Fisherman Islands and Whyte Island

Mangrove Health Assessment 2012

Prepared for:

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Introduction

The Port of Brisbane is located at the mouth of the Brisbane River. The Port of Brisbane Pty Ltd (PBPL) is responsible for the operation and management of the Port of Brisbane. The PBPL has a number of responsibilities, as defined in the company's Environmental Policy and under the *Environment Protection Act 1994*, with respect to the impact of the Port's activities on the surrounding environment. The PBPL commissioned the present study to determine the current health of mangrove communities at the Port of Brisbane, and to review this data in the context of previous studies.

Community Composition, Structure and Health

In 2012, the total area of regrowth and mangroves in poor health at western Fisherman Islands had increased, while the total area of dead mangroves and mangroves in good health had decreased. There were no recently dead mangroves in this area in 2012. There was a relatively large area of regrowth along the margin of parts of the dieback area.

In 2012, the total area of dead mangroves at eastern Fisherman Islands decreased slightly, primarily because there had been some improved health along the margin of the dieback area and mangroves. The total area of recently dead mangroves also decreased. The most eastern tip of the peninsula was in fair to good health in 2010, but in fair to poor health in 2012.

In 2012, there was an overall decline in mangrove health at northern Fisherman Islands. The most substantial change was relatively large areas of forest in poor health near the landward margin, which were regrowth forest or in fair health in 2010. There was evidence of potential impacts to water quality in the drain adjacent to northern Fisherman Islands.

Erosion and deposition of sediment has reduced the health of forests in the Coal Loader area since 2008. Several large trees had been undermined by erosion in 2012. There was evidence of potential impacts to water quality in the drain adjacent to northern Fisherman Islands, which drains into the small inlet in between western Fisherman Islands and eastern Coal Loader area.

In 2012, the major changes to health at Whyte Island included changes to the location of regrowth and a decline in health from good to fair in areas of the forest along the northern shore, and from fair to poor throughout much of the forest. There were no recently dead

mangroves in this area in 2012. The area of regrowth at southern Whyte Island in 2010 was in poor health in 2012, and a new area of regrowth had developed at southern Whyte Island in 2012. The area of mangroves in good health was significantly less in 2012 than in previous years, particularly at northern Whyte Island.

Large pieces of debris and seagrass wrack had accumulated throughout the survey area in 2012. This indicated that there had been strong water movements through the area at times, including the 2011 flooding of the Brisbane River. These berms of seagrass wrack were consolidated and likely to have severely impeded tidal drainage.

In 2012, there were thick algal mats growing over the sediment in places including in the ponded dieback area and in mangrove areas of poor health at Fisherman Islands (excluding the Coal Loader area) and Whyte Island.

Photographic Monitoring

In summary, the cover of mangroves and saltmarsh had increased in several areas. There was also evidence of more seagrass wrack in 2012 than in 2010, and substantial ponding of water in 2012.

Sediment Quality

There were no clear trends linking individual potential contaminants to mangrove health. Increased nutrient availability can negatively impact mangrove health in association with high salinity in the sediment and an interaction between nutrients and salinity may be negatively impacting mangrove health in the dieback area.

Salinity of Pore Water

In 2012, the salinity of pore water in dieback areas was significantly different to that of mangroves in good and fair health. The salinity of pore water in forests of good health was also significantly different to that of forest in fair or poor health.

Overall, the mean salinity of the pore water in the sediment was lower in 2012 than in earlier surveys. This was likely to be related to heavy rainfall prior to the survey. There was heavy regional rainfall only days before the survey, and relatively substantial rainfall during many of the months leading into the survey.

Potential Causes

In 2012, there were fewer recently dead mangroves and a larger total area of regrowth associated with dieback areas than in 2010. This was likely to be related to increased rainfall and reduced salinity in the pore water of sediment.

Between 2010 and 2012, the total area of mangroves in poor and fair health increased while the total area of mangroves in good health decreased. This was likely to be related to a number of interacting factors including the drought conditions leading into the 2010 survey, followed by severe flooding in early 2011, potential impacts to water quality and quantity (flow) in the drain adjacent to the western Fisherman Islands mangrove forest, seagrass wrack and / or boat wash.

Conclusions and Recommendations

Longer-term changes in rainfall appear to have an over-riding influence on patterns of mangrove dieback and recolonisation in Moreton Bay. However several influences also appear to be influencing the mangroves associated with the port, such as major regional flooding and boat wash. Continued monitoring is recommended, and could be enhanced by further investigations such as:

- augmentation of the pore water salinity in sediment monitoring as outlined in the report
- assessment of water quality and flow in the drain that lines the western Fisherman Islands mangrove forest
- assessment of additional permanent photographic points, particularly in areas with high erosion
- a dye run to establish which way the water flows out of the dieback areas, particularly in the new dieback area on Fisherman Islands
- laser survey or similar of dieback areas, to establish benchmark for sediment height, and
- measurement of nutrients, salinity and dissolved oxygen levels in ponded areas.

1 Introduction

The Port of Brisbane is at the mouth of the Brisbane River. The Port of Brisbane Pty Ltd (PBPL) is responsible for the operation and management of the Port of Brisbane. The PBPL has a number of responsibilities, as defined in the company's Environmental Policy and under the *Environment Protection Act 1994*, with respect to the impact of the Port's activities on the surrounding environment.

As part of these responsibilities, the PBPL has a duty of care to ensure that the operation of the Port and associated activities do not adversely impact adjacent wetland areas. Mangrove communities at the Port have shown signs of declining health, and PBPL commissioned frc environmental to develop and implement a mangrove health monitoring program to identify possible causes for the decline. The Port of Brisbane was previously known as Fisherman Islands and Whyte Island; these names are used in this report to facilitate comparisons with monitoring in previous years.

The community structure and health of mangroves at Fisherman Islands were assessed and mapped in 1999 and 2002 and every second year since. Since 2002, the distribution and health of mangroves at Whyte Island have also been mapped every second year. Permanent photographic monitoring stations were established in late 1999 / early 2000, and photographs of the mangrove communities to the north, south, east and west of each station were taken in 1999/2000, 2001, 2002, and every second year since. Since 2000, sediment samples have been collected and analysed for nutrients and potential contaminants every second year. Since 2008, samples of pore water in sediment have been collected and analysed (WBM Oceanics Australia 2000; 2002a; b; frc environmental 2004; 2007a; 2008a). These data have been used to monitor the condition of mangroves at Fisherman Islands and Whyte Island, and to provide some background for a discussion of the potential causes of their degradation, and opportunities for rehabilitation.

The PBPL commissioned the present study to determine the current health of mangrove communities at the Port of Brisbane, and to review this data in the context of previous studies. In this study we:

- resurveyed and mapped the mangrove community structure, species composition and ecological health of mangroves at Fisherman Islands (including the Coal Loader area) and Whyte Island using established survey techniques, taking particular care in identifying areas that appeared to be recently dead or regrown
- rephotographed the permanent photographic monitoring stations using established techniques, and described any changes

- collected and analysed sediment samples using established techniques, and described any changes or correlations with mangrove health
- resampled and analysed sediment pore water using established techniques, and described any changes or correlations with mangrove health, and
- compared the distribution and health of mangroves to previous years, and discussed potential causes of any recent changes.

1.1 Background

Mangroves grow at the dynamic interface between the land and the sea, growing in extreme environments that other terrestrial plants cannot tolerate. The physiology and structure of mangroves enables them to cope with extreme conditions such as high and varying levels of salinity, water logged soils that inhibit oxygen uptake, and often high temperatures, strong winds and strong currents. While mangroves are able to withstand many of these impacts, they are also easily affected by changes to their environment; for example, changes to inundation can rapidly cause mangrove dieback.

Of the eight mangrove species in Moreton Bay, five were found in the study area:

- grey mangrove (*Avicennia marina var. australasica*)
- yellow mangrove (*Ceriops tagal*)
- red mangrove (*Rhizophora stylosa*)
- river mangrove (*Aegiceras corniculatum*), and
- orange mangrove (*Bruguiera gymnorrhiza*) (WBM Oceanics Australia 2000; 2002b; frc environmental 2004; 2007a; 2008a).

Avicennia marina is the most dominant species, and community composition in the study area is typical of mangrove communities in the Moreton Bay region.

At both Fisherman Islands and Whyte Island there are large areas of dead mangroves, associated with bare / saltmarsh areas, surrounded by mangroves in poor condition.

Saltmarsh communities were dominated by:

- sea purslane (*Sesuvium portulacastrum*)
- austral seablite (*Suaeda australis*)
- jellybean plant (*Suaeda arbusculoides*)

- samphire (*Sarcocornia quinqueflora*), and
- ruby saltbush (*Enchylaena tomentosa*).

This pattern of dieback is common in mangrove communities in the dry tropics (Gordon 1987; Marius & Lucas 1991; Conacher et al. 1996), where it is thought to be largely associated with increased soil salinity due to dry conditions. It has also been observed recently at a number of other places in south-east Queensland (frc environmental 2008b).

Details of the methods and results of the survey, and a discussion of the results are presented in Appendices A to E. Appendices F and G provide the mangrove mapping data. A summary of the results and discussion is presented below.

2 Community Composition, Structure and Health of Mangrove Communities

Further details on the methods and results for the mangrove composition, structure and health assessment are provided in Appendix A.

2.1 Fisherman Islands

Between 2010 and 2012, the most substantial changes to mangrove health at Fisherman Islands were:

- a decrease in the total area of mangroves in good health from 62.2 to 52.0 ha, and
- an increase in the total area of mangroves in poor health from 25.8 to 38.4 ha, with the total area of forest in poor health increasing since 2004 (Figure 2.1).

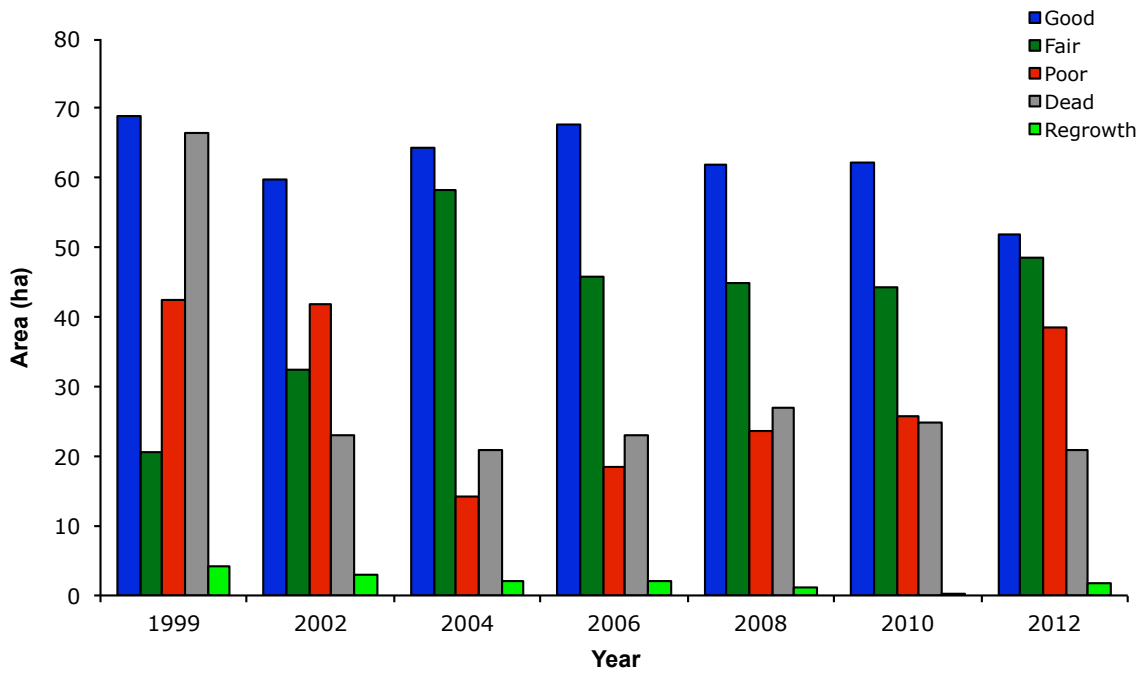


Figure 2.1 Area of mangroves in each health category at Fisherman Islands (excluding the Coal Loader area) from 1999 to 2012.

There were small changes to the total area of other health categories between 2010 and 2012, including:

- a decrease in the total area of dead mangroves from 24.9 to 20.6 ha
- an increase in the total area of regrowth from 0.3 to 1.8 ha, and
- an increase in the total area of forest in fair health from 44.4 to 48.5 ha (Figure 2.1).

Western Area

In 2012, the total area of regrowth and mangroves in poor health at western Fisherman Islands had increased, while the total area of dead mangroves and mangroves in good health had decreased. There were no recently dead mangroves in this area in 2012. There was a relatively large area of regrowth along the margin of parts of the dieback area.

The increase in the total area of forest in poor health was mostly due to reduced health in area of forest near the south-western shore that was of fair health in 2010. Evidence of poor health in this area included epicormic shoots, deformed pneumatophores, yellowing leaves, insect damage and reduced canopy cover. There was evidence of potential impacts to water quality in the drain adjacent to northern Fisherman Islands, which drains into the small inlet in between western Fisherman Islands and eastern Coal Loader area (Figure 2.2).

Figure 2.2

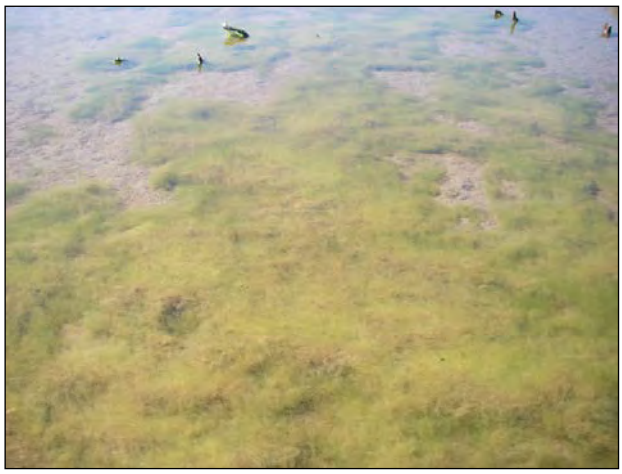
Potential impacts to water quality in the drain next to northern Fisherman Islands.

The dieback area at western Fisherman Islands is periodically inundated, resulting in the subsequent ponding of water. Dense algal mats grew in the ponded areas in 2012 (Figure 2.3) and during earlier surveys. Between 2010 and 2012, the extent of saltmarsh in association with the dieback areas on western Fisherman Islands (and eastern

Fisherman Islands and Whyte Island) slightly decreased. In 2010 there was new growth of *S. quinqueflora* at the boundary of the saltmarsh and bare area, however in 2012 there was no new growth and the saltmarsh appeared to be reducing in extent.

Figure 2.3

Macroalgae growing on bare substrate at western Fisherman Islands.



Large pieces of debris and *Zostera muelleri* [1] seagrass wrack had accumulated along the landward edge of the dieback area in 2012, as was the case during earlier surveys (and at eastern Fisherman Islands, the Coal Loader area and Whyte Island in 2012 and earlier surveys). This indicated that there had been strong water movements through the area at times, including the 2011 flooding of the Brisbane River.

Eastern Area

In 2012, the total area of dead mangroves at eastern Fisherman Islands decreased slightly, primarily because there had been some improved health along the margin of the dieback area and mangroves. The total area of recently dead mangroves also decreased.

The most eastern tip of the peninsula was in fair to good health in 2010, but in fair to poor health in 2012. This decline in health was mostly evident via reduced canopy cover, leaf loss and yellowing of leaves.

Large pieces of debris and seagrass wrack had accumulated in areas of eastern Fisherman Islands in 2012, as was the case during earlier surveys (and at western

[1] Until recently, and in previous reports, this species was known as *Zostera capricorni*.

Fisherman Islands, the Coal Loader area and Whyte Island). There was more seagrass wrack in 2012 than in 2010. In 2008, there were small accumulations of seagrass wrack on the substrate to the north-east of the dieback area, although accumulation was less than in 2006. In 2006 and 2012, seagrass wrack littered the lower branches of the mangroves and formed berms of up to 0.5 m high along the south-eastern shore (Figure 2.4). This indicated that there had been strong water movements through the area at times, including the 2011 flooding of the Brisbane River. These berms of seagrass wrack were consolidated and likely to have severely impeded tidal drainage.

Figure 2.4

Large banks of seagrass wrack at eastern Fisherman Islands.

Northern Area

In 2012, there was an overall decline in mangrove health at northern Fisherman Islands. The most substantial change was relatively large areas of forest in poor health near the landward margin, which were regrowth forest or in fair health in 2010. These areas of poor health were characterised by patches of very soft sediment with macroalgal mats and slicks on the water surface, together with reduced canopy cover, leaf damage by insects and deformed pneumatophores. There was evidence of potential impacts to water quality in the drain adjacent to northern Fisherman Islands (Figure 2.2).

The relatively large area of dead mangroves recorded during earlier surveys had decreased since 2004. Mangrove forest in poor health had grown in to the dead area since it was first mapped in detail in 2004.

2.2 Coal Loader Area of Fisherman Islands

Overall mangrove health at the Coal Loader area remained largely unchanged since 2004 (Figure 2.5). Most of the mangrove forest was in good health. In 2012, no regrowth was observed because the mangroves in the two large regrowth areas (along the landward margin to the east and west of Port Drive) had matured, and are now forest in fair or poor health.

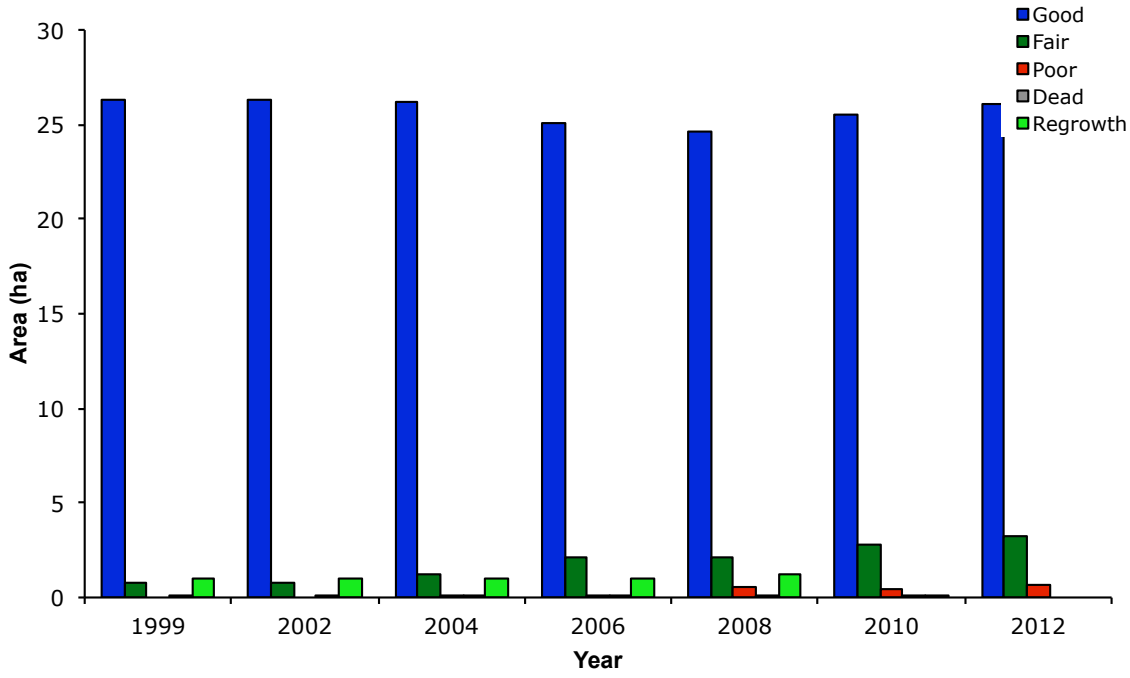


Figure 2.5 Area of mangroves in each health category in Coal Loader area of Fisherman Islands from 1999 to 2012.

Two new areas of forest in poor health developed in the eastern Coal Loader area:

- an area in the north downstream of the drain running along the landward margin of the Fisherman Island mangroves, and
- an area at the southern end of this area.

There were also changes to health along the landward margin of the eastern Coal Loader area:

- the health of the northern section improved from poor to good in 2012, while
- the health of the southern section declined from good to poor.

Erosion and deposition of sediment has reduced the health of this area since 2008. There were several sand berms in the eastern and western sections of the Coal Loader area (e.g. Figure 2.6). Several large trees had been undermined by erosion (e.g. Figure 2.7). There was evidence of potential impacts to water quality in the drain adjacent to northern Fisherman Islands, which drains into the small inlet in between western Fisherman Islands and eastern Coal Loader area (Figure 2.2).

Figure 2.6

Sand deposition, rubbish and debris across mangroves in Coal Loader area, east of Port Drive.

Figure 2.7

Erosion along south-eastern shore in Coal Loader area, east of Port Drive.

Large pieces of debris and seagrass wrack had accumulated in this area in 2012, as was the case during earlier surveys (and at Fisherman Islands and Whyte Island) (Figure 2.8). This indicated that there had been strong water movements through the area at times, including the 2011 flooding of the Brisbane River. These berms of seagrass wrack were consolidated and likely to have severely impeded tidal drainage.

There was evidence of human activity in the western Coal Loader area (Figure 2.9). [2]

Figure 2.8

Debris and seagrass wrack at the eastern Coal Loader area.

Figure 2.9

Evidence of human activity in the western Coal Loader area.

2.3 Whyte Island

The major changes to mangrove health at Whyte Island were that the total area of dead mangroves and mangroves in poor and fair health had slightly increased since 2010, while the total area of mangroves in good health had declined since 2002 (but there had been little change since 2006). Since 2010:

[2] This type of activity has been recorded during previous surveys and appears to be related to training by local police.

- the total area of dead mangroves had increased from 26.81 to 30.9 ha
- the total area of poor mangroves had increased from 19.16 to 23.36 ha, and
- the total area of fair mangroves had increased from 2.2 to 2.7 ha (Figure 2.10).

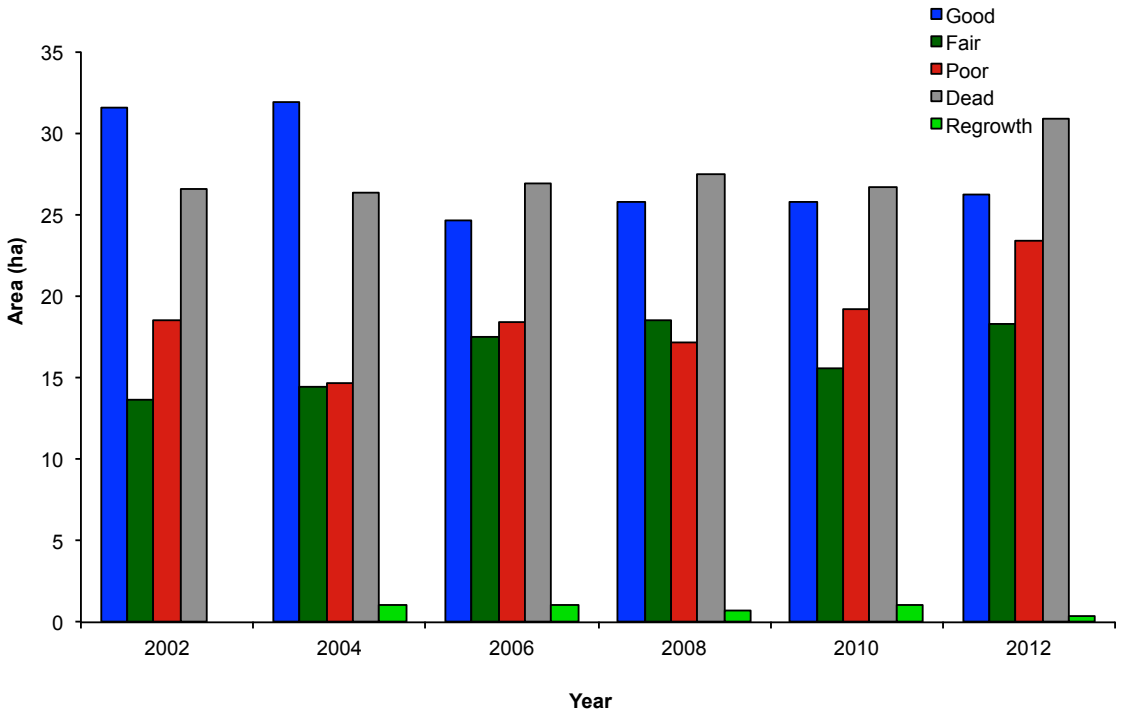


Figure 2.10 Area of mangroves in each health category at Whyte Island from 2002 to 2012.

