeons, mullet and rainbow fish

were observed. There was evidence of the use of this area by numerous native fish species suggesting a healthy ecosystem.

Presently, there is no suggestion of expansion of agriculture into these areas although a large part of it is privately owned. The impact of adjacent agricultural land use is currently minimal due to the nature of the soils, relatively small sub-catchments and shallow drainage. Local landholders are taking a leading role in managing this area including encouraging wildlife through maintenance of vegetation buffers and corridors and controlling feral animals and plants.

In drier areas within this wetland complex, fire has destroyed some underlying peat. According to locals, the fire was reportedly part of the management program for the area but once the peat ignited, it was unable to be controlled or extinguished until heavy rain intervened. The fire was reportedly deliberately lit to reduce the fuel load at ground level, however this has not been achieved as the peat has collapsed, killing many large trees and causing them to fall over. The fuel load has increased significantly over what was observed in adjacent unburnt areas. This area and Wyvuri Swamp have both been degraded in a similar manner. It is strongly recommended that fire should not be used for fuel hazard reduction in or near peat wetlands.

Risks or threats to Mount Coom wetland:

1. Lack of knowledge of the use of this area by fish.
2. The impacts of fire on the underlying peat.
3. Invasive weeds and feral pigs.
4. Agricultural, residential and tourism development.

11.1.7. Tully and Murray Rivers

The Cardwell Shire has a network of wetlands that represent the best of what remains in the Queensland Wet Tropics at a catchment scale providing an insight into how a much larger area from Ingham to Daintree may have once interacted with the GBR lagoon. The Tully and Murray floodplain has the most extensive areas of off-stream freshwater wetlands of importance to fishery resources remaining in the Wet Tropics.

The Tully River is the main river system on this part of the floodplain and has high rainfall throughout its catchment. Its headwaters are in the WTWHA. The Tully River has few tributaries on the floodplain and overflows extensively into the Murray River in its middle reaches and the Hull River in the lower reaches during large flood events.

The Tully River is typical of many larger rivers in that during flood times it is distributary to the floodplain (Summerfield, 1991). In-stream habitat in the Tully

River has been affected by a range of impacts from artificial bank stabilisation to sedimentation as a result of land clearing.

Figure 22: Lagoons and wetlands on the Tully–Murray floodplain

Koombooloomba Dam is located in the upper reaches of the Tully River but has minimal impact on fish migration as it is above a large natural waterfall. It causes the Tully River to have an artificial flow regime due to daily releases from the dam for electricity production and white water rafting. The impact of these modified flows has been the subject of investigation as there is concern that it is affecting spawning sites for Sooty Grunter (Digman, 2003; *pers comm*. A Hogan). The impact on other species is unknown and has not been investigated. The Tully River still has a wide variety of habitat available to fish.

The Murray River also starts in the WTWHA but has a much smaller catchment than the Tully in its upper reaches with less rainfall. Although the Murray River receives floodwaters from the Tully River and tributaries on the floodplain, it is also distributary in its middle and lower reaches and even in moderate rainfall it backflows into many of its feeder creeks and some permanent wetland areas. The Murray River suffers from sedimentation and the impact of this muddy water on fish productivity in a stream that once ran clean for most of the time is unknown but potentially significant.

Despite extensive clearing for agriculture, there are still large areas of ephemeral and permanent melaleuca and bulkuru wetlands. An extensive network of permanent deepwater lagoons still remains although there is a range of impacts that, in many cases, degrade their suitability as fishery resources. This network of lagoons is the most significant wetlands to fishery resources remaining in the Wet Tropics section of the Queensland coast. The main wetlands are complemented by a network of smaller natural and artificial lagoons, some of which have been developed primarily to reduce the impacts of adjacent farming by acting as sediment and nutrient sinks, flood detention basins or both.

Permanent wetlands between the Tully and Murray Rivers (*figures 22 and 23*) include:

1. Raccanello Lagoon
2. Jalum Lagoon
3. Bunta Lagoon
4. Boar Creek wetland
5. Kyambol Lagoon
6. Selby's Lagoon
7. Lillipocket Lagoon
8. Blue lagoon
9. Hassell Lagoon
10. Barretts Lagoon

Some of the above lagoons have been surveyed for fish by DPI&F, however formal reports are not currently available detailing the species. It is expected that species would be similar to those found in the survey of the adjacent Hull River.

Numerous other lagoons have high fishery values including the network of artificial lagoons on the Digman property (Digman, 1996), which have the highest diversity of fish species of any lagoon on the floodplain (Hogan, 2000).

A total of 10 marine species were identified in the lagoons along with 14 freshwater species (Hogan, 2000).