In 2012, the major changes to health included changes to the location of regrowth and a decline in health from good to fair in areas of the forest along the northern shore, and from fair to poor throughout much of the forest. There were no recently dead mangroves in this area in 2012. The area of regrowth at the southern Whyte Island in 2010 was in poor health in 2012, and a new area of regrowth had developed at southern Whyte Island in 2012.

Large pieces of debris and seagrass wrack had accumulated in this area in 2012, as was the case during earlier surveys (and at Fisherman Islands and the Coal Loader area) (Figure 2.11). This indicated that there had been strong water movements through the area at times, including the 2011 flooding of the Brisbane River. These berms of seagrass wrack were consolidated and likely to have severely impeded tidal drainage.

Figure 2.11

Large debris at Whyte Island.

In 2012, there were thick algal mats growing over the sediment in the ponded dieback area and mangrove areas of poor health (Figure 2.12 and Figure 2.13). The abundance of algal mats was widespread.

Figure 2.12

Ponding water at the Whyte Island dieback area with extensive algal mats.

Figure 2.13

Macroalgal mats in the dieback area at Whyte Island.

3 Photographic Monitoring

Further details on the methods and results for the photographic monitoring are provided in Appendix B.

In summary, the cover of mangroves and saltmarsh had increased in several areas. There was also evidence of more seagrass wrack in 2012 than in 2010 and substantial ponding in 2012.

4 Sediment Quality

Further details on the methods and results for the sediment quality assessment are provided in Appendix C.

4.1 Nutrients

Fisherman Islands

Total nitrogen concentrations in the sediment of mangroves in good health were highly variable, ranging from one of the lowest concentrations recorded to the highest concentration recorded. In areas of fair health, concentrations were variable. In areas of poor health, concentrations were relatively similar and moderate compared to other sites. In the dieback area total nitrogen concentrations were relatively low. There were no clear trends linking total nitrogen concentrations to mangrove health, as a single contaminant.

Total phosphorus concentrations in the sediment of mangroves in good health were highly variable, ranging from the lowest concentration recorded to the highest concentration recorded. In areas of fair health, concentrations were relatively low. In areas of poor health, concentrations were relatively similar and moderate compared to other sites. In the dieback areas total nitrogen concentrations were relatively low. There were no clear trends linking total phosphorus concentrations to mangrove health, as a single contaminant.

Increased nutrient availability can negatively impact mangrove health in association with high salinity in the sediment (Lovelock et al. 2009) and an interaction between nutrients and salinity may be negatively impacting mangrove health in the dieback area (given salinity in the sediment is consistently higher in the dieback areas, as discussed in Appendix D).

Whyte Island

The highest total nitrogen and phosphorus concentration was recorded in the sediment of mangroves in good health; whereas the lowest concentration of total nitrogen was recorded in the sediment of the dieback area and the lowest total phosphorus concentration was recorded in the sediment of mangroves in poor health. There were no clear trends linking total nitrogen and phosphorus concentrations in sediment to mangrove health at Whyte Island, as a single contaminant. Increased nutrient availability can

negatively impact mangrove health in association with high salinity in the sediment (Lovelock et al. 2009) and an interaction between nutrients and salinity may be negatively impacting mangrove health in the dieback area.

Regional Perspective

In 2012, nutrient concentrations at Fisherman Islands were generally similar to those at other Queensland sites. The total nitrogen concentration at sites 3 and 6 was above those at most other Queensland sites, as was the case in 2010; these sites were in forests of good health. The concentration at site 6 in 2012 was also higher than the concentration recorded at Luggage Point (located near a sewage discharge area). The total phosphorus concentration at most sites (3, 6, 9, 11, 13, 19 and 23) were above most other Queensland sites; these sites were in forests of good, fair and poor health and the dieback area. Total phosphorus concentrations in this survey were below the concentration recorded at Luggage Point.

In 2012, nutrient concentrations at Whyte Island were often higher than those recorded at other Queensland sites, as was the case in 2010. The nitrogen concentration at sites 1 and 3 was above the concentration recorded at Luggage Point, with site 3 almost three-times higher; those sites were in forests of poor and good health. The phosphorus concentration at site 2 was above the concentration recorded at Luggage Point; this site was next to the dieback area.

Nutrient concentrations were generally higher at Whyte Island than Fisherman Islands. This was likely to be associated with the discharge from the Wynnum Wastewater Treatment Plant (WWTP).

4.2 Petroleum Hydrocarbons and BTEX

Fisherman Islands

In 2012, total petroleum hydrocarbon (TPH) concentrations at Fisherman Islands were below the National Assessment Guidelines for Dredging (NAGD) (DEWHA 2009). Screening Level (500 mg/kg) at most sites. The concentration exceeded the Screening Level at sites 6, 22 and 23; as was the case for sites 6 and 23 in 2010. Concentrations of the C15–C28 and C29–C36 fractions were generally similar in 2012 and 2010; there were some site specific changes but these changes were not clearly related to health, as a single indicator. For example, there was a general decline in health near sites 9 and 11

between 2010 and 2012, however the TPH concentration in the sediment at these sites did not increase between 2010 and 2012.

In 2012, benzene, toluene, ethylene and xylene (BTEX) concentrations at Fisherman Islands were below the laboratory limit of reporting at all sites.

Whyte Island

In 2012, TPH concentrations at Whyte Island were above the Screening Level at sites 1 and 2, which were located in mangrove areas of poor health and dead. TPH concentrations in 2012 were similar to or slightly higher than 2010, for most fractions at most sites, but similar to concentrations recorded in earlier surveys.

In 2012, BTEX concentrations at Whyte Island were below the laboratory limit of reporting at all sites.

There were no clear trends linking TPH or BTEX concentrations in sediment to mangrove health at Whyte Island, as a single indicator.

4.3 Metals and Metalloids

Fisherman Islands

In 2012, the concentration of most metals was below the low-ISQG level (ANZECC & ARMCANZ 2000) in the sediment at most Fisherman Islands sites. The concentration of nickel was above the low-ISQG level at site 13 and 19; as was the case at site 13 in 2010. The nickel concentration in the sediment at sites 13 and 19 only slightly exceeded the low ISQG level, and was within the background range and similar to that recorded in previous surveys.

The concentration of several metals and metalloids (arsenic, copper, lead and zinc) were higher in 2012 than in 2010 at several sites. Mangrove forests at most of these sites were in good health, therefore metals and metalloids are unlikely to be associated with mangroves health at Fisherman Islands, as a single indicator.

Whyte Island

In 2012, the concentration of most metals in the sediment was below the low-ISQG level (ANZECC & ARMCANZ 2000) at most Whyte Island sites; the concentration of nickel was above the low-ISQG level at site 1. The concentration of at least one metal was above the low-ISQG value at each site during at least one survey, however there was no clear link between the concentration of metals and mangrove health. Metals are unlikely to be associated with mangroves health at Whyte Island, as a single indicator.

4.4 Organochlorine Pesticides

In 2012, the concentration of all organochlorine pesticides in the sediment at Fisherman Islands and Whyte Island was below the laboratory limit of reporting. Organochlorides are unlikely to be associated with the large dieback areas.

5 Salinity of Pore Water

Further details on the methods and results for the pore water assessment are provided in Appendix D.

Overall, the mean salinity of the pore water in the sediment was lower in 2012 than in earlier surveys. The difference in salinity between categories was less in 2012 than in earlier surveys; however there was still a significant difference in the salinity of each health category (p = 0.00), as was the case in earlier surveys (Figure 5.1).

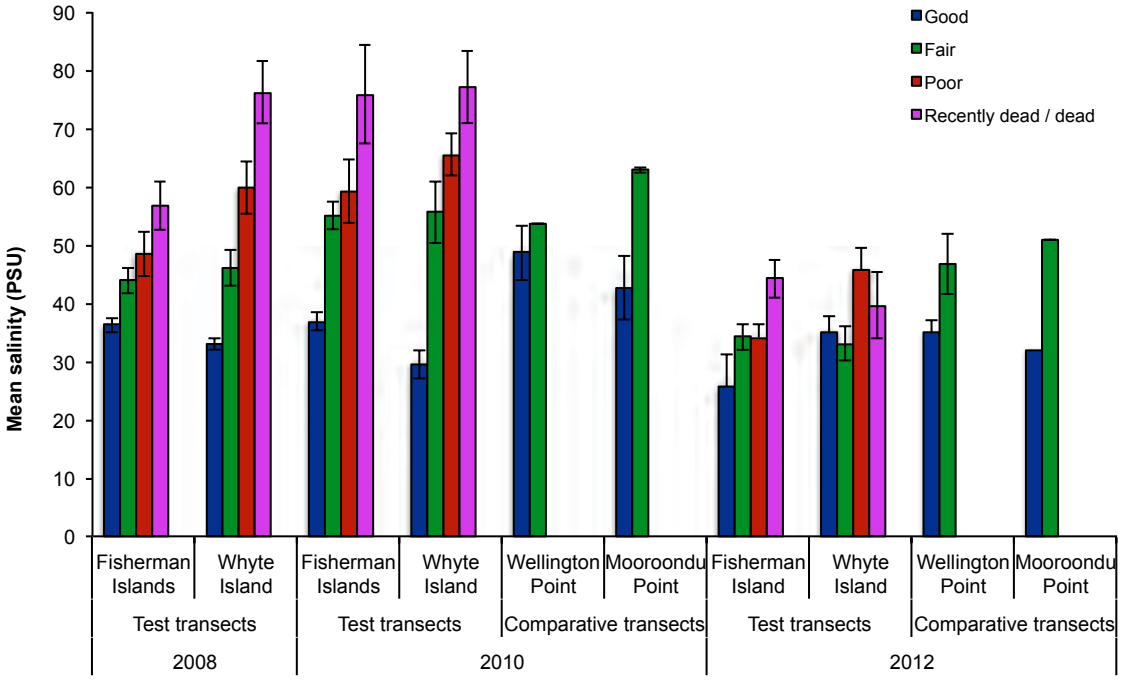


Figure 5.1 Mean salinity of pore water (± SE) in each area surveyed in 2008. 2010 and 2012.

In 2012, the salinity of pore water in dieback areas was significantly different to that of mangroves in good and fair health. The salinity of pore water in forests of good health was also significantly different to that of forest in fair or poor health.

The lower salinity of pore water in 2012 was likely to be related to heavy rainfall prior to the survey. There was heavy regional rainfall only days before the survey and relatively substantial rainfall during many of the months leading into the survey. There was also substantial surface water pooling in the survey area.

6 Potential Causes of Mangrove Dieback

Further discussion of the potential causes of mangrove dieback are provided in Appendix E.

In a historical context, the major damage to the mangroves of Fisherman Island and Whyte Island has been direct reclamation, and the impacts of unconfined dredge material spreading out over mangrove communities. However, some decades since reclamation in these areas has ceased, large areas of mangroves continue to decline in health. While this may in part be due to the forests reaching a new equilibrium with the newly created morphology and hydrology, there are likely to be other factors involved.

Our assessment of impacts likely to be causing mangrove dieback focuses on the larger areas of dieback at Fisherman Islands and Whyte Island, but also includes a brief discussion of the overall decline in health in parts of Fisherman Islands (excluding the Coal Loader area) and Whyte Island.

6.1 Major Flooding of the Brisbane River

There was major flooding of the Brisbane River in January 2011, which is likely to have impacted the mangroves in the survey area to some extent. The flood caused an almost complete destruction of mangroves upstream of the Indooroopilly Bridge to the Moggill Ferry. Downstream of the Indooroopilly Bridge, impacts were less evident and mainly dependent on the level of siltation. As of June 2011, no impacts due to flooding had been recorded for the survey area. There was a similar, but somewhat larger, flood in January 1974. Mangrove loss due to this flood was much less, as there were only mangroves near the mouth of the river at that time (DERM 2012).

Impacts of riverine flooding on mangrove communities include:

- prolonged inundation
- lower salinity
- siltation
- strong currents associated with the flood water
- higher wave action on the edge of the mangrove forest due to higher water levels
- wind, waves and current associated with the storms, and
- damage by debris.

In a number of species, including *A. marina*, prolonged flooding with brackish water can impede photosynthetic processes such as leaf water potential whereas flooding with freshwater enhanced the same processes (Naidoo 1983; 1985; Pezeshki et al. 1990; Krauss et al. 2006).

While the mangroves in the survey area may not have been subjected to the strong currents associated with the floodwater, it is likely that they may have been impacted by waves and currents and the movement of debris. Changes to inundation and salinity regimes may also have had some impact.

6.2 Summary of Mangrove Health in 2012

In 2012, there were fewer recently dead mangroves and a larger total area of regrowth associated with dieback areas than in 2010. The total area of recently dead mangroves was 2.5 ha (0.9% of the total mangrove area) in 2008 and only 0.2 ha (0.1% of the total mangrove area) in 2012. The total area of dead mangroves has slightly decreased from 52.9 ha (19.1% of the total mangrove area) in 2008 to 51.5 ha (17.7% of the total mangrove area) in 2012.

Between 2010 and 2012, the total area of mangroves in poor and fair health increased while the total area of mangroves in good health decreased. This was likely to be related to a number of interacting factors including the drought conditions leading into the 2010 survey, followed by severe flooding in early 2011.

Fisherman Islands

Western Area

Between 2010 and 2012, the total area of dead mangroves decreased and there were no recently dead mangroves in this area in 2012. There was a relatively large area of regrowth along the margin of the dead area, which was likely to be related to increased rainfall (effectively diluting the salinity of the pooling water, and creating more favourable conditions for mangrove growth).

There was an increase in the total area of forest in poor health in this area, mostly due to reduced health in the area of forest near the south-western shore. This may be related to potential impacts to water quality in the drain adjacent to northern Fisherman Islands, which drains into the small inlet between western Fisherman Islands and the eastern Coal Loader area, and / or the early 2011 flooding. The flooding was likely to have caused this

drain to overflow into the mangroves for an extended period of time, and may have introduced contaminants from upstream. [3] Assessment of water quality in this drain would assist in determining whether the decline in mangrove health is related to water quality in this drain, and with run-off from the port area.

Seagrass wrack had accumulated along the landward edge of the dieback area in 2012, as was the case during earlier surveys (and at eastern Fisherman Islands, the Coal Loader area and Whyte Island in 2012 and earlier surveys). This indicated that there had been strong water movements through the area at times, including the 2011 flooding of the Brisbane River. The seagrass wrack was likely to have impeded tidal drainage and contributed to water pooling and possibly the decrease in mangrove health in the area.

Eastern Area

In 2012, the total area of dead mangroves decreased slightly, primarily because there had been some improved health along the margin of the dieback area and mangroves. The total area of recently dead mangroves also decreased. This was likely to be related to increased rainfall.

While not associated with the dieback area, the most eastern tip of the peninsula was in fair to good health in 2010, but in fair to poor health in 2012. This decline in health was mostly due to reduced canopy cover, leaf loss and yellowing of leaves, which may be related to damage associated with flooding in early 2011 (as large volumes of water would have rapidly moved over the peninsula).

Seagrass wrack had accumulated in areas of eastern Fisherman Islands in 2012. This indicated that there had been strong water movements through the area at times, including the 2011 flooding of the Brisbane River. These berms of seagrass wrack were consolidated and likely to have severely impeded tidal drainage and contributed to water pooling and possibly mangrove health in the area.

[3] The concentration of most contaminants was below the laboratory limit of reporting and / or trigger values at the sediment quality sites in 2012; however potentials contaminants were likely to have been introduced to the water and / or sediment of the survey area at some stage between January 2011 and the 2012 survey, given the extent of flooding.

Northern Area

Since 2004 the relatively large area of dead mangroves in the northern area has progressively decreased in size, with mangroves in poor health growing into this area.

In 2012, there was an overall decline in mangrove health at northern Fisherman Islands. The most substantial change was relatively large areas of forest in poor health near the landward margin. This may be related to potential impacts to water quality in the drain adjacent to northern Fisherman Islands and / or the early 2011 flooding. The flooding was likely to have caused this drain to overflow into the mangroves for an extended period of time and may have introduced contaminants from upstream. Assessment of water quality in this drain would assist in determining whether the decline in mangrove health is related to water quality in this drain, and with stormwater run-off from the port area.

Coal Loader Area

Erosion and deposition of sediment has reduced the health of this area since 2008. In 2012, several large trees had been undermined by erosion, primarily along the western (lining the main channel of the Brisbane River) and south-eastern shore of the forest to the east of Port Drive, and along the northern shore of the forest to the west of Port Drive (lining the inlet that receives the water from the drain lining the western Fisherman Islands forest). An assessment of flow data from the gauging station at the downstream end of the drain lining the western Fisherman Islands forest and the establishment of permanent photographic points along the eroding shores would assist in determining the extent and potential cause of erosion. The potential causes are likely to include influences such as fast water flow in the Brisbane River (including that of the early 2011 floods) and from the drain adjoining the western Fisherman Islands forest (although we understand that there is a gate on this drain), and boat wash.

Whyte Island

There were no recently dead mangroves in this area in 2012, and regrowth continued. This was likely to be related to the higher rainfall, and consequent lower pore water salinity.

Health decreased from good to fair in areas of the forest along the northern shore, and from fair to poor throughout much of the forest. This general decline in health may have been related to contaminants and / or physical damage associated with the 2011 flooding. Seagrass wrack had also accumulated in some areas in 2012. This indicated that there

had been strong water movements through the area at times, including the 2011 flooding. These berms of seagrass wrack were consolidated and likely to have severely impeded tidal drainage and contributed to water pooling and possibly mangrove health in the area.

6.3 Possible Causes

Salinity

In 2008, 2010 and 2012, the pore water salinity in the sediment was generally higher in dieback areas than from forests in good health. In 2012, the salinity of pore water in the mangrove forests was generally lower for all health categories at all locations, than in earlier surveys. This was likely to be related to high rainfall prior to the survey. This overall decrease in salinity was likely to be associated with the overall reduction in total area of recently dead mangroves on Fisherman Islands and Whyte Island; however salinity is unlikely to be the only factor contributing to mangrove health and dieback.

Rainfall

In 1999, rainfall was above average, but decreased again in 2000, and was below average from 2000 to 2007. It was likely that this increased soil salinity, particularly in marginal mangrove habitats, and increased physiological stress on the mangroves. Over this time, a number of areas of mangrove dieback were recorded in Moreton Bay, including Whyte Island, Fisherman Islands, Luggage Point, the Caboolture River, Boondall Wetlands, (Pedersen 2002; frc environmental 2007b), Cobby Cobby Island, Coombabah Lake, and Hayes Inlet.

In 2008, there was an increase in annual rainfall, and rainfall has generally remained above the long-term annual average since 2008 (BOM 2012). Higher rainfall is likely to have reduced the salinity of surface and pore waters. This is also likely to have increased regrowth of mangrove in areas that were dieing in 2008 and 2010, and decreased the rate of dieback.

Potential Contaminants

Sediments at Fisherman and Whyte Islands have been tested for contaminants including nutrients, TPH, BTEX and Organochlorides and heavy metals. There were no clear trends between the concentration of potential contaminants and mangrove health.

Increased nutrient availability in association with high salinity in the sediment can negatively impact mangrove health (Lovelock et al. 2009). The interaction between nutrients and salinity may be contributing to changes in mangrove health in the dieback area. Assessment of nutrient concentrations along the pore water transects would assist in determining whether this is the case.

Ponding of Water

Recent dieback at both Fisherman Islands and Whyte Island was often associated with the ponding of water. Similar dieback associated with the ponding of water has also been recorded in other areas of Moreton Bay, in particular Nudgee, Nundah and Burpengary Creeks (frc environmental 2007b; 2008b). A detailed discussion of this process was provided in the 2010 monitoring report (frc environmental 2010).

7 Conclusions and Recommendations

Longer-term changes in rainfall appear to have an over-riding influence on patterns of mangrove dieback and recolonisation in Moreton Bay. However several influences also appear to be influencing the mangroves associated with the port, such as major regional flooding and boat wash.

Continued monitoring is recommended, and could be enhanced by further investigations such as:

- ongoing measurement of pore water salinity in sediment from dieback and healthier areas, including
  - an assessment of potential contaminants, particularly nutrients, along a sub-set of transects
  - increasing the number of samples per sampling point, particularly in the poor and dieback areas
  - collecting pore water data from the areas that have been dead for some time, and from areas where saltmarsh is colonising, and
  - increasing the frequency of surveys (to bi-annually) will also provide information about seasonal variations associated with influences such as rainfall
- assessment of water quality and flow in the drain that lines the western Fisherman Islands mangrove forest
- assessment of additional permanent photographic points, particularly in areas with high erosion
- a dye run to establish which way the water flows out of the dieback areas, particularly in the new dieback area on Fisherman Islands
- laser survey or similar of dieback areas, to establish benchmark for sediment height, and
- measurement of nutrients, salinity and dissolved oxygen levels in ponded areas.

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Appendix A Community Composition, Structure and Health of Mangrove Communities

Contents

Tables

Figures

1 Methods

1.1 Survey Sites

The community structure, composition and health of mangrove communities at Fisherman Islands and Whyte Island were assessed and mapped from 2 to 6 July 2012 (Figure 1.1 to Figure 1.4). To facilitate mapping, the mangroves at Fisherman Islands were divided into two areas:

- Coal Loader area, which is next to the Coal Loader at Fisherman Islands (west and east of Port Drive)
- Fisherman Islands area, which is the large area east of Lucinda Drive that is sub-divided into the:
  - western area, which is the large area of mangroves south-east of the Port of Brisbane Pty Ltd (PBPL) office
  - eastern area, which is divided from the western area by a channel, and extends to the east in a long peninsula, and the
  - northern area, a smaller strip of mangroves to the north-east of the PBPL office.

Within each survey area, aerial photography and previous survey reports were used to target specific areas for field assessment. In particular, boundaries between health categories that were established in the previous report, were targeted to see if there had been any substantial change to these areas. In addition, broad transects, usually running landward to seaward, were surveyed to determine the boundaries of health and community composition categories. Survey sites were established at regular intervals (approximately every 10 meters), or when a change in mangrove community structure or health was noted. The position of each site was recorded using GPS (accurate to ±4 m) (Figure 1.3 and Figure 1.4).

At each site, the community composition, structure and health of the mangroves in the immediate vicinity were assessed.

This appendix presents the results of this mapping, with a focus on ecological changes to communities since 2010. The historical context and potential causes of any changes to the mangrove communities are provided in Appendix E.

Figure 1.1 Survey areas within the Port of Brisbane in 2012.

Figure 1.2 Survey sites at Fisherman Islands and Whyte Island for the Mangrove Health Assessment in 2012.

Figure 1.3 Survey sites at Coal Loader and Western Fisherman Islands for the Mangrove Health Assessment in 2012.

Figure 1.4 Survey sites at Whyte Island for the Mangrove Health Assessment in 2012.

1.2 Description of Community Composition and Structure

At each site the following was recorded:

- species composition (% cover of each species)
- canopy height (m)
- canopy cover (%), and
- structural formation of the mangroves.

For structural formation, the classification system used by the Queensland Herbarium (Dowling & Stephens 2001) was used. Using this method, no Tall Forests were identified, as canopy height did not reach 30 m. Therefore, what may have been referred to as Tall Open or Closed Forests in earlier surveys (WBM Oceanics Australia 2000; 2001; 2002) were described as Open or Closed Forests in the current survey. Community structural formation classifications (Neldner 1993; Specht et al. 1995) are presented in Table 1.1.

During our surveys, the yellow mangrove is referred to as *Ceriops tagal* (as opposed to *Ceriops australis*) as this is the name used by the Queensland Herbarium and in *Flora of Australia* (Jessup 1984; QLD Herbarium pers. comm. 2004; McCusker 1984; Bostock & Holland 2010).

Table 1.1 Structural formations in Australia.

Life form and height of tallest stratum		Foliage Projective Cover of the Dominant Stratum (%)			
		100-70 (4)#	70-30** (3)	30-10 (2)	<10 (1)
Trees* > 30m	(T)	tall closed-forest	tall open-forest	tall woodland	–
Trees 10-30m	(M)	closed-forest	open-forest	woodland	open-woodland
Trees 5-10m	(L)	low closed-forest	low open-forest	low woodland	low open-woodland
Trees < 5m	(VL)	v. low closed-forest	v. low open-forest	v. low woodland	v. low open-woodland
Shrubs* > 2m	(S)	closed-scrub	open-scrub	tall shrubland	tall open-shrubland
Shrubs 0.25-2m sclerophyllous &	(Z)	closed heathland	heathland	open-heathland	sparse heathland
semi-sclerophyllous non-sclerophyllous Shrubs < 0.25m	(C)	low closed-scrub	low open-scrub	low shrubland	low open-shrubland
sclerophyllous &	(D)	–	–	dwarf open-heathland (fell-field)	dwarf sparse-heathland (fell-field)
semi-sclerophyllous non-sclerophyllous	(W)	–	–	dwarf open-shrubland	dwarf sparse-shrubland
Hummock grasses Herbaceous layer	(H)	–	dense hummock grassland	hummock grassland	open hummock grassland
graminoids & grass	(G)	closed (tussock) grassland	(tussock) grassland	open (tussock) grassland	sparse (tussock) grassland

Life form and height of tallest stratum		Foliage Projective Cover of the Dominant Stratum (%)			
		100-70	**70-30****	**30-10**	**<10**
		(4)#	**(3)**	**(2)**	**(1)**
sedges	(Y)	closed-sedgeland	sedgeland	open-sedgeland	sparse-sedgeland
herbs	(X)	closed-herbland	herbland	open-herbland	sparse-herbland
ferns	(f)	closed-fernland	fernland	–	–
reeds/rushes	(R)	closed-reedland	reedland	–	–

* a tree is defined as a woody plant usually with a single stem; a shrub is a woody plant with many stems arising at or near the base

\# Symbols and numbers given in parentheses may be used to describe the formation, e.g. tall closed-forest = T4

** this cover class may be subdivided into cover intervals 70-50% and 50-30% to distinguish commercial forests

1.3 Description of Mangrove Health

At each site, the ecological health of the mangroves was determined using the classification system developed in previous surveys (Table 1.2 and Figure 1.5 to Figure 1.10). The recently dead and dead categories were mapped separately in more recent surveys.

Table 1.2 Criteria for visual assessments of mangrove health.

Mangrove Health Category	Criteria
Good	Green leaves with no yellowing or curling
	Little evidence of damage by insects
	No abnormal leaf loss
Fair	Mainly green leaves with <20% of the canopy affected by yellowing or curling leaves, or damage by insects
	Some epicormic growth
Poor	Many yellowing or curled leaves
	Reduced canopy cover
	High insect damage
	Abundant epicormic growth
Recently Dead	Leaves brown or absent with no new growth
	Note: while trees appear to be dead, they can sometimes regrow
Dead	No leaves or twigs, in some cases there are no small branches
	Trees have been dead for years
Regrowth	Canopy cover low but new trees evident.
	New growth shooting from the base or trunks of older trees
	Previous disturbance sometimes evident

Figure 1.5

Mangroves in good health at Fisherman Islands.

Figure 1.6

Mangroves in fair health at Whyte Island, with some epicormic growth and dense saplings and seedlings.

Figure 1.7

Mangroves in poor health at Fisherman Islands, with numerous dead branches, epicormic growth and yellowing leaves.

Figure 1.8

Recently dead mangroves at eastern Fisherman Islands, including mangroves in poor health showing signs of stress with epicormic growth.

Figure 1.9

Dead mangroves at Fisherman Islands.

Figure 1.10

Regrowth at Fisherman Islands.

Each site was visually assessed for signs of disturbance, such as:

- damage by insects
- anthropogenic or natural disturbances such as clearing
- presence of drains or bunds, litter, incursion of exotic weeds
- erosion of the foreshore, and
- other flood-related impacts such as large debris or physical damage (given the January 2011 flooding of the Brisbane River occurred since our previous survey).

The percent cover and depth of seagrass wracks was estimated, and the abundance of macroalgae, macrofauna and seedlings were recorded, as they are indicative of mangrove health.

Macroalgae

Epiphytic Algae

Macroalgae are a common component of mangrove ecosystems. Common species on the trunks and exposed roots of mangroves in south-east Queensland (Karsten et al. 2000), include:

- *Bostrychia* spp.
- *Caloglossa leprieurii*, and
- *Catenella nipae*.

These species are frequently more abundant in well-flushed, seaward communities (Karsten et al. 2000), and are consequently an indication of a healthy mangrove environment. They are an important source of primary production in mangrove ecosystems. The abundance of algal epiphytes on aerial roots (pneumatophores and prop roots) and trunks was assessed using the abundance categories developed in earlier surveys (Table 1.3).

Table 1.3 Epiphytic macroalgae abundance categories.

Category [a]		**Abundance of Epiphytic Macroalgae**
Very abundant	4	>75% cover of macroalgae on pneumatophores (heavy coating)
Abundant	3	50 to 75% cover of macroalgae on pneumatophores (easily visible)
Common	2	10 to 50% cover of macroalgae on pneumatophores (some algae visible)
Rare	1	<10% cover of macroalgae on pneumatophores
Absent	0	No visible macroalgae on pneumatophores

[a] assigning of numerical values to categories were modified in 2010 (i.e. very abundant category was assigned a score of 4 in 2010, but a score of 1 in previous surveys) so that all indices were consistent. Absent (0) category was added in 2010

Macroalgal Mats

In contrast, other types of algae and some cyanobacteria rapidly respond to increased nutrient availability, including:

- algae
  - *Ulva lactuca*
  - *Microcoleus chthonoplastes*
  - *Cladophora*, and
  - *Enteromorpha intestinalis*
- cyanobacteria
  - *Lyngbya* sp.

In mangrove forests, these species can form mats over the sediment and roots, decreasing oxygen uptake and negatively impacting mangrove condition. These mats are typical of mangrove forests in poor ecological health. The abundance of macroalgal mats was assessed using density and abundance categories developed in earlier surveys (Table 1.4).

Table 1.4 Macroalgal mat abundance categories.

Category [a]		**Density and Abundance of Macroalgae Mats**
Very abundant	4	>75% of sediment covered by macroalgae (heavy coating / carpet)
Abundant	3	50 to 75% of sediment covered by macroalgae (easily visible)
Common	2	10 to 50% of sediment covered by macroalgae (some algae visible)
Rare	1	<10% of sediment covered by macroalgae
Absent	0	No visible macroalgae on sediment

[a] assigning of numerical values to categories was modified in 2010 (i.e. very abundant category was assigned a score of 4 in 2010, but a score of 1 in previous surveys) so that all indices were consistent. Absent (0) category was added in 2010

Macrofauna

While macrofaunal abundance may not give a good indication of mangrove health, it can give an indication of the suitability of the mangrove forest as faunal habitat. This can have implications for the importance of the site as fisheries habitat. Crabs are considered to be a keystone species in the intertidal zone (Saintilan & Mazumder 2004); therefore, the abundance of crabs and crab burrows was recorded as an indicator of the ability of the site to support marine fauna. The abundance of molluscs and other macrofauna was also recorded. Macrofaunal abundance was ranked, based on the density of crab holes and the visible abundance of fauna (Table 1.5).

Table 1.5 Macrofaunal abundance categories.

Category [a]		**Macrofaunal Abundance**
Very abundant	4	>50% of substrate covered by crab holes
Abundant	3	25 to 50% of substrate covered by crab holes.
Common	2	<25% of substrate covered by crab holes.
Rare	1	<10% of substrate covered by crab holes.
Absent	0	No macrofauna or crab holes evident

[a] assigning of numerical values to categories was modified in 2010 (i.e. very abundant category was assigned a score of 4 in 2010, but a score of 1 in previous surveys) so that all indices were consistent. Absent (0) category was added in 2010

Seedling Density

The abundance of seedlings at each site were assessed using seedling abundance categories (Table 1.6).

Table 1.6 Seedling abundance categories.

Category [a]		Seedling Abundance
Very abundant	4	Available space 100% covered with seedlings, seedlings form dense carpet with few (if any) gaps
Abundant	3	Most available space covered with seedlings with some gaps
Common	2	Seedlings common, but do not form a carpet
Sparse	1	Less than 1 seedling per square metre
Absent	0	No seedlings present

[a] assigning of numerical values to categories was modified in 2010 (i.e. very abundant category was assigned a score of 4 in 2010, but a score of 1 in previous surveys) so that all indices were consistent. Absent (0) category was added in 2010

1.4 Mapping and Assessment of Mangrove Health and Community Structure

Field survey data was mapped using GIS software (*MapInfo*). Data points and field survey data were overlain onto rectified aerial photographs taken in June 2012. [1] Maps were updated based on field data, and interpretation of the aerial photography. The area of each community and health category was then calculated and compared to previous surveys. Each of the communities was described, based on the field data. Field data was also summarised and compared to data from previous surveys.

Field data is presented in Appendices F (Fisherman Islands) and G (Whyte Island).

[1] PBPL provided aerial photographs that were taken in September 2011, however these photographs were not used as the mapping underlay due to a large cloud over the survey area and the availability of good quality more recent photography from Nearmap.

2 Fisherman Islands

2.1 Community Composition and Structure

Mangrove community composition and structure at Fisherman Islands was similar to that recorded in previous years (Figure 2.2).

Low closed forests lined the landward and dieback margins, with open forests in more seaward locations. The grey mangrove (*Avicennia marina* subsp. *Australasica*) (Figure 2.1) dominated forests together with areas of:

- yellow mangrove (*Ceriops tagal*) (Figure 2.3)
- river mangrove (*Aegiceras corniculatum*)
- red mangrove (*Rhizophora stylosa*)
- orange mangrove (*Bruguiera gymnorrhiza*), and
- mixed forest.

Ceriops tagal dominated areas of forest in the south-western corner and along the southern shore of the peninsula (Figure 2.3).

Figure 2.1

Open *A. marina* forest dominated seaward areas.

Figure 2.2 Mangrove community composition at Fisherman Islands in 2012.

Figure 2.3

Ceriops tagal dominated areas of forest on Fisherman Islands.

Saltmarsh communities on Fisherman Islands were dominated by:

- sea purslane (*Sesuvium portulacastrum*)
- austral seablite (*Suaeda australis*)
- jellybean plant (*Suaeda arbusculoides*)
- samphire (*Sarcocornia quinqueflora*), and
- ruby saltbush (*Enchylaena tomentosa*).

Some other coastal species were also present along the landward margin of the bare or saltmarsh areas and in association with berms, including:

- coastal pigface (*Carpobrotus glaucescens*), and
- beach morning glory (*Ipomoea pes-caprae* subsp. *brasiliensis*).

2.2 Mangrove Health

Between 2010 and 2012, the most substantial changes to mangrove health at Fisherman Islands were:

- a decrease in the total area of mangroves in good health from 62.2 to 52.0 ha, and
- an increase in the total area of mangroves in poor health from 25.8 to 38.4 ha, with the total area of forest in poor health increasing since 2004 (Figure 2.4).

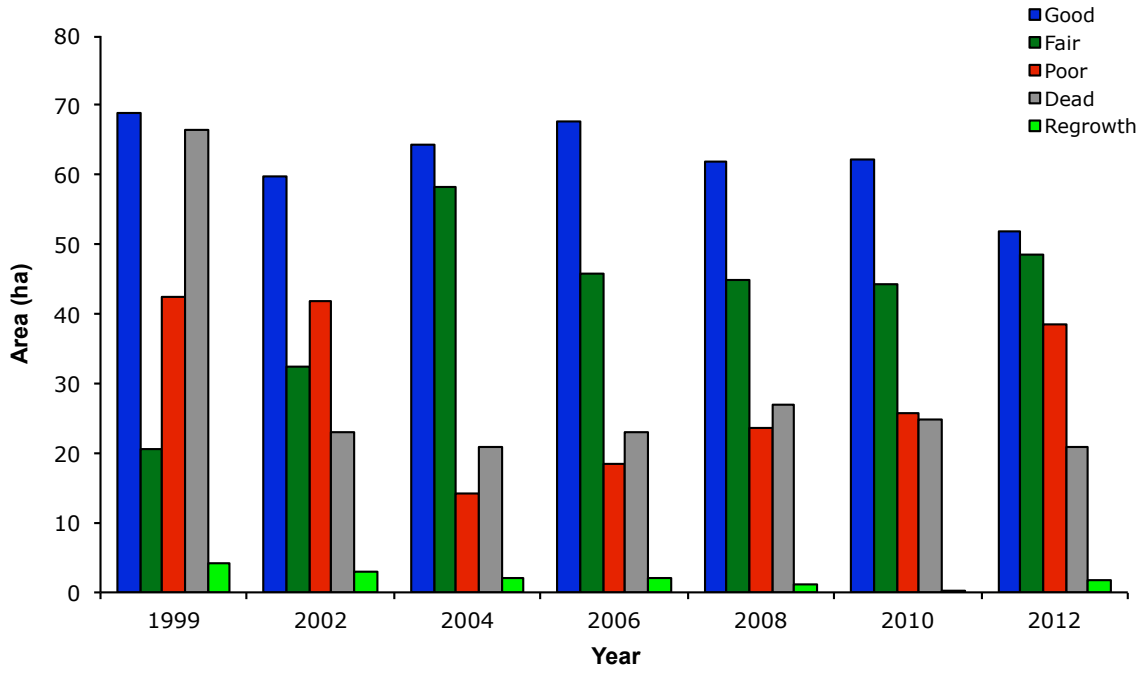


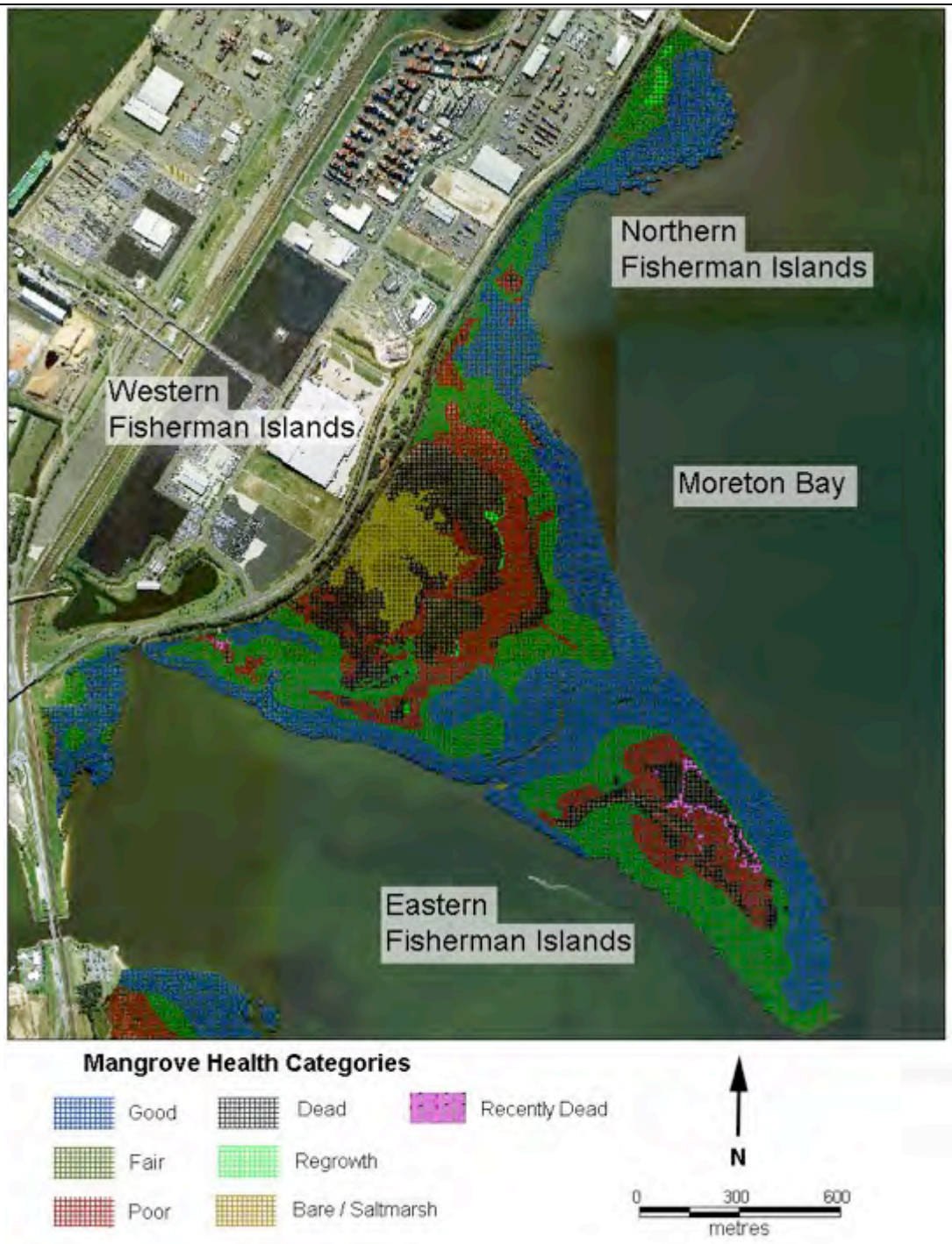
Figure 2.4 Area of mangroves in each health category at Fisherman Islands (excluding the Coal Loader area) from 1999 to 2012.

There were small changes to the total area of other health categories between 2010 and 2012, including:

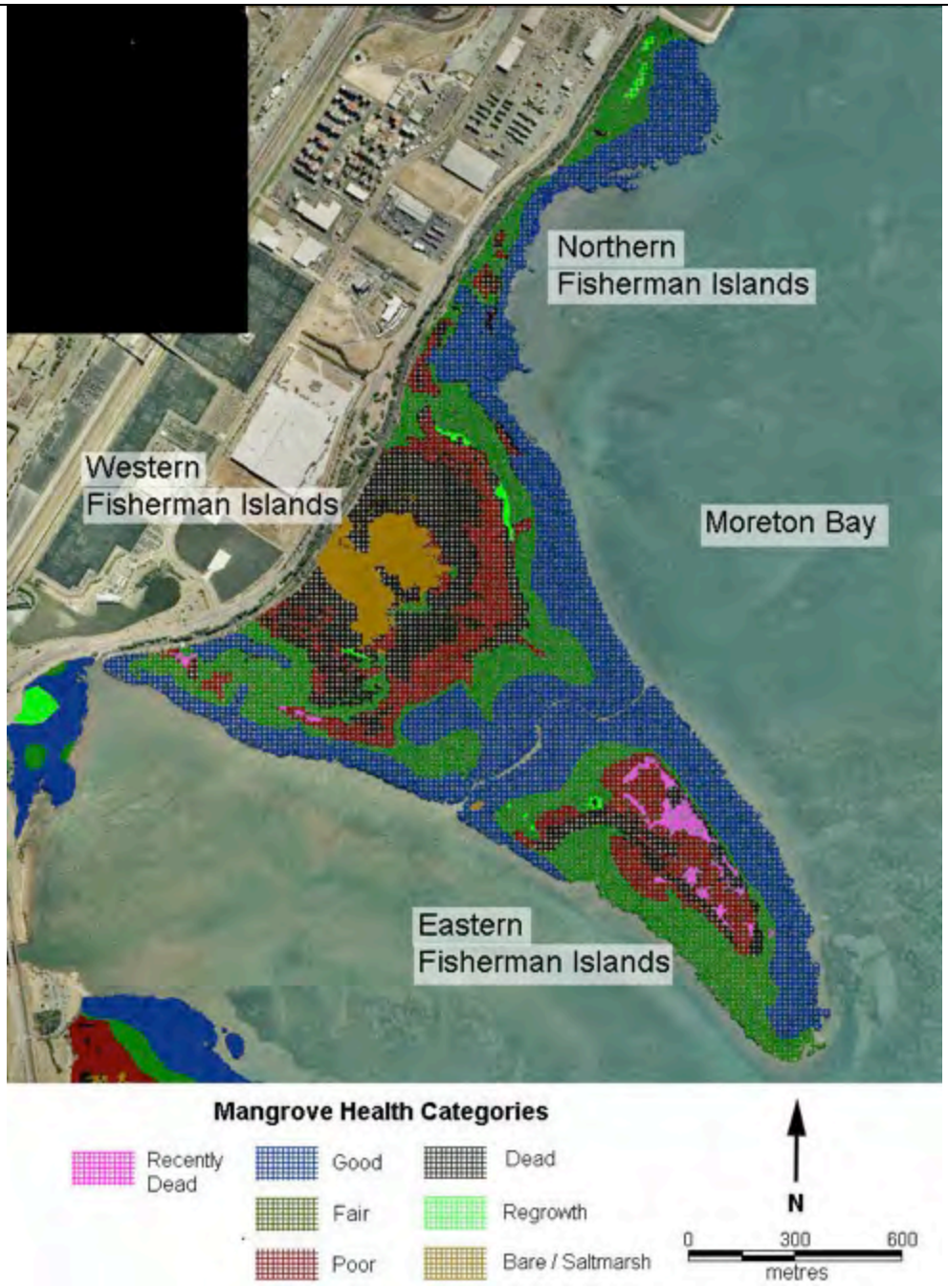
- a decrease in the total area of dead mangroves from 24.9 to 20.6 ha
- an increase in the total area of regrowth from 0.3 to 1.8 ha, and
- an increase in the total area of forest in fair health from 44.4 to 48.5 ha (Figure 2.4).

The health of the mangrove communities during each survey from 1999 to 2012 is shown in Figure 2.5 to Figure 2.11.

Figure 2.5 Mangrove health at Fisherman Islands in 2012.