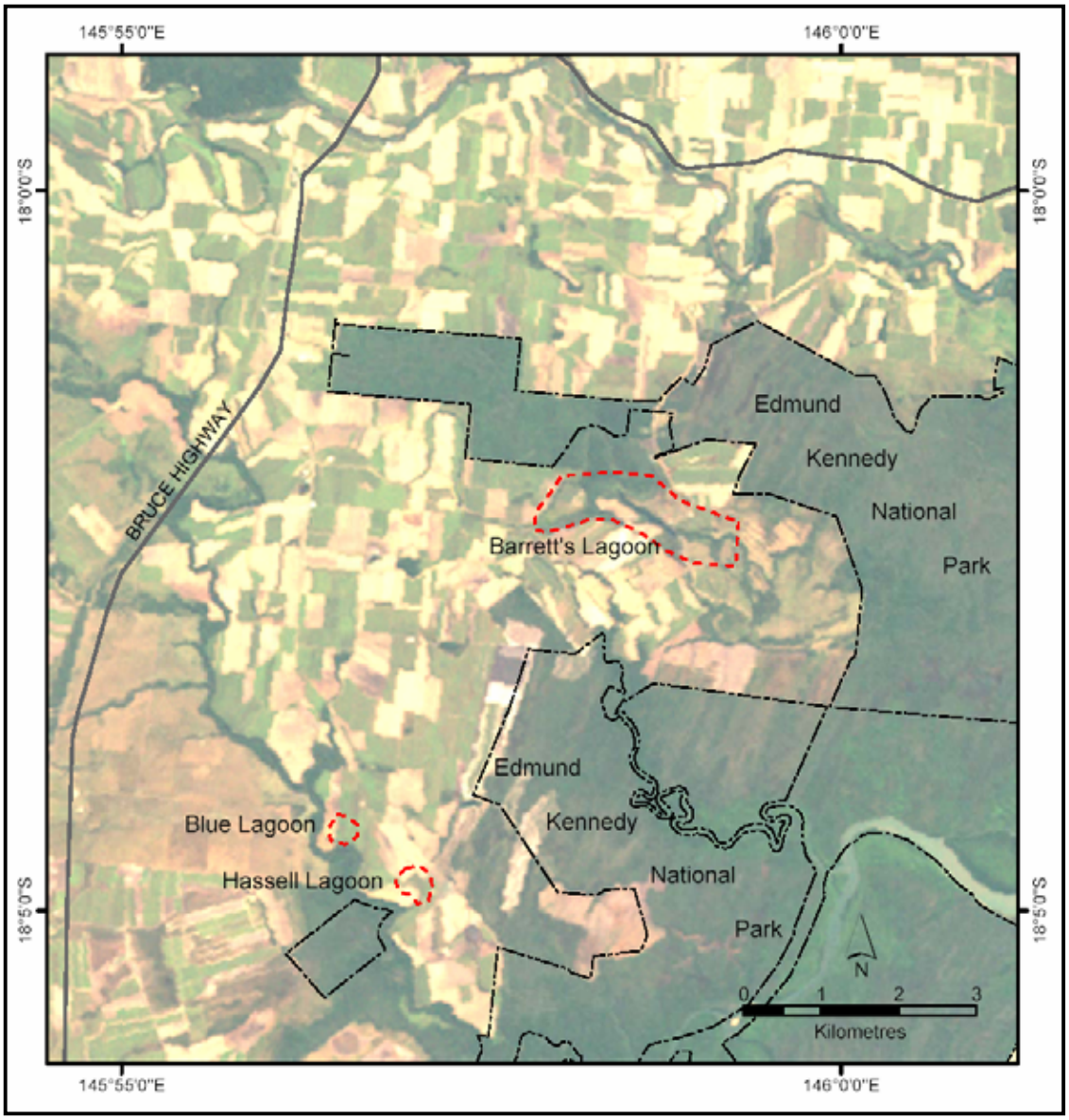

Figure 23: Barrett's Lagoon, Blue Lagoon and Hassell Lagoon on the Murray River floodplain

A description of the floodplain and the full range of impacts on it was described in detail during the SIIP planning process (Tait, 1994); however, further development has taken place since that time. While the district has suffered from numerous minor fish kills over the last five years, a better indicator of chronic long-term problems is the reduced diversity of fish species in many remaining wetlands, probably as a result of water quality and habitat quality impacts from upstream land use and/or changed downstream hydrology affecting fish passage.