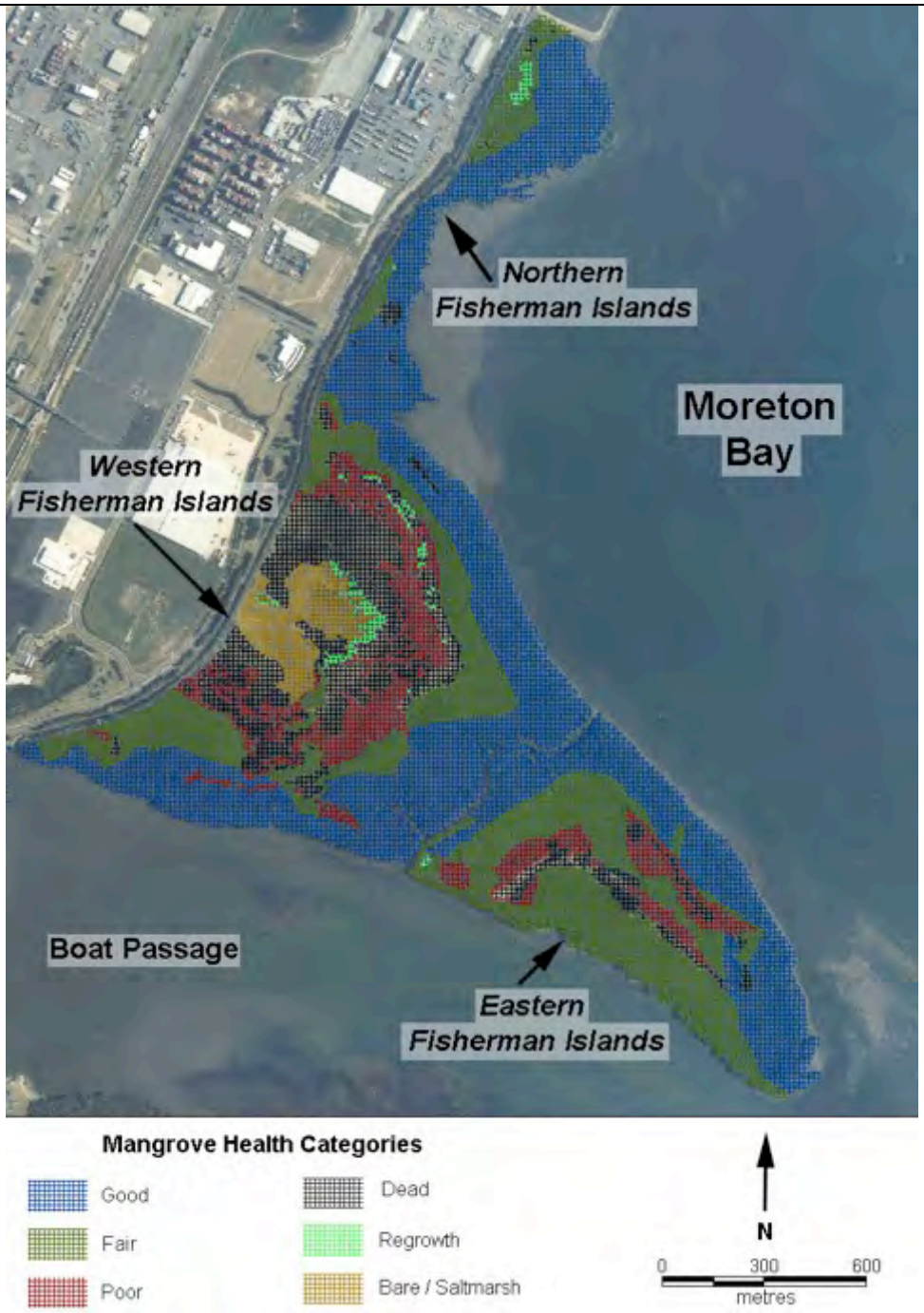


frc environmental AQUATIC ECOLOGISTS deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment
	Figure 2.6 Mangrove health at Fisherman Islands in 2010.



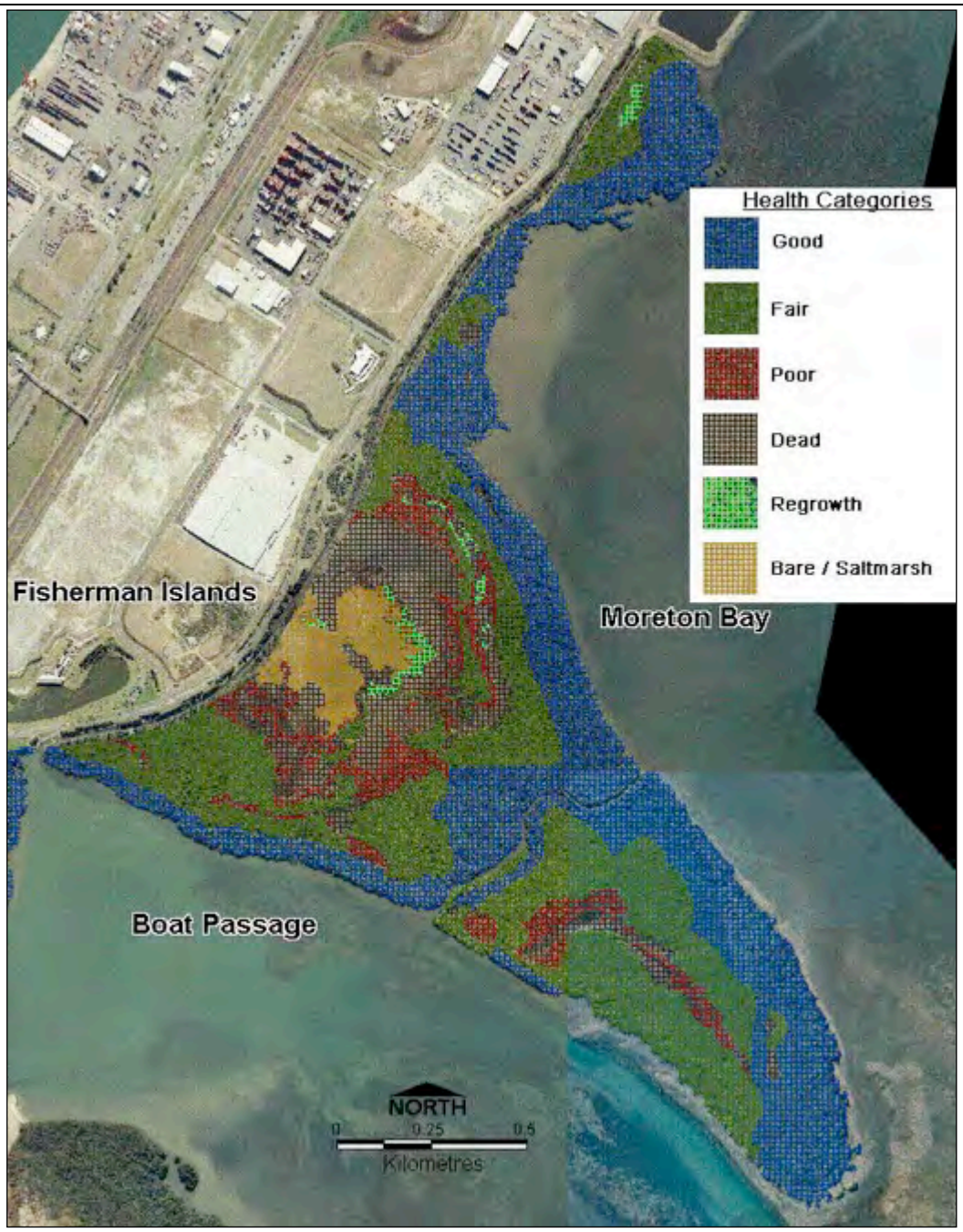
Fisherman Islands and Whyte Island Mangrove Health Assessment

Figure 2.7 Mangrove health at Fisherman Islands in 2008.

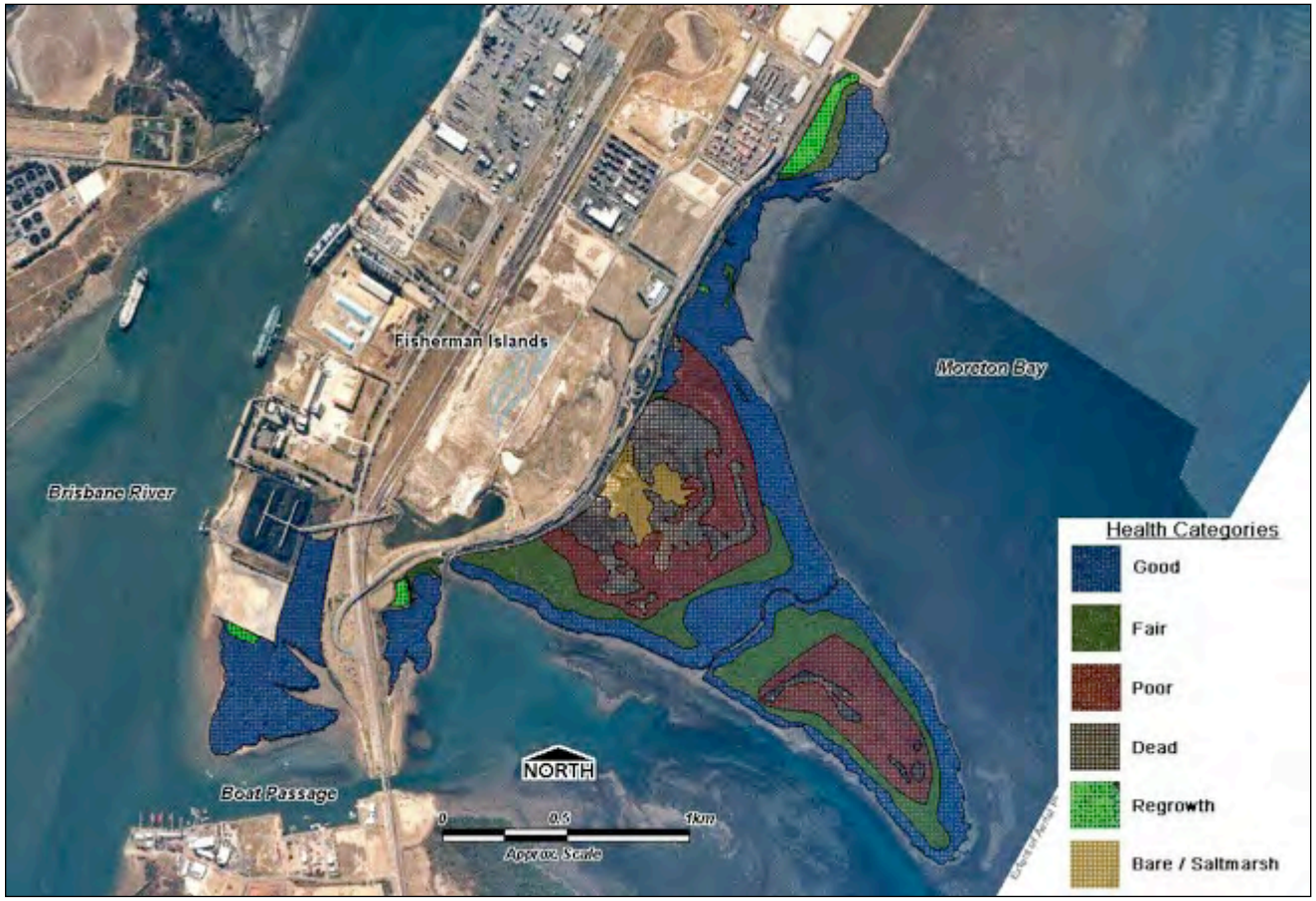


Fisherman Islands and Whyte Island Mangrove Health Assessment

Figure 2.8 Mangrove health at Fisherman Islands in 2006.



frc environmental AQUATIC ECOLOGISTS deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment
	Figure 2.9 Mangrove health at Fisherman Islands in 2004.



frc environmental AQUATIC ECOLOGISTS deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment
	Figure 2.10 Mangrove health at Fisherman Islands, including the Coal Loader area in 2002.

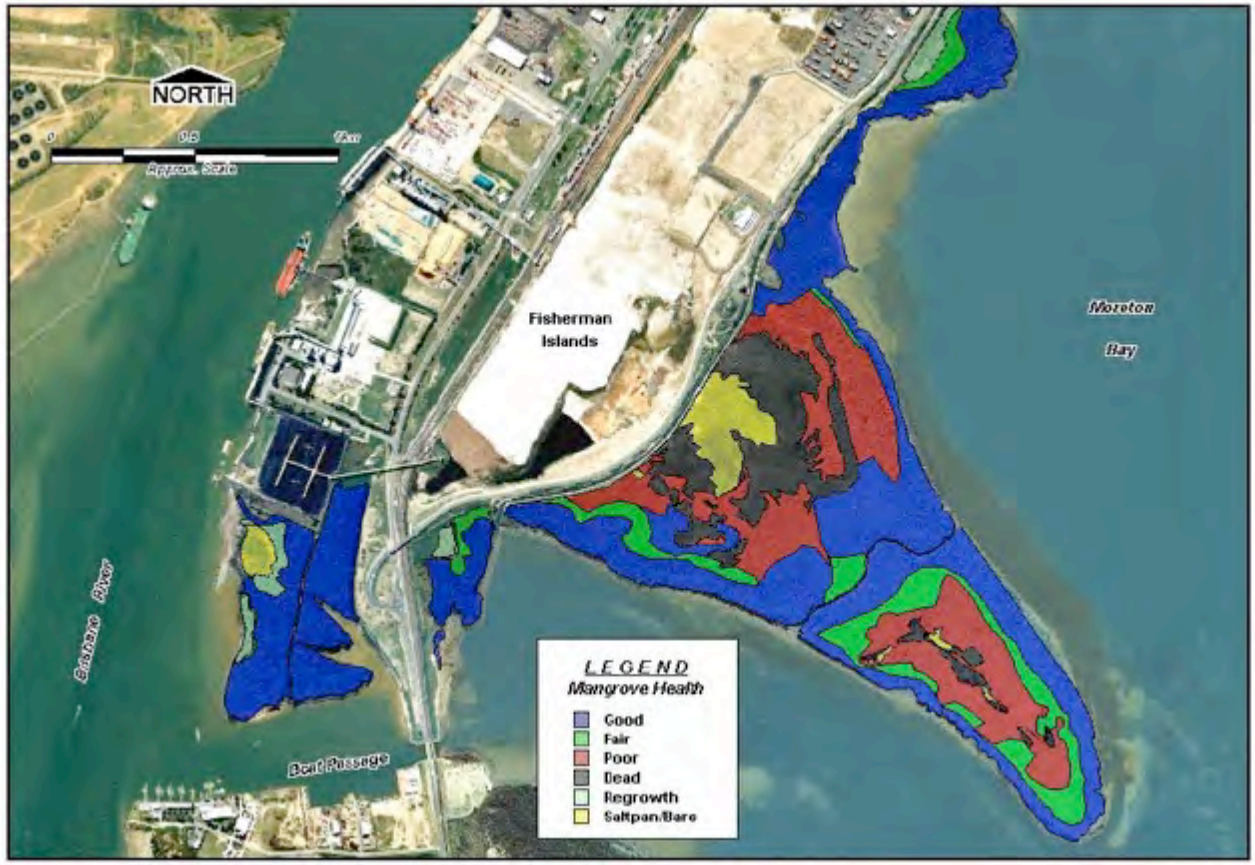


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	Figure 2.11 Mangrove health at Fisherman Islands , including the Coal Loader area in 1999.

Western Area

In 2012, the total area of regrowth and mangroves in poor health had increased, while the total area of dead mangroves and mangroves in good health had decreased. There were no recently dead mangroves in this area in 2012. There was a relatively large area of regrowth along the margin of parts of the dieback area (i.e. extensive epicormic shoots and dense seedlings) (Figure 2.5, Figure 2.12 and Figure 2.14).

Between 1999 and 2002, a relatively large area of mangroves, west of the cross channel, declined from good health, to fair or poor health (Figure 2.10 and Figure 2.11). Between 2002 and 2004, there was little change in the area of mangroves in good health, or in the areas of dead mangroves. However, some areas that were in poor health in 2002 were in fair health in 2004 (Figure 2.9).

Between 2004 and 2006, there was an increase in the area of mangroves in good health, particularly near the cross channel and along the southern shore (Figure 2.8). Trees in this area had fewer yellowing leaves, and less damage by insects in 2006 than in 2004. However, mangroves declined from fair to poor health around the dieback area; predominantly *A. marina* trees. These trees had a higher proportion of yellowing or dead leaves and more epicormic growth in 2006 than in 2004, and there were some dead trees.

In 2008, the total area of mangroves in good health was smaller than in 2006; in particular, large tracts of mangroves in the south had declined from good health in 2006 to fair health in 2008. Changes included a decrease in canopy cover and a higher proportion of yellowing leaves. Between 2006 and 2008, the area of mangroves in poor health also increased in this area, with mangrove death in the centre of some of these patches. In 2008, many of the previous regrowth areas had not survived or were in poor or fair health. Most regrowth in 2008 and 2010 was confined to the north; there was less regrowth in the central area than in 2006 (Figure 2.7).

In 2010, there was a decrease in the total area of dead or recently dead mangroves and an increase in the adjacent bare or saltmarsh area. Trees that were dead in 2008 continued to breakdown and there had been extensive recent colonisation by saltmarsh. In other areas, particularly along the seaward margin and to the south of the western dieback area, areas that were recently dead in 2008 had regrown and were in similar condition to the adjacent forest in poor health (Figure 2.6).

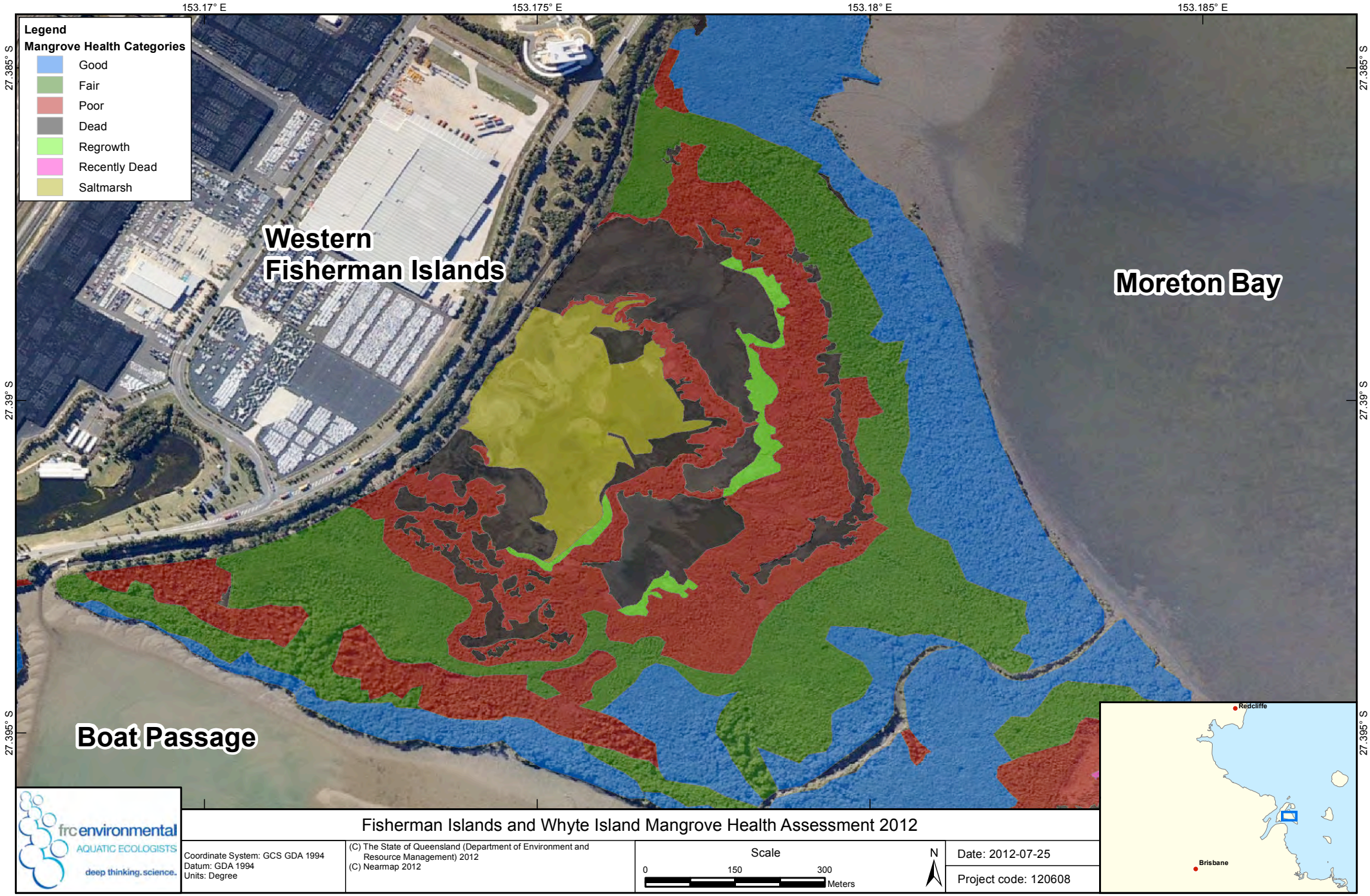

Figure 2.12 Mangrove health at western Fisherman Islands in 2012.

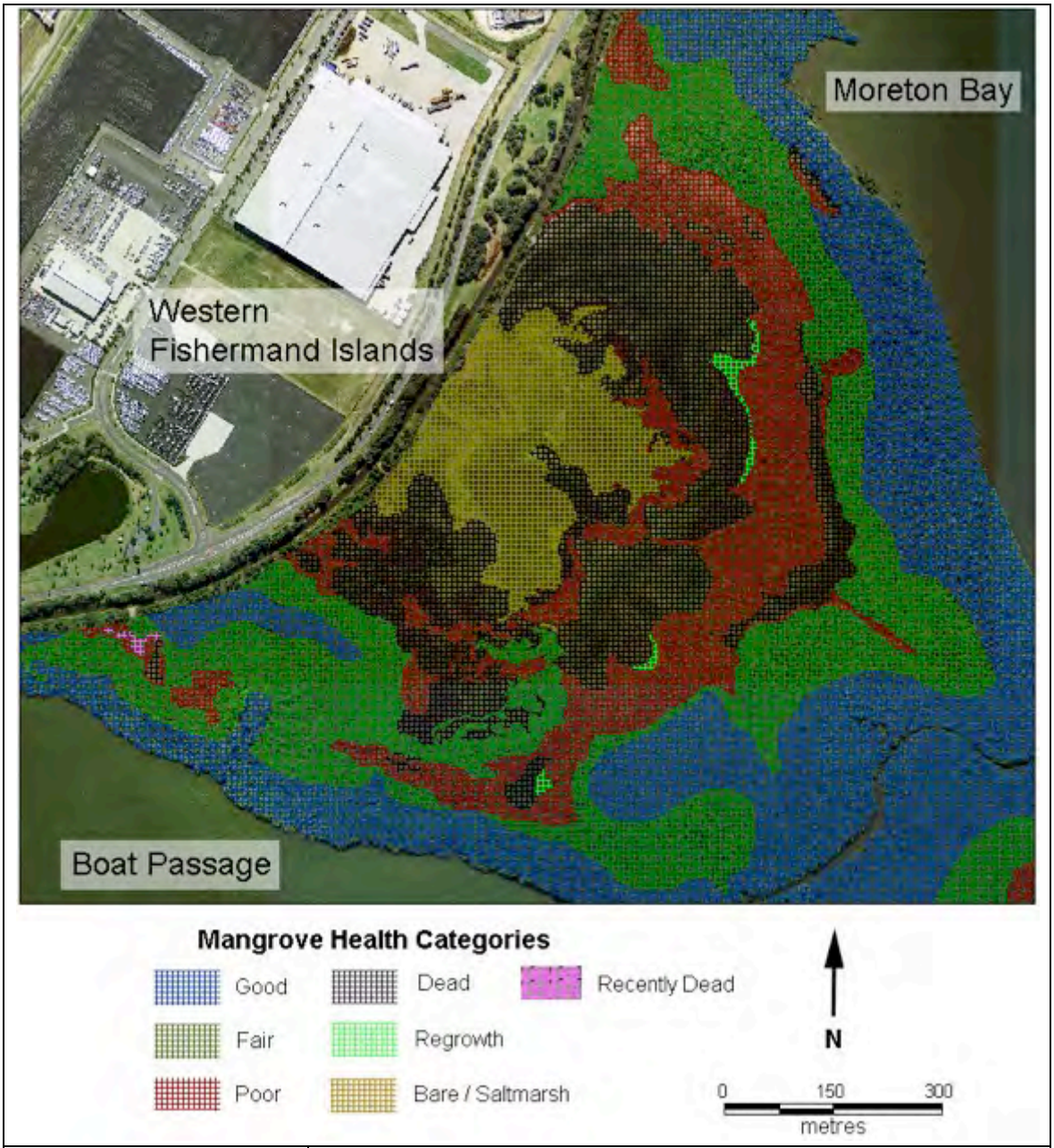

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	Figure 2.13 Mangrove health at western Fisherman Islands in 2010.

Figure 2.14

Seedlings and regrowth in saltmarsh at western Fisherman Islands.

The increase in the total area of forest in poor health was mostly due to reduced health in area of forest near the south-western shore that was of fair health in 2010. [2] Evidence of poor health in this area included epicormic shoots, deformed pneumatophores, yellowing leaves, insect damage and reduced canopy cover (Figure 2.15). There was evidence of potential impacts to water quality (milky-coloured water) in the drain adjacent to northern Fisherman Islands, which drains into the small inlet in between western Fisherman Islands and eastern Coal Loader area (Figure 2.16).

Figure 2.15

Extensive epicormic shoots of *A. marina* in poor health at western Fisherman Islands.

[2] There was also an increase in the total area of forest in poor health along the southern edge of the dieback area, however this was likely to be largely related to refinement of the mapping over time (rather than a change to the health category).

Figure 2.16

Potential impacts to water quality in the drain next to northern Fisherman Islands.

The dieback area at western Fisherman Islands is periodically inundated, resulting in the subsequent ponding of water. Dense algal mats grew in the ponded areas in 2012 (Figure 2.17) and during earlier surveys. Between 2010 and 2012, the extent of saltmarsh in association with the dieback areas on western Fisherman Islands (and eastern Fisherman Islands and Whyte Island) slightly decreased. In 2010 there was new growth of *S. quinqueflora* at the boundary of the saltmarsh and bare area, however in 2012 there was no new growth and the saltmarsh appeared to be reducing in extent (Figure 2.18 and Figure 2.19).

Figure 2.17

Macroalgae growing on bare substrate at western Fisherman Islands.

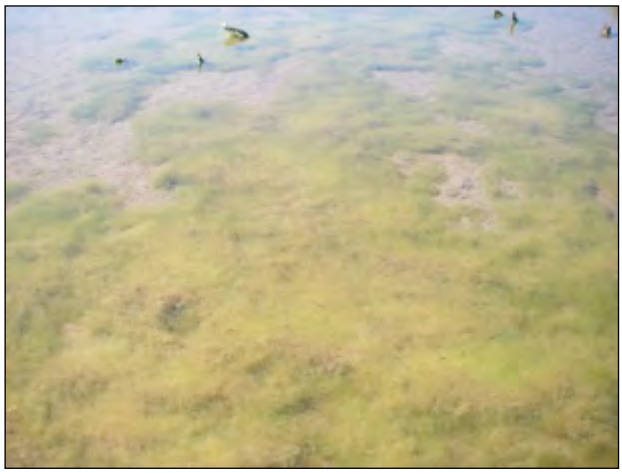


Figure 2.18

New growth of *S. quinqueflora* along the boundary of saltmarsh and bare substrate in 2010.

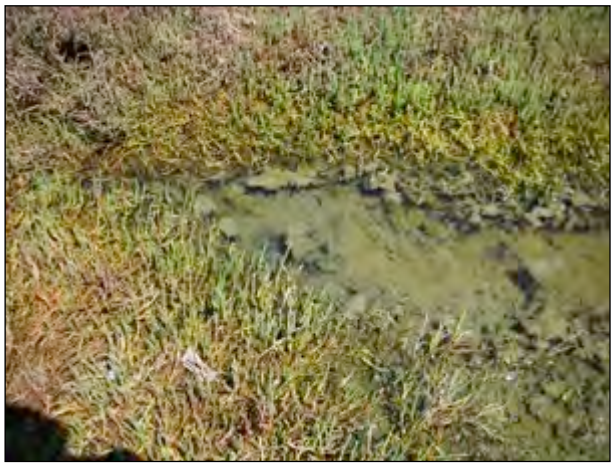


Figure 2.19

No new growth of *S. quinqueflora* along the boundary of saltmarsh and bare substrate in 2012.

In 2012, wader birds were observed foraging on benthic invertebrates in the ponded area, particularly on bare sediment. Similar bird activity has also been observed in earlier surveys.

Large pieces of debris and *Zostera muelleri* [3] seagrass wrack had accumulated along the landward edge of the dieback area in 2012, as was the case during earlier surveys (and at eastern Fisherman Islands, the Coal Loader area and Whyte Island in 2012 and earlier surveys). This indicated that there had been strong water movements through the area at times, including the 2011 flooding of the Brisbane River.

[3] until recently, and in previous reports, this species was known as *Zostera capricorni*.

Eastern Area

In 2012, the total area of dead mangroves decreased slightly, primarily because there had been some improved health along the margin of the dieback area and mangroves. The total area of recently dead mangroves also decreased (Figure 2.20 and Figure 2.23).

In 1999 and 2002, the mangroves along the shore of eastern Fisherman Islands were in good health. Inside these mangroves, there were concentric areas of mangroves in fair and poor health, with a strip of dead mangroves in the centre (Figure 2.10 and Figure 2.11).

In 2004, mangroves along the southern shore had declined in health, primarily due to shore erosion. In some areas, the seaward fringe of *A. marina* trees had been completely undermined and washed away, exposing an area of *C. tagal* trees growing on higher ground. In 2004, the health of most of the mangroves in the central area had improved from poor to fair health, with only those mangroves close to the dieback areas in poor health (Figure 2.9).

In 2006, there was a new area of dieback on the eastern end of Fisherman Islands, surrounded by an area in poor health (Figure 2.8).

In 2008, the greatest area of new dieback was at eastern Fisherman Islands with the area of dieback increasing substantially since 2006. In 2008, there were recently dead (i.e. brown and curled) leaves on the trees along the margin of the eastern dieback area. New growth, including seedlings, epicormic shoots and leaves at the tips of branches, were most susceptible to die-off (leaf curl and browning) (Figure 2.22).

In 2010, the area of recently dead mangroves had reduced since 2008, however it was still relatively large. The total area of regrowth reduced between 2008 and 2010, primarily because much of the 2008 regrowth was of similar health (fair) to the surrounding forest in 2010. Areas of good health were generally similar in 2010 and 2008 (Figure 2.21).

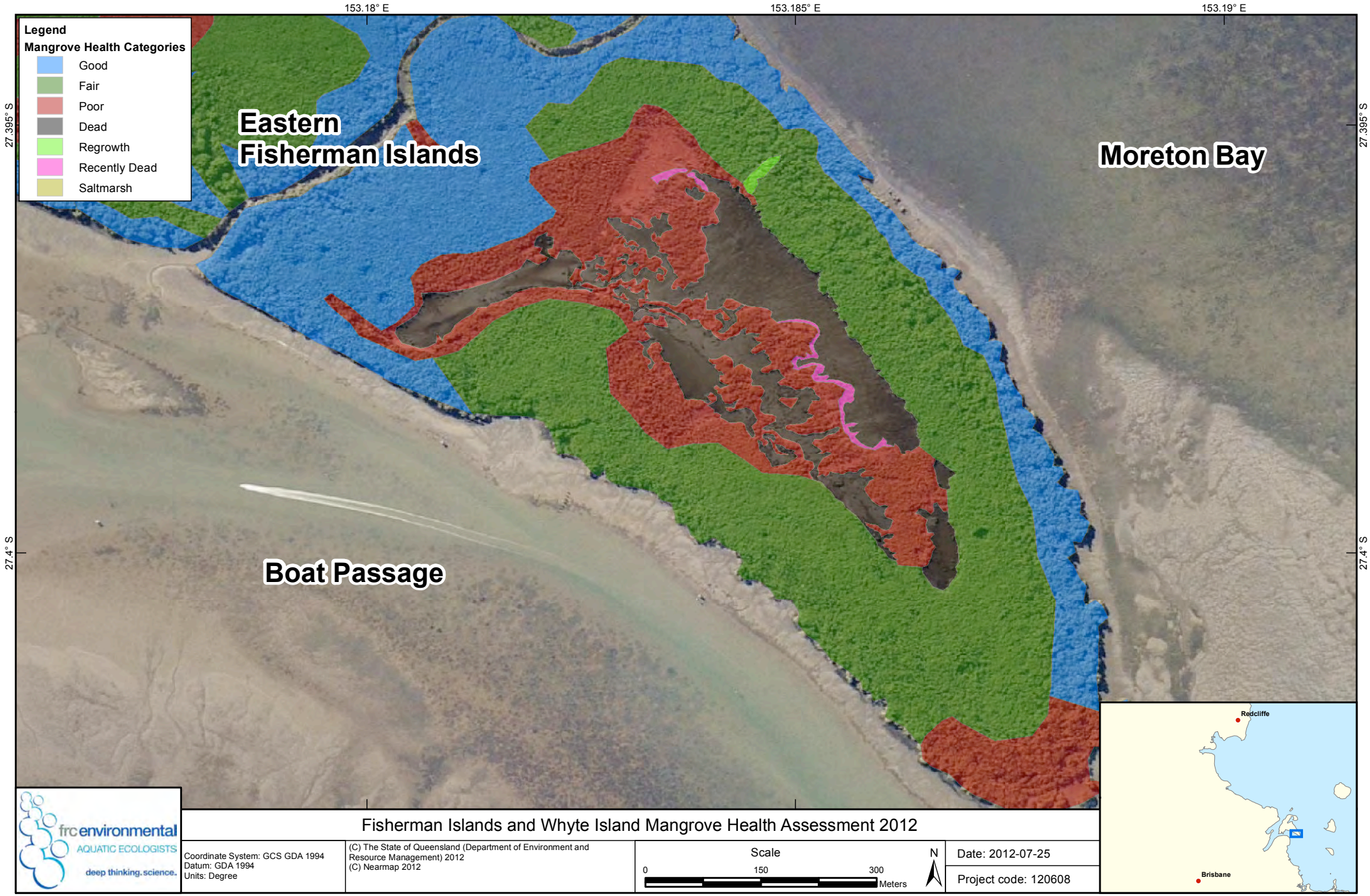
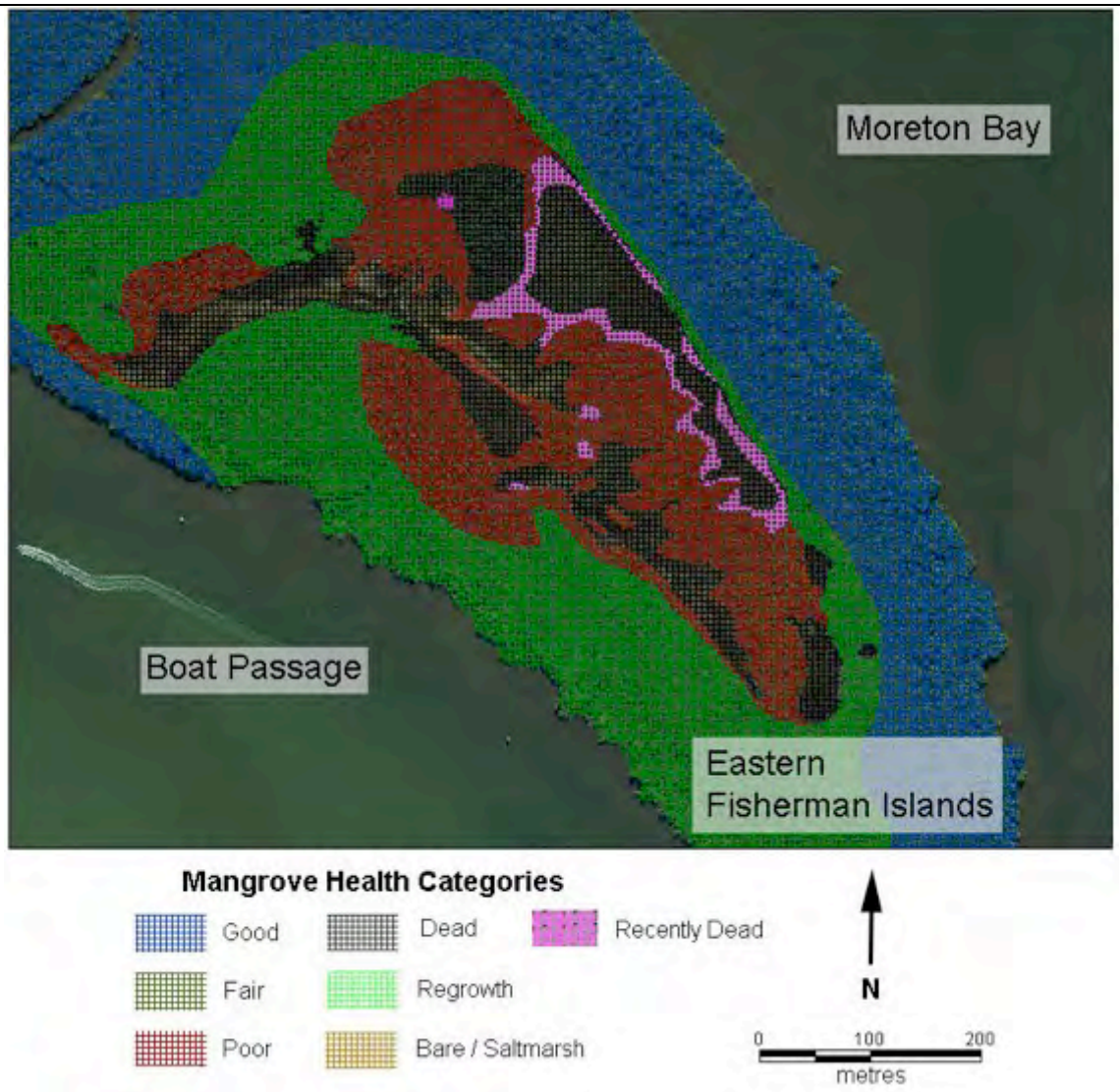


Figure 2.20 Mangrove health at eastern Fisherman Islands in 2012.



Fisherman Islands and Whyte Island
Mangrove Health Assessment 2012

Figure 2.21 Mangrove health at eastern Fisherman Islands in 2010.

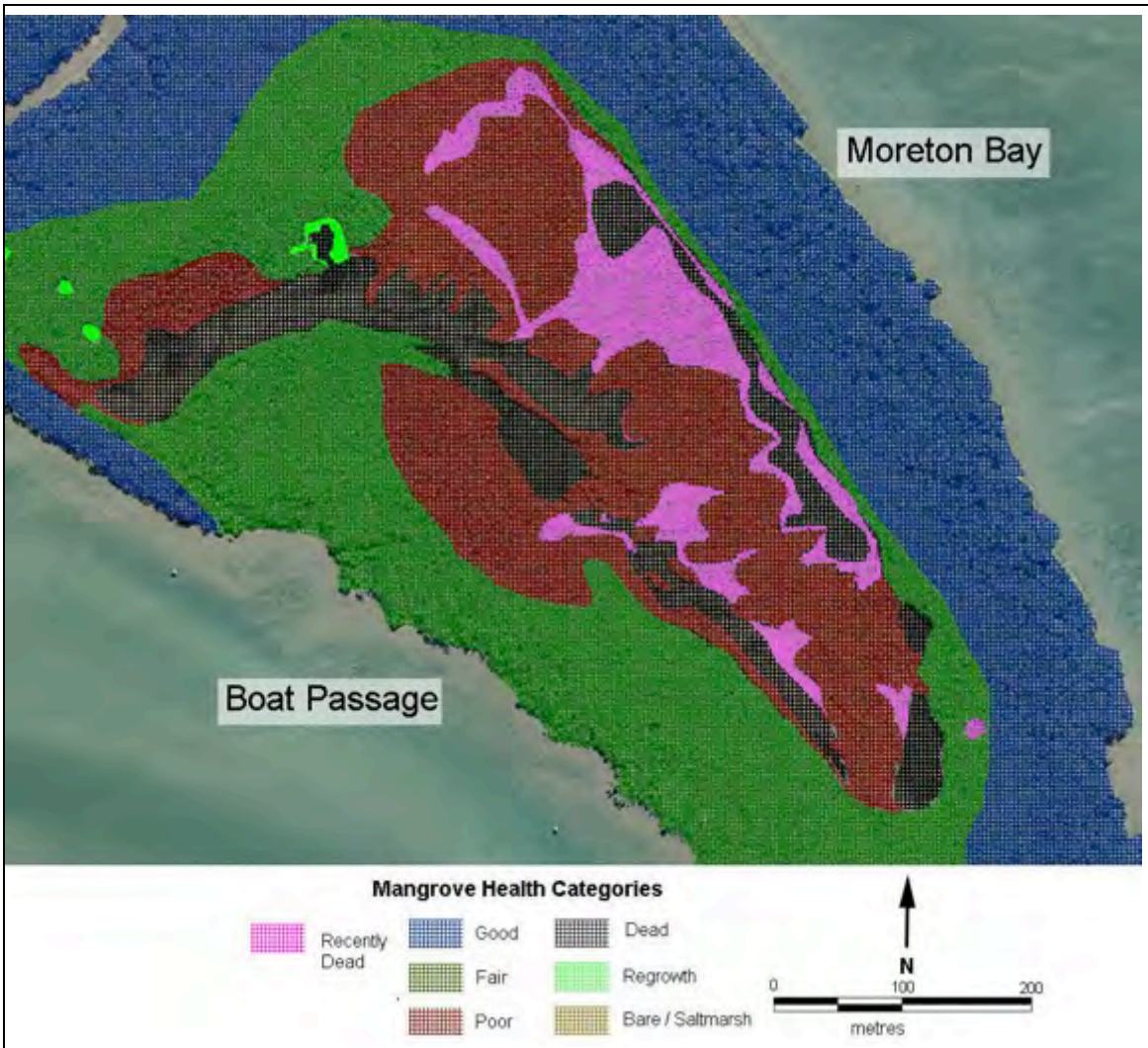


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	Figure 2.22 Mangrove health at eastern Fisherman Islands in 2008.

Figure 2.23

Recently dead mangroves at eastern Fisherman Islands.

The area of mangroves lining the channel was in good health in 2010 and 2012, and the total area in good health had increased in this part of the forest since 2010. The extent of forest in good health along the north-eastern shore had decreased since 2010, and there was a small area of forest next to the dieback area that had started to die in 2010 but has since regrown.

The most eastern tip of the peninsula was in fair to good health in 2010, but in fair to poor health in 2012. This decline in health was evident in the reduced canopy cover, leaf loss and yellowing of leaves.

Large pieces of debris and seagrass wrack had accumulated in areas of eastern Fisherman islands in 2012, as was the case during earlier surveys (and at western Fisherman Islands, the Coal Loader area and Whyte Island). There was more seagrass wrack in 2012 than in 2010. In 2008, there were small accumulations of seagrass wrack on the substrate to the north-east of the dieback area, although accumulation was less than in 2006. In 2006 and 2012, seagrass wrack littered the lower branches of the mangroves and formed berms of up to 0.5 m high along the south-eastern shore (Figure 2.24). This indicated that there had been strong water movements through the area at times, including the 2011 flooding of the Brisbane River. These berms of seagrass wrack were consolidated and likely to have severely impeded tidal drainage.

Figure 2.24

Large banks of seagrass wrack at eastern Fisherman Islands.

Northern Area

In 2012, there was an overall decline in mangrove health at northern Fisherman Islands (Figure 2.25). The most substantial change was relatively large areas of forest in poor health near the landward margin, which were regrowth forest or in fair health in 2010. These areas of poor health were characterised by patches of very soft sediment with macroalgal mats and slicks on the water surface, together with reduced canopy cover, leaf damage by insects and deformed pneumatophores (Figure 2.26 to Figure 2.28). There was evidence of potential impacts to water quality (milky-coloured water) in the drain adjacent to northern Fisherman Islands (Figure 2.16).

The relatively large area of dead mangroves recorded during earlier surveys had decreased substantially since 2004. This was because mangrove forest in poor health had regrown in to the dead area since it was first mapped in detail in 2004 (Figure 2.29 to Figure 2.31).

In 1999 and 2002, most of the mangroves at northern Fisherman Islands were in good health, with an area of fair health and regrowth parallel to the shore in the north (Figure 2.10 and Figure 2.11). By 2004, one of the regrowth areas to the north of Sandpiper Drive had died and there was an area of fair health (Figure 2.9). In 2006, the dead area was of a similar size to that recorded in 2004 and the dead trees (visible in the 2004 aerial photographs) had fallen over, leaving a clear ponded area (Figure 2.8). In 2008, this dead patch was similar in size to that recorded in 2006, but the health of the surrounding forest, particularly to the west, had declined substantially and was in poor health (Figure 2.7). In 2010, the dieback area was smaller than in previous years, with seedlings and saplings growing in from the forest margin, and the health of some areas had improved. However, the small northern-most regrowth area in 2008 was largely dead in 2010 (Figure 2.6).