An inspection in December 2003 identified that the Tully/Murray floodplain suffers from a wide range of introduced woody weeds and grasses including but not restricted to pond apple, mimosa, chinee apple, lantana, rubber vine, hymenacne, para grass and aleman. Woody weeds are also affecting hydrology, increasing sheet, bank and gully erosion and, in some areas, effectively reducing the nutrient removal role that deep-rooted trees have on groundwater (Johnson, 1997).

Drainage works, including paddock drainage such as coil pipes and deeper canal drainage, impact significantly on the fishery values of freshwater wetlands (*pers comm*. R Digman). Groundwater drainage carries mostly deoxygenated water from the paddocks into adjacent surface drainage networks (Rayment and Bohl, 2002) that, in some cases, drain into areas occupied by fish. This deoxygenated water can lead to fish kills and is likely to be a cause of sub-lethal stress that can reduce the productivity of the fishery. Deep, surface drainage reduces the detention time of surface waters and therefore increases sediment and nutrient transportation (Rayment and Bohl, 2002). Most of the drainage network, whether natural or artificial, has little or no riparian vegetation. In areas that have extensive groundwater drainage it may be beneficial to install rock areas in the bed of drains to increase water aeration (Hunt and Christiansen, 2000).

Figure 24: Cheerin Creek on the Tully River floodplain in the King Ranch area

In many cases, major drainage works impact significantly on the large remaining natural wetlands in the area (Tait, 1994). Outlet points at some waterholes such

as Bunta and Jalum Lagoons are two metres or more below their natural height. This effectively reduces the depth and volume of water in the lagoons. Reduced water volume results in higher and increased fluctuations in water temperatures and reduced dissolved oxygen levels (Tait, 1994), less dilution of contaminants, increased risk of algal blooms and increased invasion of introduced grasses. Consideration should be given to reinstating the normal discharge levels of the remaining natural lagoons.

Recent land clearing in the King Ranch area of Cherrin Creek (*figure 24*) at the top of the catchment has reduced its flood retention capacity. This area drains into the Murray River and since being cleared and having drainage improved, the area now suffers from significant levels of sheet erosion. Field observations in December 2003 revealed increased sediment loads in the Murray River to the extent that when the river backs up into lower floodplain wetlands, the water entering these wetlands from the river appears to be carrying much larger volumes of sediment than that coming off adjacent floodplain farms. The increased sediment load has been identified in the long-term monitoring program undertaken on the Tully floodplain by AIMS (Furnas, 2003). Sheet erosion in the upper catchment appears to be leading to increased gully erosion. There is a need for a large detention basin as originally recommended in the Murray-Riversdale SIIP proposals. Alternately, an extensive network of smaller lagoons such as has been developed in the lower catchment may provide some sediment and nutrient sink capacity that will improve downstream riverine water quality in heavy rain events.

The Tully River flood plain lagoons have been monitored for fish on a regular basis and there is also an extensive set of scientific and community water quality data for the region (Furnas, 2003). The loss of wetlands in this region, and the further degradation of those remaining is likely to impact significantly on the productivity of the fishery including marine species such as mangrove jack, mullet, bream, barramundi and smaller species, many of which are important sources of food for predators. There has been no assessment of heavy sediment loads on estuarine and marine fish.

Barramundi tagged in Barrett's Lagoon (*figure 25*) have been recaptured in Hinchinbrook Channel with one fish recaptured in the Gorge area of the Herbert River. A barramundi tagged in Hassell Lagoon was recaptured at Lucinda (Suntag, 2004).

A survey by DPI&F staff in 2004 showed large numbers of Barramundi had occupied a recently constructed artificial lagoon upstream from Selby's Lagoon (*pers comm*. R Digman). Approximately 80 fish were identified with

electro-fishing and an estimated 300 fish occupied the lagoon. This again highlights the importance of freshwater wetlands to the productivity of coastal fishery resources.

Figure 25: Barramundi tagged in Barrett's Lagoon

Risks or threats to wetlands on the Tully and Murray River floodplains:

1. Continued loss or degradation of lagoons by adjoining land use.
2. Increased or ongoing sedimentation and reduction in depth.
3. Invasive weeds.
4. Loss of riparian vegetation.
5. Further impacts on water quality from works to improve drainage.
6. Loss of connectivity resulting from increased use of water for production.

11.1.8. Murray River to Cardwell

Numerous small creeks join the coast between the mouth of the Murray River and the northern end of Hinchinbrook Island. There are a number of lagoons that appear to have permanent deep water along the coastal strip including a lagoon to the east of Bilyana and Black's Lagoon that could not be accessed.

There are also a number of lagoons that feed into Wreck Creek and associated wetlands and known locally as Wreck Lagoons (*figure 26*). The lagoons are within Edmund Kennedy National Park and protected from on-site impacts. Barramundi have been tagged in the lower brackish lagoon. The relatively small catchment above the lagoon provides some protection from catchment impacts associated with intensive agriculture. The melaleuca wetland complex that

provides a buffer between the coast and floodplain agricultural land between the Murray River and Cardwell appears similar to that found around Mount Coom. The fishery values of this wetland have not been determined but are likely to be important.

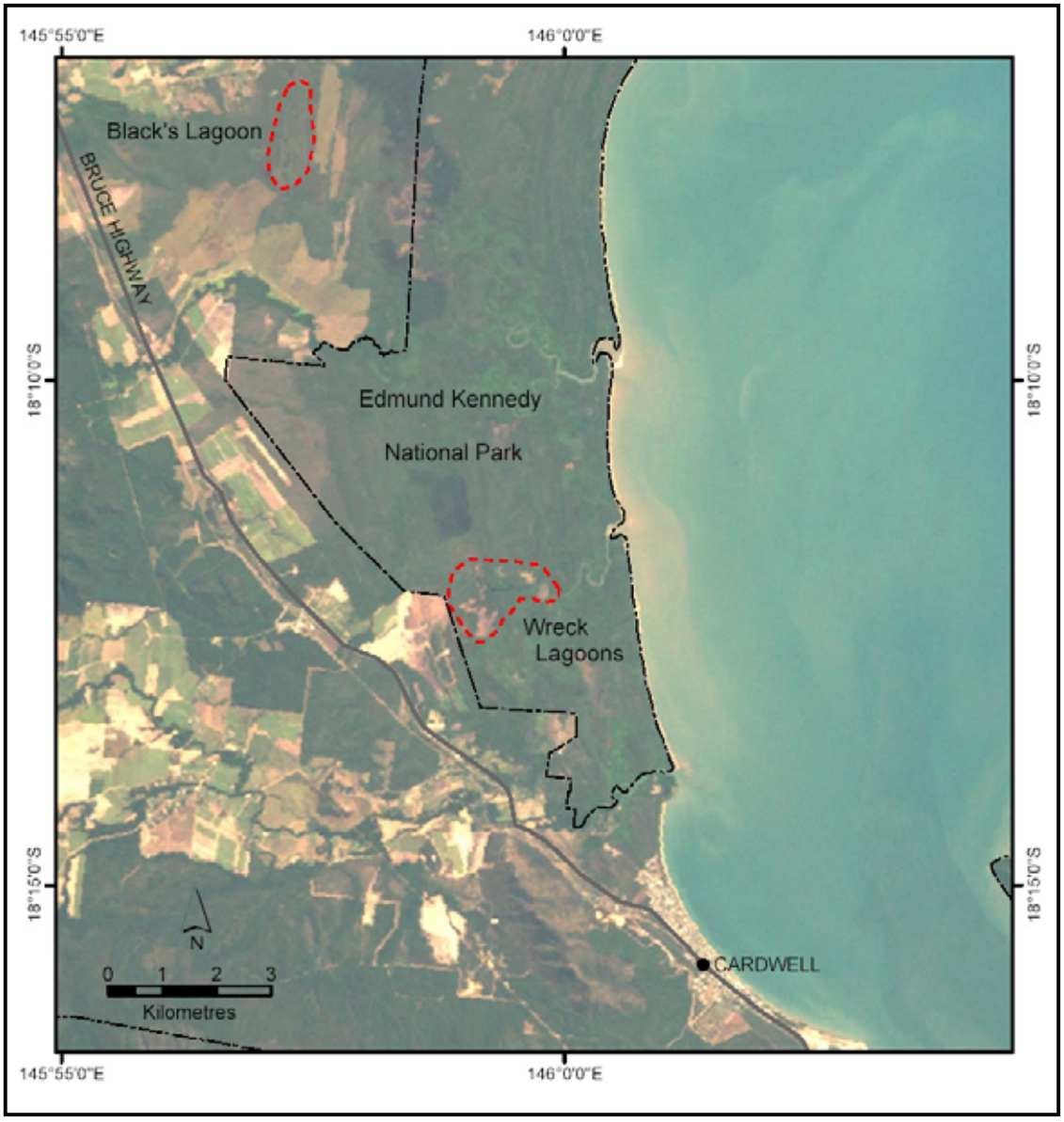

Figure 26: Black's Lagoon and Wreck Lagoons north of Cardwell

11.1.9. Hinchinbrook Island and the Cardwell Range

There are only small areas of freshwater wetland from Cardwell to the Cardwell Range and no off-stream habitat that is significant to fishery resources. Hinchinbrook Island has in-stream habitat that is pristine in numerous creek systems and there is a small freshwater wetland complex that drains into North Zoe Bay Creek but it is remote and difficult to access. The primary threat is from

a relatively small population of feral pigs that are subject to intensive control program by the QPWS. In-stream freshwater habitat above the tidal limit in Deluge Inlet has outstanding environmental values but is small and may not contribute significantly to local fishery resources. Threats to wetlands in this district are primarily restricted to feral animals and introduced weeds.