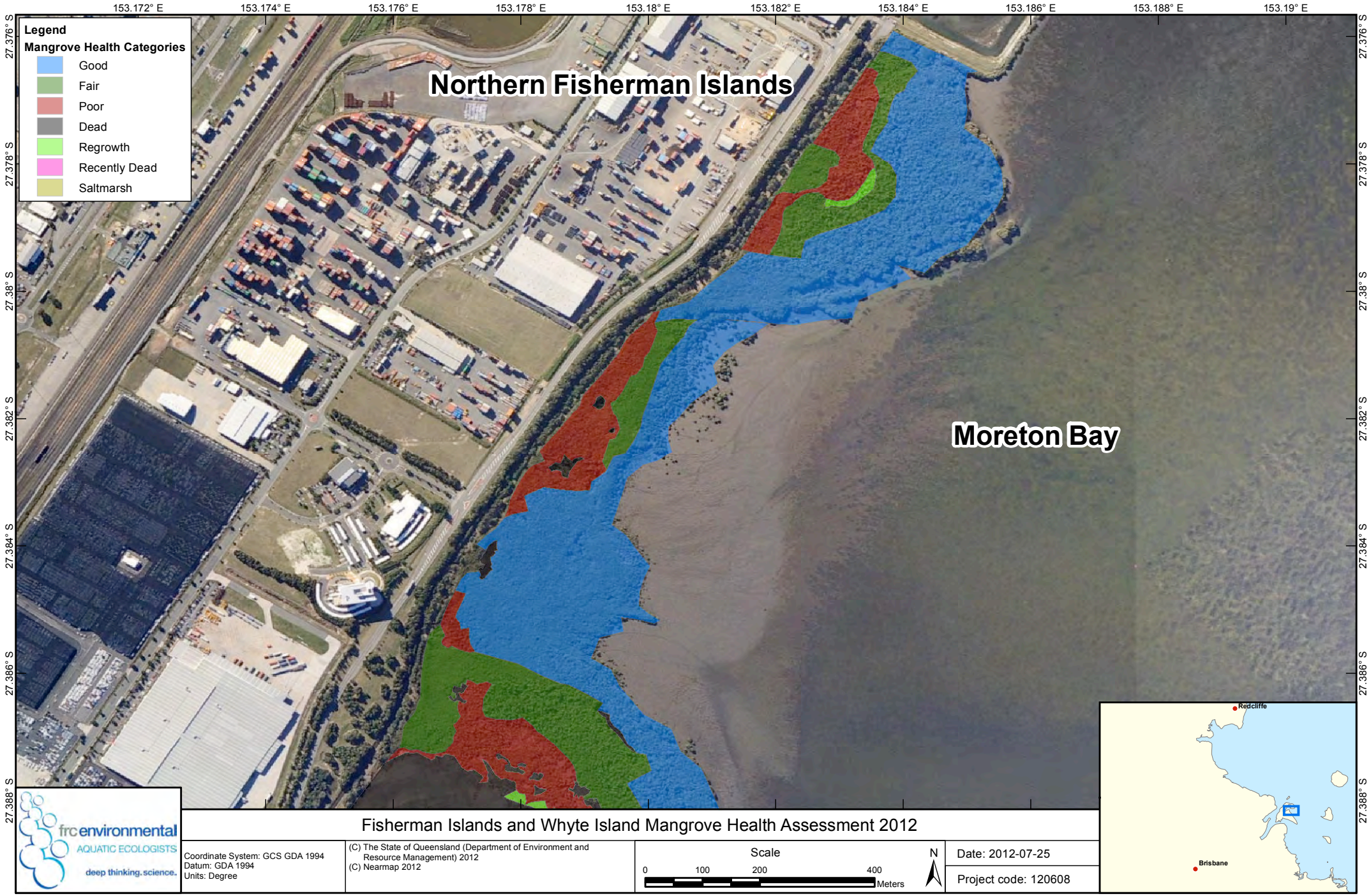


Figure 2.25 Mangrove health at northern Fisherman Islands in 2012.

Figure 2.26

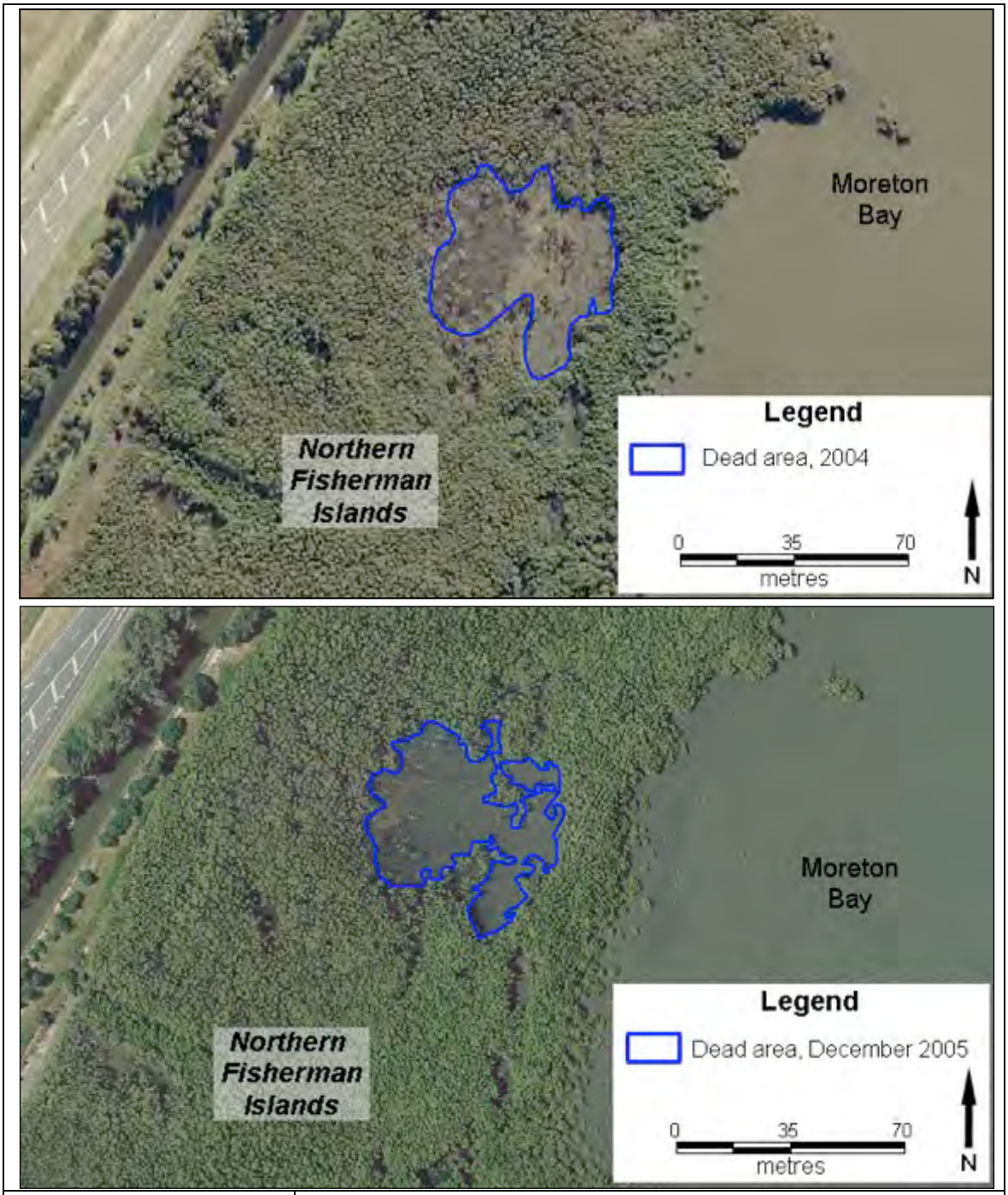
Saplings and seedlings growing in very soft sediment at northern Fisherman Islands.

Figure 2.27

Macroalgal mats and a slick on the water surface at northern Fisherman Islands.

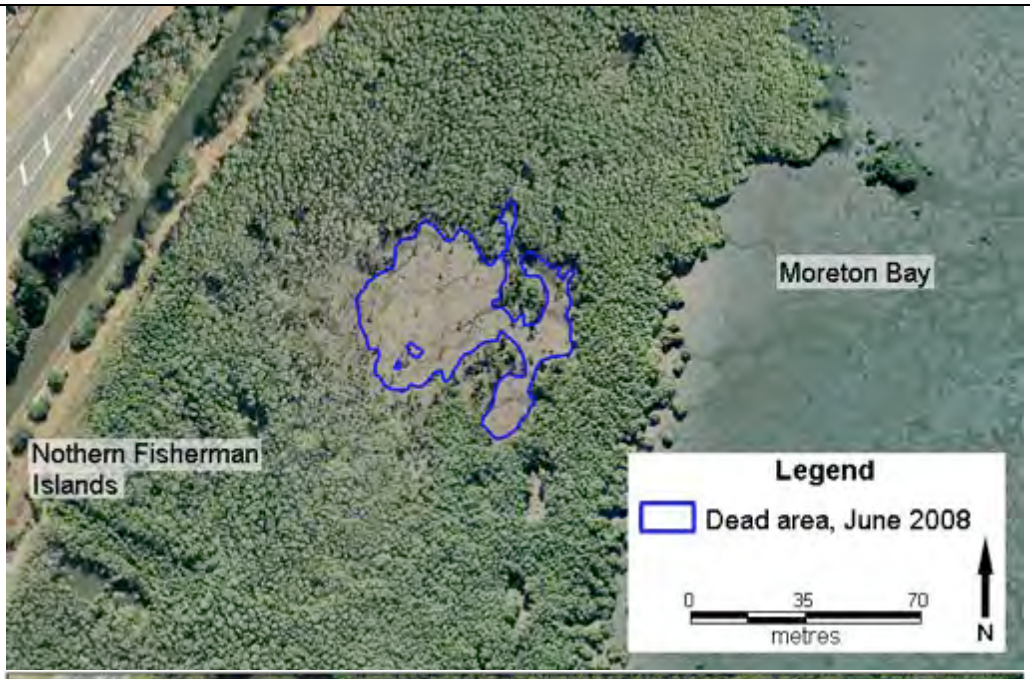
Figure 2.28

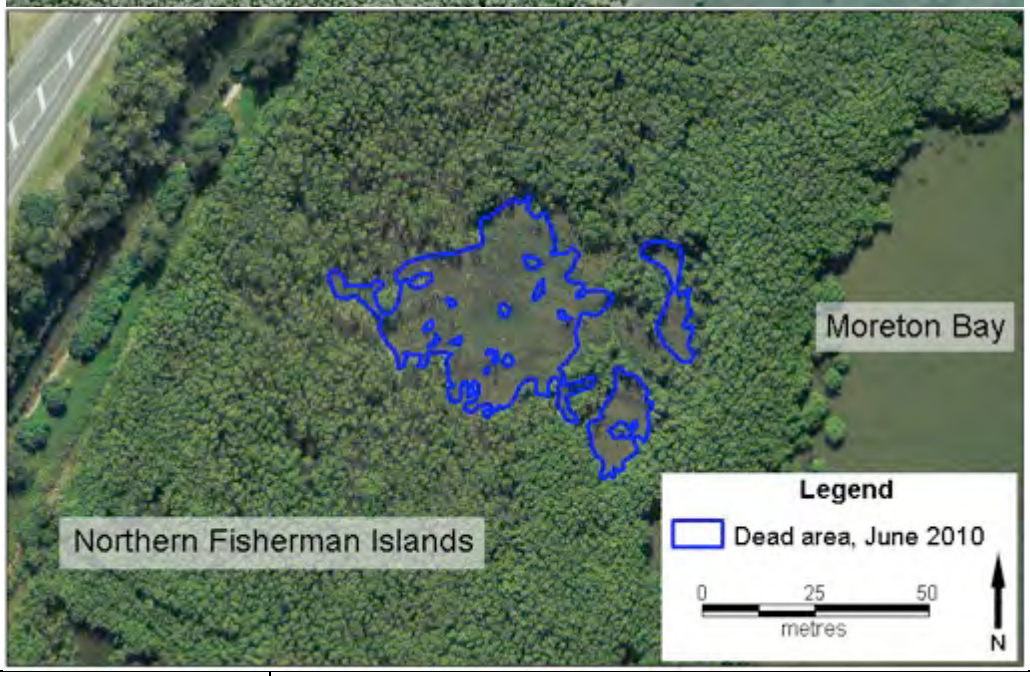
Seedlings in poor health at northern Fisherman Islands (note insect damage and thin layer of sediment on the leaves).



Fisherman Islands and Whyte Island Mangrove Health Assessment

Figure 2.29 Dead patch at northern Fisherman Islands in 2004 and 2006.





Fisherman Islands and Whyte Island Mangrove Health Assessment

Figure 2.30 Dead patch at northern Fisherman Islands in 2008 and 2010.

Figure 2.31 Dead patch at northern Fishman Island in 2012.

2.3 Sub-lethal Indicators of Mangrove Health

Epiphytic Macroalgae

Epiphytic macroalgae covering the roots and pneumatophores of mangroves were common on the seaward mangrove communities. In these areas, the pneumatophores of *A. marina* were covered by red algae (*B. moritiziana* and *C. nipae*). The abundance of epiphytic algae was consistently highest in the healthiest areas of mangroves, particularly on the seaward edges of the forests. Mangrove pneumatophores along landward margins and next to dieback areas usually had less or no epiphytic macroalgae.

Macroalgal Mats

Macroalgal mats were common in the dieback areas, especially where water was ponded. Mats included cyanobacteria such as *Lyngbya* sp. (not *Lyngbya majuscula*) and *M. chthonoplastes*; and green filamentous algae such as *E. intestinalis*.

Insect Damage

Damage by insects was common throughout the mangrove communities at Fisherman Islands. It was most common on new growth in areas of fair or poor health, with leaves on tree tops and epicormic growth particularly susceptible to damage.

Mangrove Seedlings

Patterns in seedling density at Fisherman Islands were generally similar to those recorded since 2004, however there had been an increase in seedling densities bordering dieback areas. Seedling densities were generally sparse in low closed forests. Seedlings were generally denser in open forests, such as mature seaward forests.

Macrofauna

Macrofaunal abundance was generally higher in the more seaward areas of Fisherman Islands. Very little fauna was recorded on the substrate in ponded areas; sparse gastropods were recorded in some areas. Very little fauna or crab burrows were found in

the dieback or bare areas with thick algal mats, however infaunal invertebrate communities appeared to be abundant in these areas based on wader bird foraging.

3 Coal Loader Area of Fisherman Islands

3.1 Community Composition and Structure

Mangrove community composition and structure at the coal loader area of Fisherman Islands was similar to that recorded in previous years. It was dominated by an open forest of A. marina, with small areas of mixed low closed forest, C. tagal-dominated low closed forest, and terrestrial communities with some saltmarsh (Figure 3.1).

The mixed low closed mangrove forest was composed, in varying compositions, of:

- *A. marina*
- *C. tagal*
- *R. stylosa*, and
- *B. gymnorrhiza*.

Saltmarsh species included:

- *S. portulacastrum*
- *S. australis*
- *S. arbusculoides*
- *S. quinqueflora*, and
- *E. tomentosa*.

The terrestrial communities included:

- *C. glaucescens*
- *I. pes-caprae*
- coastal hibiscus (*Hibiscus tiliaceus*), and
- swamp oak (*Casuarina glauca*).

These terrestrial species grew on sand berms, with the saltmarsh on the lower, more frequently inundated parts of the berms (Figure 3.2). On some berms there were also a number of introduced species, such as:

- broad-leaf pepper tree (*Schinus terebinthifolius*), and
- mile-a-minute (*Ipomoea cairica*).

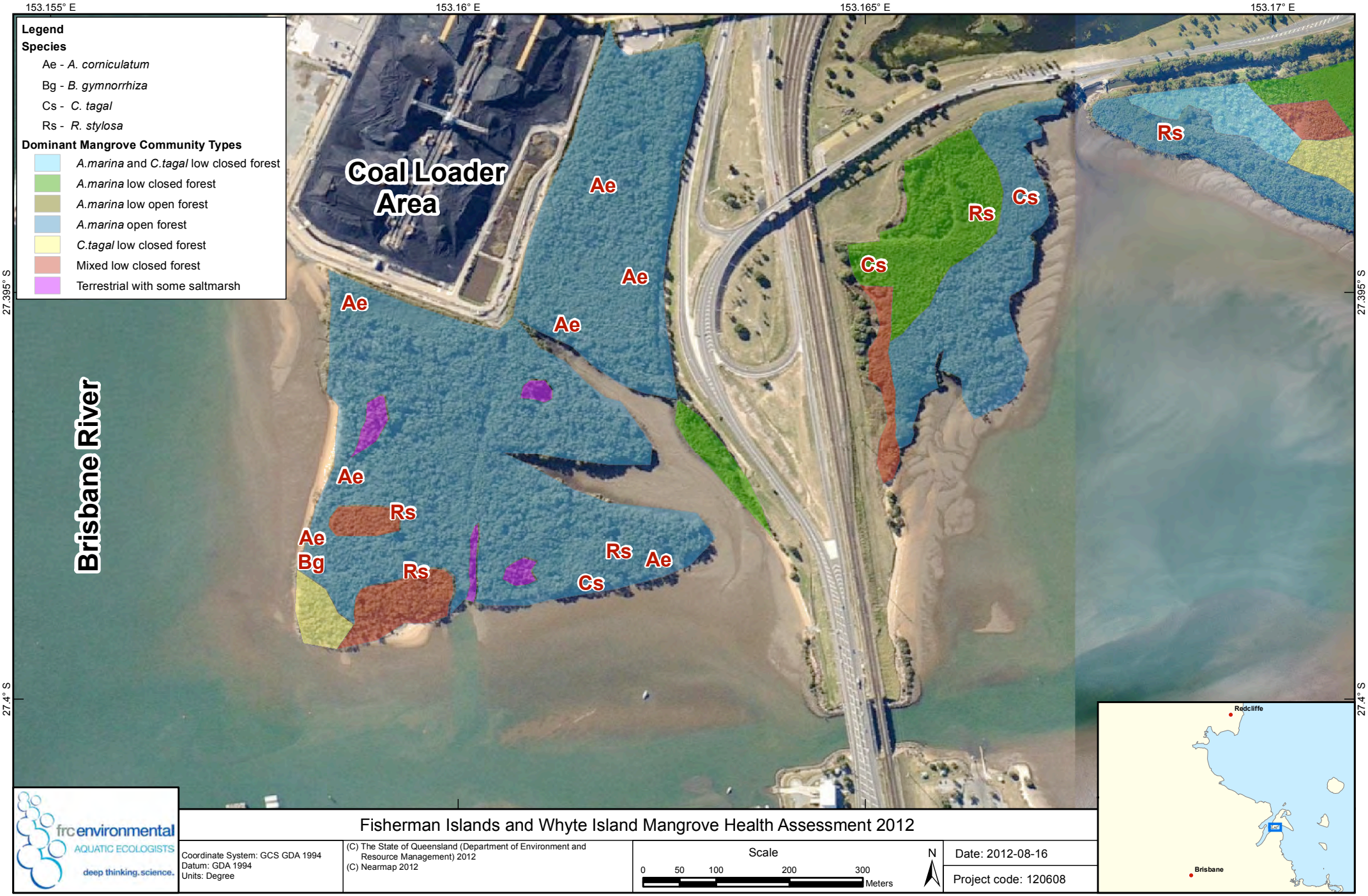


Figure 3.1 Mangrove species composition at Coal Loader area in 2012.

Figure 3.2

Mangrove forest, with coastal terrestrial community, next to the drain in the Coal Loader area.

Marine plants that grew in the drain bisecting the southern section, included:

- the exotic green algae *Caulerpa taxifolia*
- the red algae *Gracilaria* spp., and
- the seagrass *Z. muelleri*.

3.2 Mangrove Health

Overall mangrove health at the Coal Loader area remained largely unchanged since 2004 [4] (Figure 3.3 to Figure 3.8). Most of the mangrove forest was in good health. In 2012, no regrowth was observed because the mangroves in the two large regrowth areas (along the landward margin to the east and west of Port Drive) had matured, and are now forest in fair or poor health.

[4] mapping files not available for 1999, so 1999 values are based on 2002 values, as mapping of Coal Loader area did not significantly change between 1999 and 2002

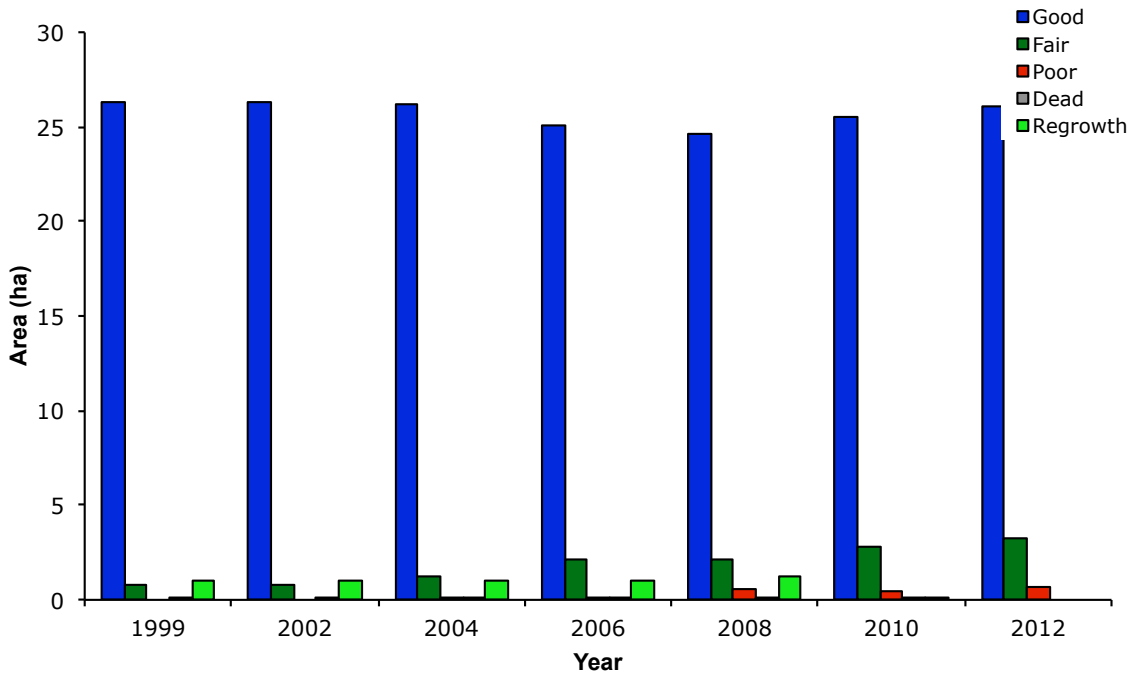


Figure 3.3 Area of mangroves in each health category in Coal Loader area of Fisherman Islands from 1999 to 2012.

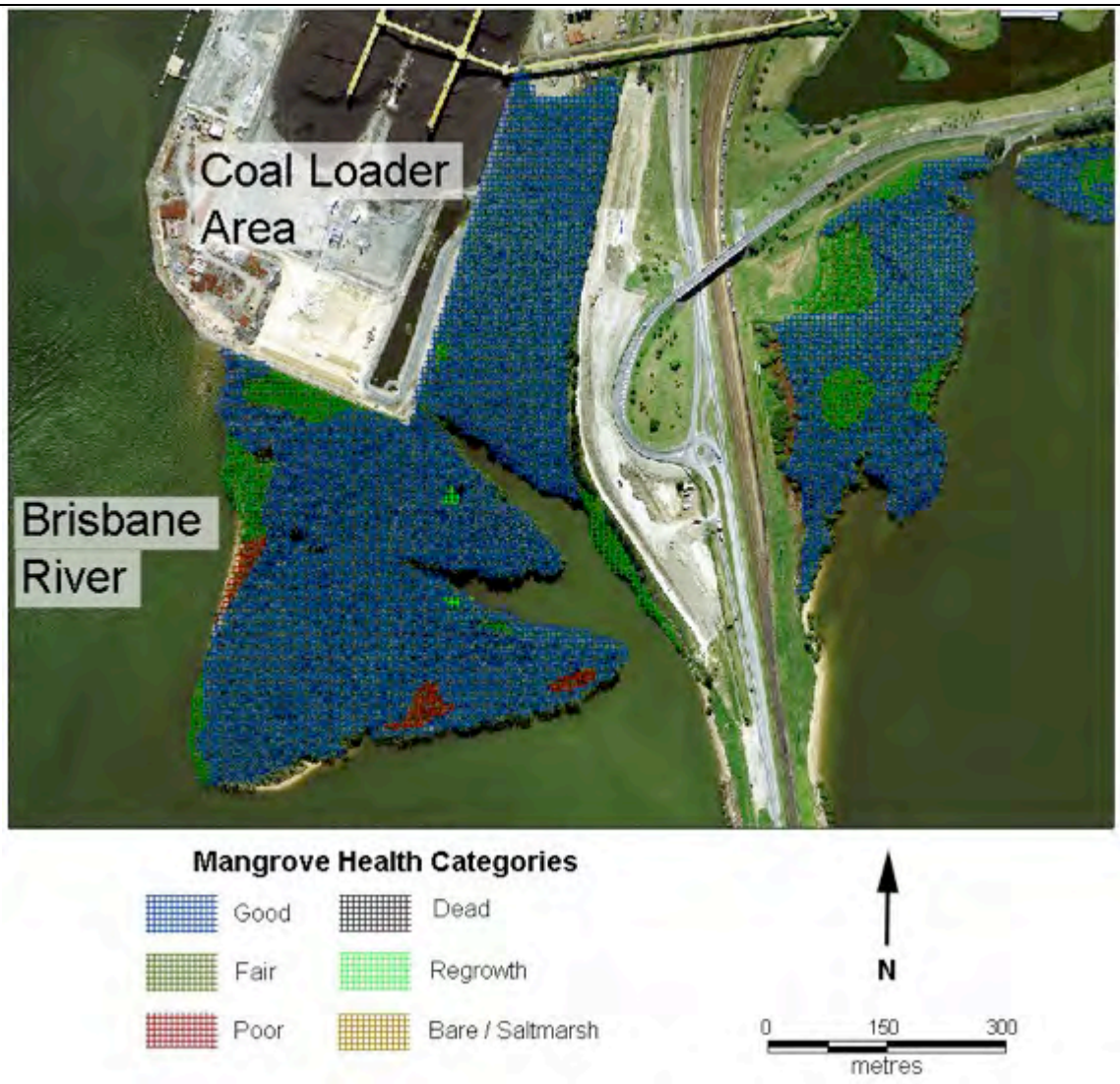
Two new areas of forest in poor health developed in the eastern Coal Loader area:

- an area in the north downstream of the drain running along the landward margin of the Fisherman Island mangroves, and
- an area at the southern end of this area.

There were also changes to health along the landward margin of the eastern Coal Loader area:

- the health of the northern section improved from poor to good in 2012, while
- the health of the southern section declined from good to poor (Figure 3.9).

Figure 3.4 Mangrove health in Coal Loader area of Fisherman Islands in 2012.



frc environmental AQUATIC ECOLOGISTS deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment
	Figure 3.5 Mangrove health in Coal Loader area of Fisherman Islands in 2010.

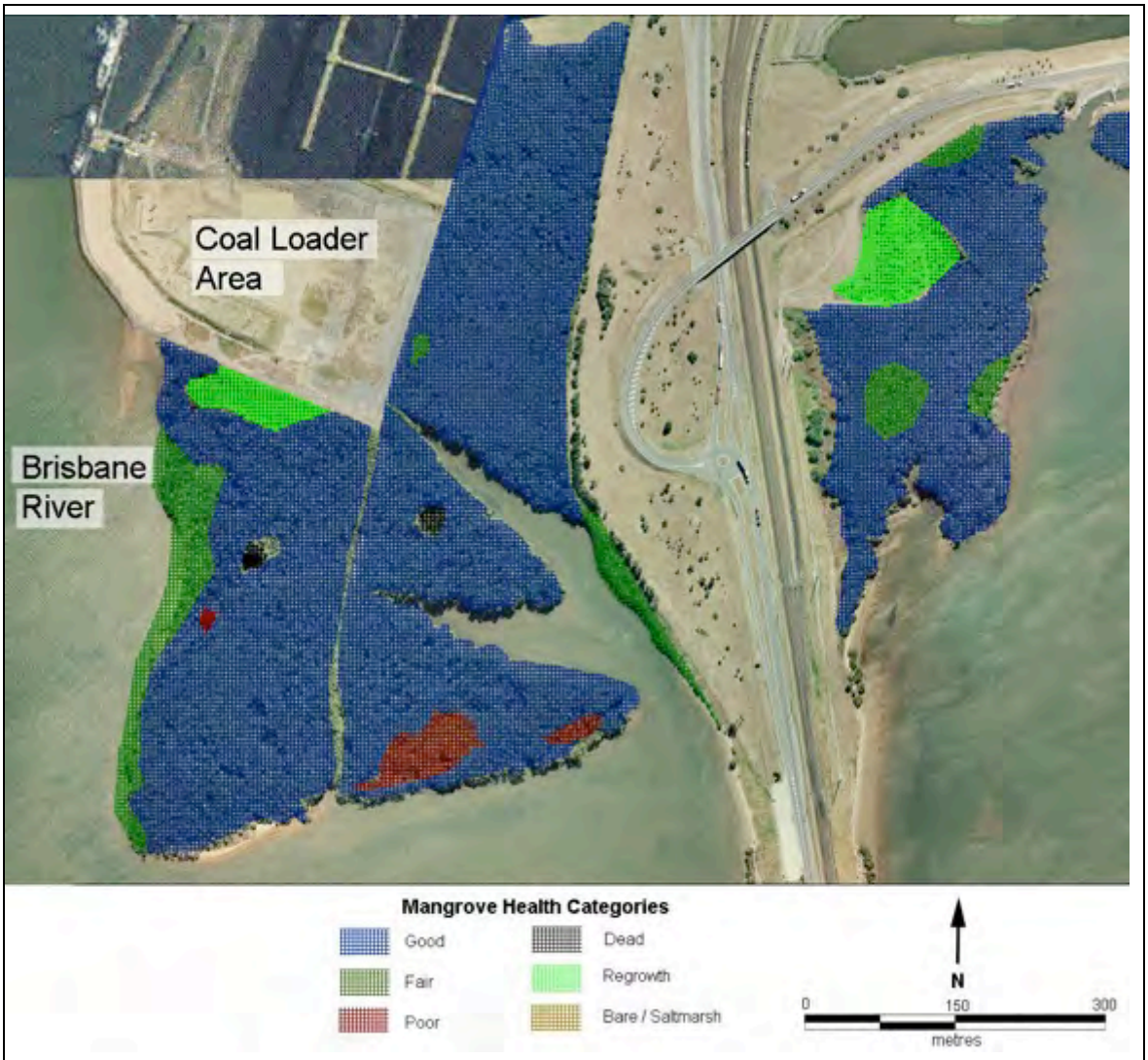


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	Figure 3.6 Mangrove health in Coal Loader area of Fisherman Islands in 2008.

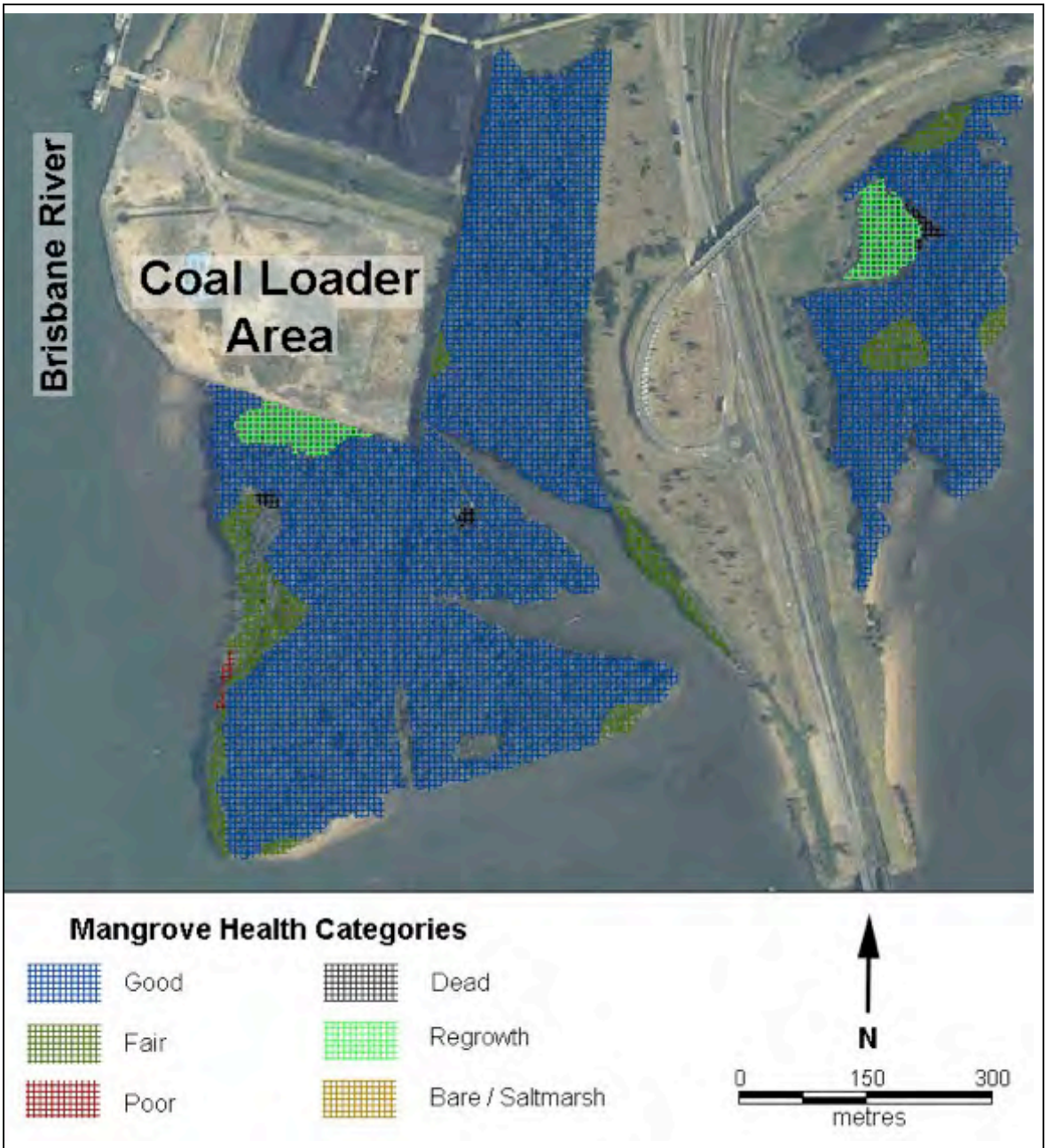

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Figure 3.7 Mangrove health in Coal Loader area of Fisherman Islands in 2006.

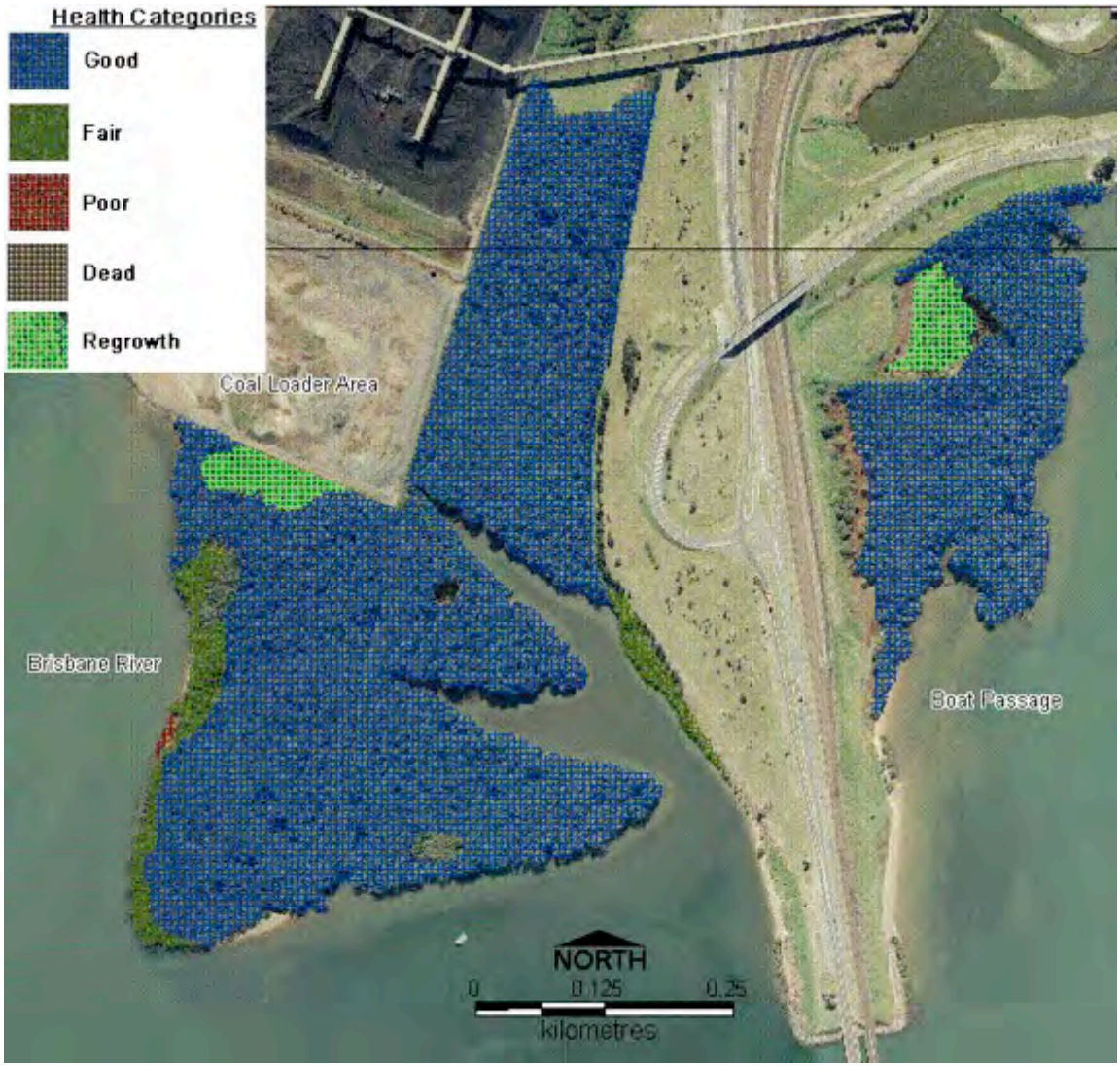

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	Figure 3.8 Mangrove health in Coal Loader area of Fisherman Islands in 2004.

Figure 3.9

Mangrove in poor condition in the southern section of the landward margin at the eastern Coal Loader area (note dead branchlets and yellowing leaves).

Erosion and deposition of sediment has reduced the health of this area since 2008. There were several sand berms in the eastern and western sections of the Coal Loader area (e.g. Figure 3.10). Several large trees had been undermined by erosion (e.g. Figure 3.11). There was evidence of potential impacts to water quality (milky-coloured water) in the drain adjacent to northern Fisherman Islands, which drains into the small inlet in between western Fisherman Islands and eastern Coal Loader area (Figure 2.16).

Saltmarsh in the area was the same as in 2010, dense areas growing amongst dead mangroves (Figure 3.12).

Large pieces of debris and seagrass wrack had accumulated in this area in 2012, as was the case during earlier surveys (and at Fisherman Islands and Whyte Island) (Figure 3.13 and Figure 3.14). This indicated that there had been strong water movements through the area at times, including the 2011 flooding of the Brisbane River. These berms of seagrass wrack were consolidated and likely to have severely impeded tidal drainage.

There was evidence of human activity in the western Coal Loader area (Figure 3.15). [5]

[5] This type of activity has been recorded during previous surveys and appears to be related to training by local police.

Figure 3.10

Sand deposition, rubbish and debris across mangroves in Coal Loader area, east of Port Drive.

Figure 3.11

Erosion along south-eastern shore in Coal Loader area, east of Port Drive.

Figure 3.12

Dense saltmarsh growing around dead mangroves.

Figure 3.13

Debris and seagrass wrack at the eastern Coal Loader area.

Figure 3.14

Large debris at the western Coal Loader area.

Figure 3.15

Evidence of human activity in the western Coal Loader area.

3.3 Sub-lethal Indicators of Mangrove Health

Epiphytic Macroalgae

Algae that covered the roots and pneumatophores of most *A. marina* trees in the Coal Loader area, particularly on the seaward margins, was dominated by:

- *B. moritiziana,* and
- *C. nipae* (Figure 3.16).

Figure 3.16

Epiphytic algal cover on pneumatophores along the south-eastern shore.

Macroalgal Mats

Dense macroalgal mats have not been recorded in the Coal Loader area during earlier surveys. In 2012, there were patches of sparse algal growth on the sediment, pneumatophores and mangrove trunks in parts of the Coal Loader area.

Insect Damage

In 2012, there was limited damage by insects to the mangroves in the Coal Loader area.

Mangrove Seedlings

Grey mangrove seedlings were moderately dense in the Coal Loader area, with some patches of very dense seedlings, particularly in canopy gaps.

Macrofauna

Macrofaunal abundance was high throughout most of the Coal Loader area, with a lower abundance of macrofauna in more elevated areas, such as the landward *C. tagal* forest and saltmarsh area.

4 Whyte Island

4.1 Community Composition and Structure

Mangrove community composition and structure at Whyte Island was similar to that recorded in previous years, with communities dominated by *A. marina*. There were also some areas of *C. tagal*, and scattered *R. stylosa* trees in areas of open forests (Figure 4.1).

Low closed forests dominated most of Whyte Island, with open forests along the seaward margin (Figure 4.1). There were also some areas of low open forest, seaward of the closed forests.

Saltmarsh communities were dominated by:

- *S. portulacastrum*
- *S. australis*
- *S. arbusculoides*
- *S. quinqueflora*, and
- *E. tomentosa*.

4.2 Mangrove Health

The major changes to mangrove health were that the total area of dead mangroves and mangroves in poor and fair health had slightly increased since 2010, while the total area of mangroves in good health had declined since 2002 (but there had been little change since 2006). Since 2010:

- the total area of dead mangroves had increased from 26.81 to 30.9 ha
- the total area of poor mangroves had increased from 19.16 to 23.36 ha, and
- the total area of fair mangroves had increased from 2.2 to 2.7 ha (Figure 4.2).

Figure 4.1 Mangrove community structure at Whyte Island in 2012.

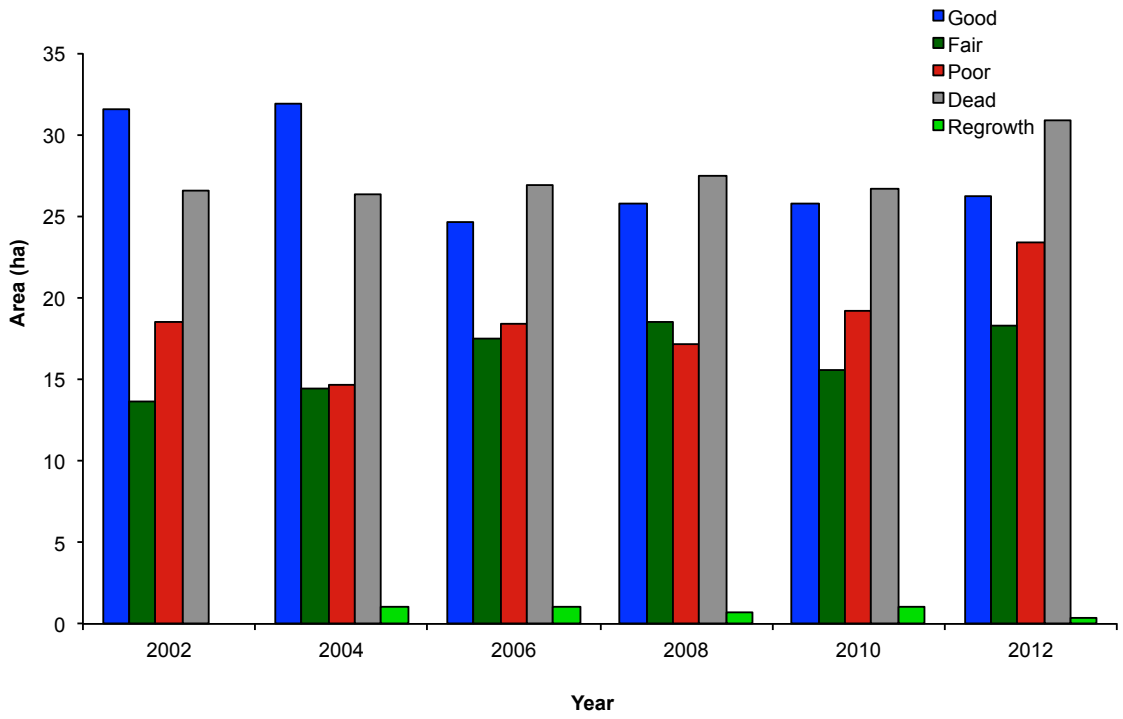


Figure 4.2 Area of mangroves in each health category at Whyte Island from 2002 to 2012.

In 2012, the major changes to health included changes to the location of regrowth and a decline in health from good to fair in areas of the forest along the northern shore and fair to poor throughout much of the forest. There were no recently dead mangroves in this area in 2012. The area of regrowth at the southern Whyte Island in 2010 was in poor health in 2012, and a new area of regrowth had developed at southern Whyte Island in 2012. The area of mangroves in good health was significantly less in 2012 than in previous years, particularly at northern Whyte Island (Figure 4.3).

Since 2002, the central area in poor health had generally expanded and the trees had thinned and become patchier. In 2004, there were patches of regrowth along the south-east margin of the dieback area. This regrowth continued through 2006, but by 2008, much of the regrowth had died or was in poor health. In 2008, regrowth was confined to two small areas at the southern end of the dieback area. In 2010, the landward area of regrowth recorded in 2008 had died but the seaward area had extended to the north into an area of previously dead mangroves (recorded in 2008). The recently dead mangroves lining the northern margin of the dieback area had not recovered in 2010 (Figure 4.4 to Figure 4.8).