11.1.10. Herbert River Floodplain

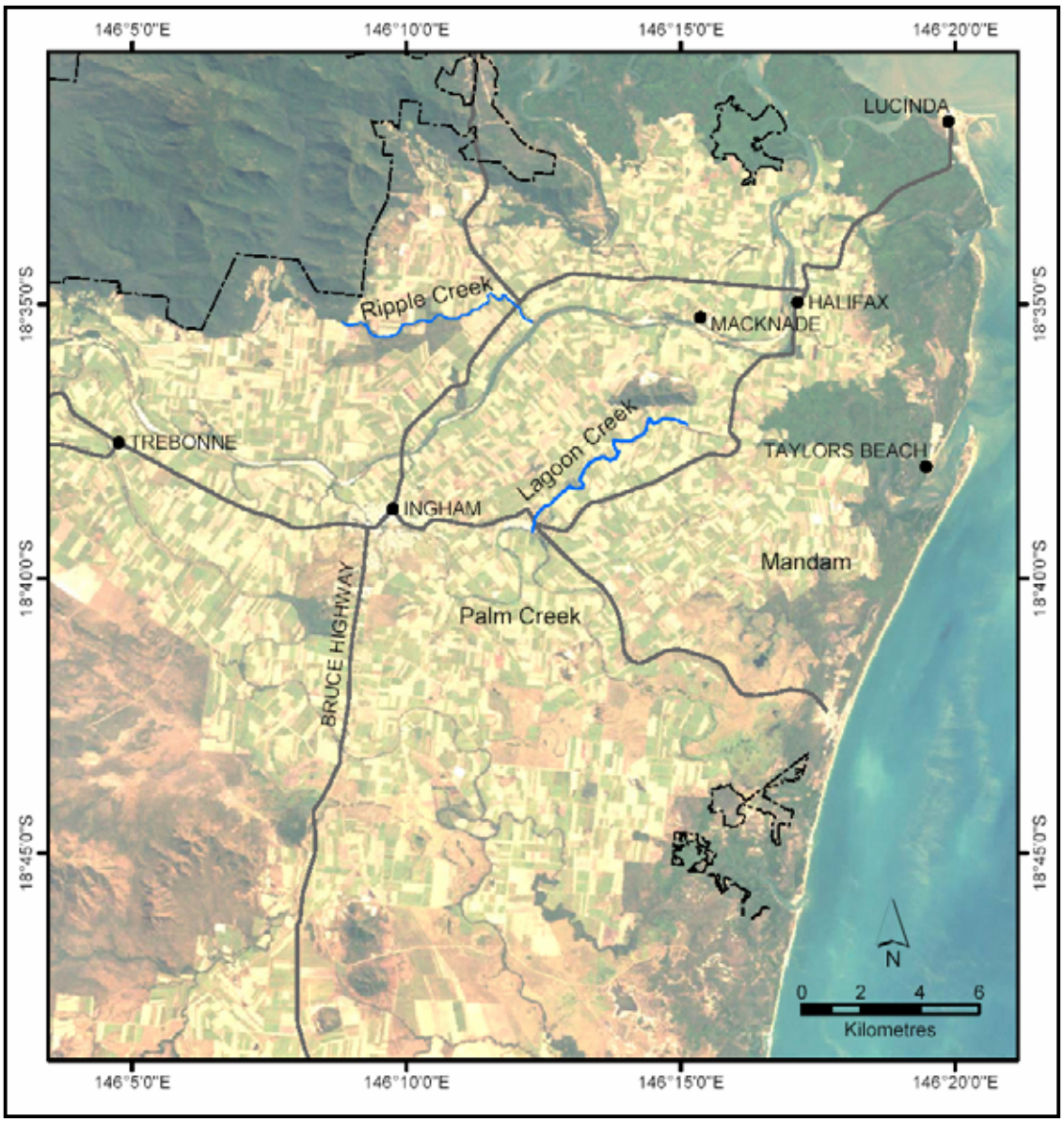

Figure 27: Lower Herbert River and Mandam wetlands

The Herbert River has meandered extensively across its floodplain in recent geological history as evidenced by old flow paths from the Seymour River to Cattle Creek. RA Johnstone (1905) described the area as having extensive