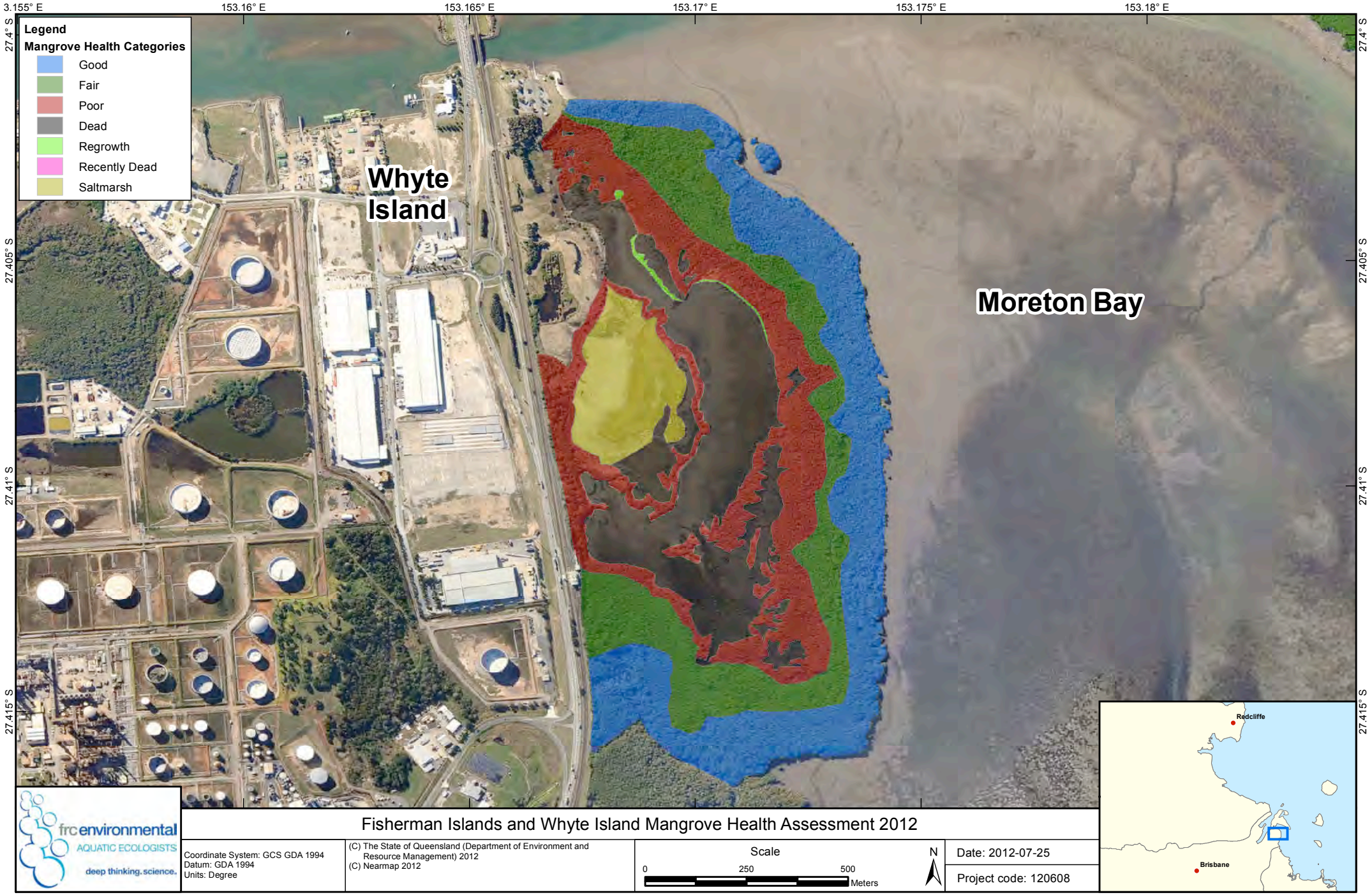
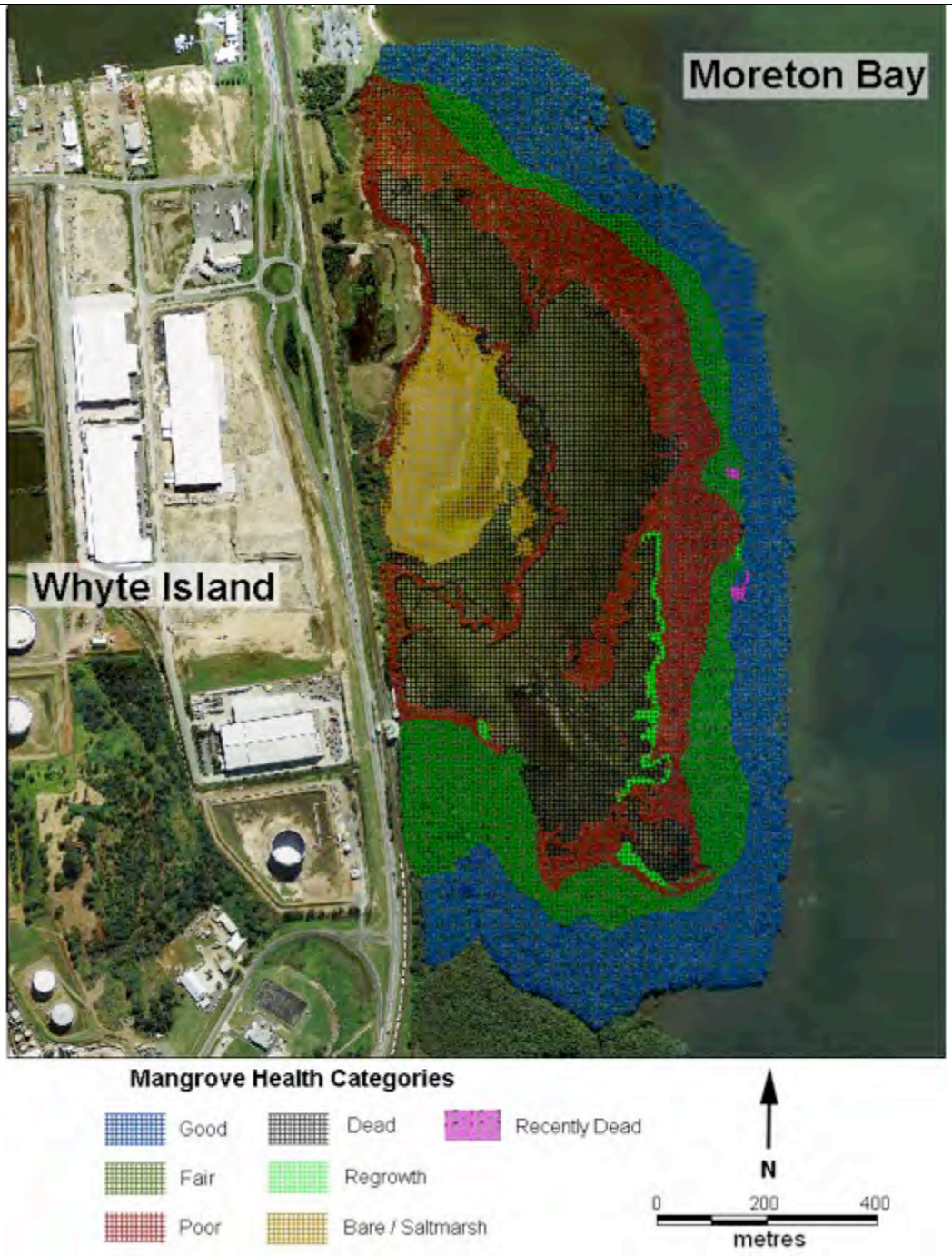
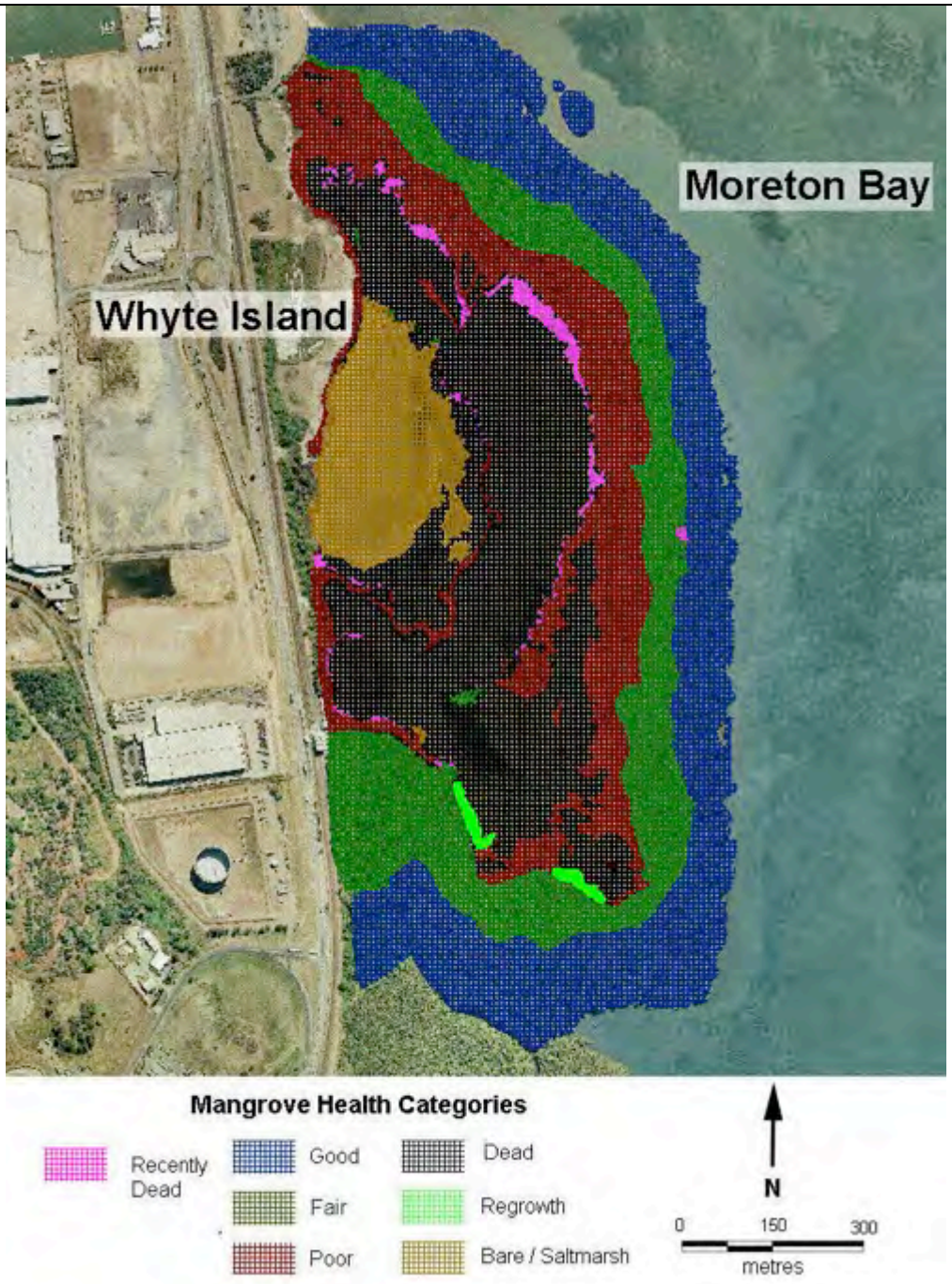


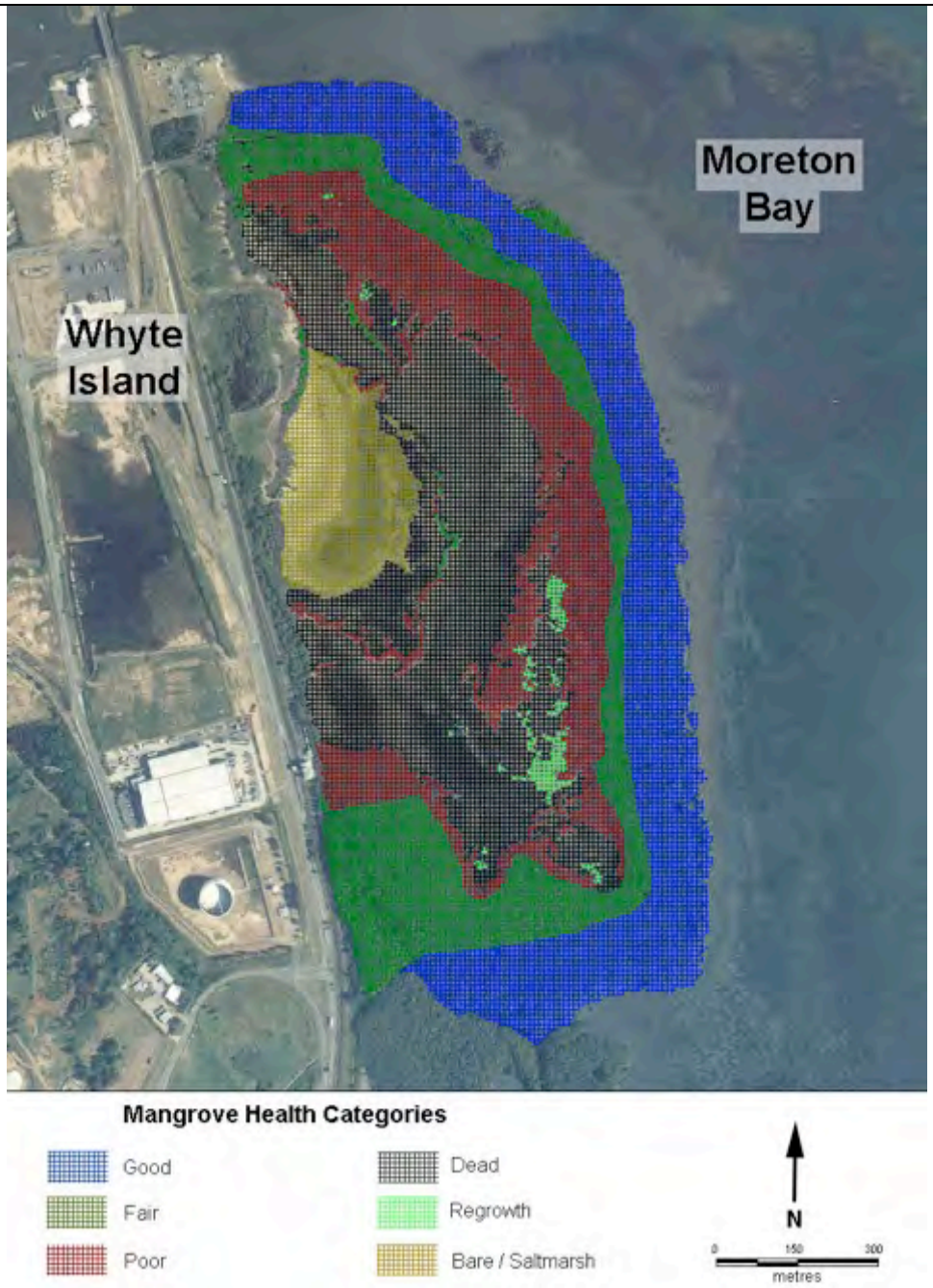
Figure 4.3 Mangrove health at Whyte Island in 2012.



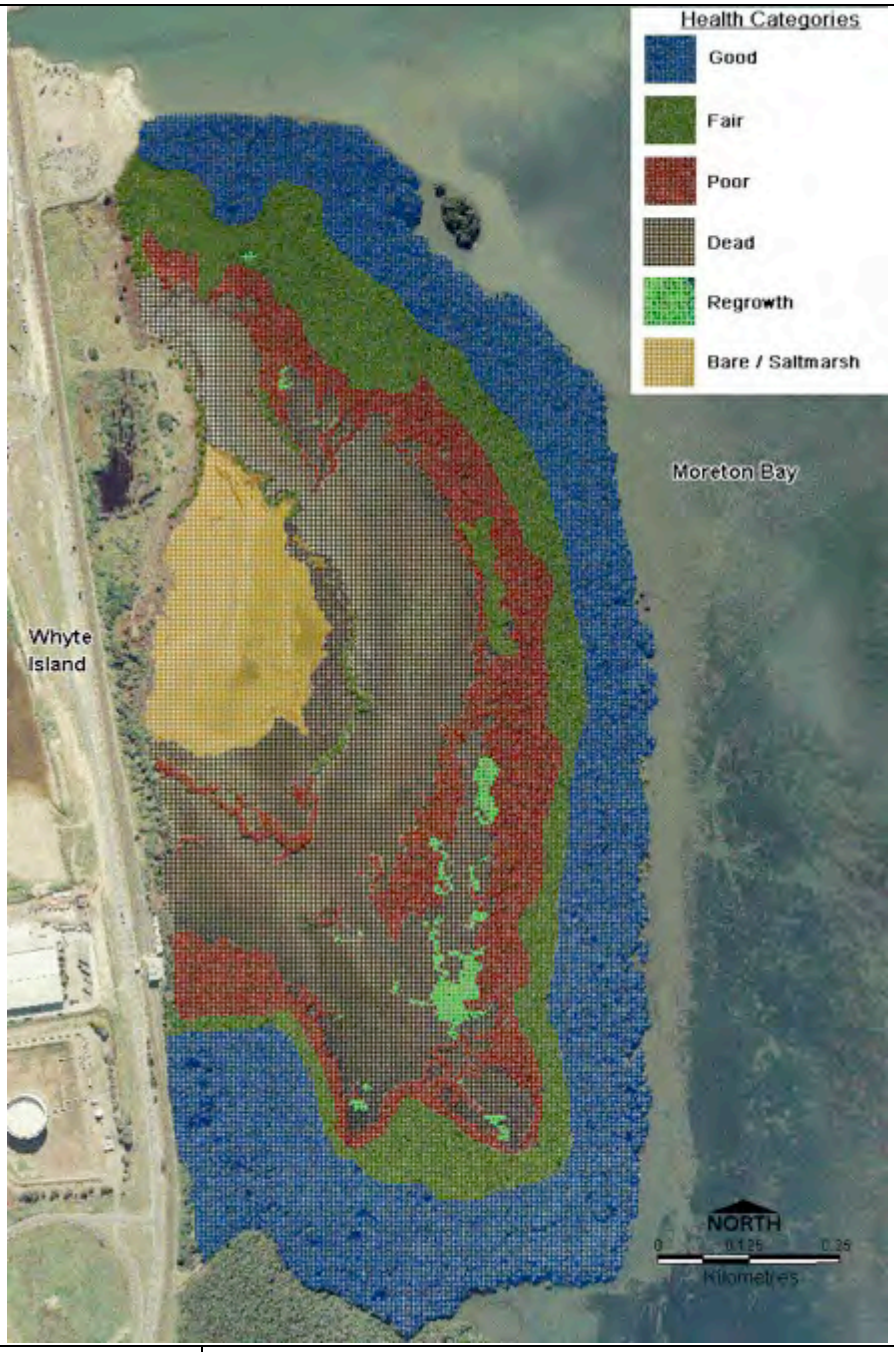
frc environmental AQUATIC ECOLOGISTS deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment
	Figure 4.4 Mangrove health at Whyte Island in 2010.



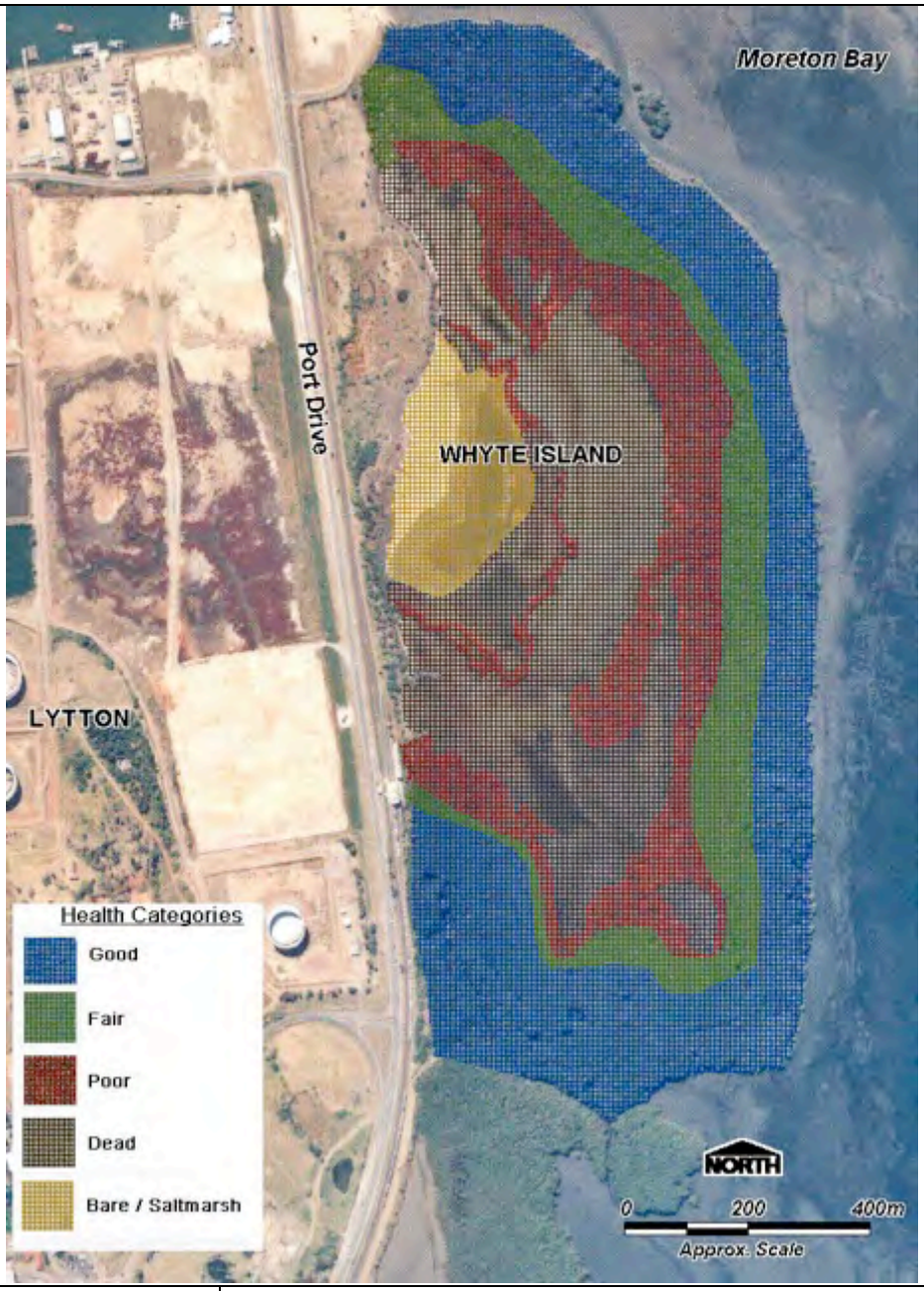
frc environmental AQUATIC ECOLOGISTS deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment
	Figure 4.5 Mangrove health at Whyte Island in 2008.



frc environmental AQUATIC ECOLOGISTS deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment
	Figure 4.6 Mangrove health at Whyte Island in 2006.



frc environmental AQUATIC ECOLOGISTS deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment
	Figure 4.7 Mangrove health at Whyte Island in 2004.



frc environmental AQUATIC ECOLOGISTS deep thinking.science.	Fisherman Islands and Whyte Island Mangrove Health Assessment
	Figure 4.8 Mangrove health at Whyte Island in 2002.

Large pieces of debris and seagrass wrack had accumulated in this area in 2012, as was the case during earlier surveys (and at Fisherman Islands and the Coal Loader area) (Figure 4.9 and Figure 4.10). This indicated that there had been strong water movements through the area at times, including the 2011 flooding of the Brisbane River. These berms of seagrass wrack were consolidated and likely to have severely impeded tidal drainage.

Figure 4.9

Large debris at Whyte Island.

Figure 4.10

Debris at Whyte Island.

4.3 Sub-lethal Indicators of Mangrove Health

Epiphytic Macroalgae

Epiphytic algae such as *B. moritiziana* and *C. nipae* grew on *A. marina* pneumatophores in the open forests of Whyte Island. Epiphytic algae were greatest in seaward areas in good and poor health.

Macroalgal Mats

In 2012, there were thick algal mats growing over the sediment in parts of the ponded dieback area and in mangroves in poor health (Figure 4.11 and Figure 4.12). The abundance of algal mats was widespread.

Figure 4.11

Ponding water at the Whyte Island dieback area with extensive algal mats.

Figure 4.12

Macroalgal mats in the dieback area at Whyte Island.

Insect Damage

In 2012, there was damage by insects in many areas at Whyte Island, as was the case in earlier surveys. Insect damage was highest in areas of poor health and regrowth. There was no improvement in health in areas previously damaged by insects, with extensive insect damage in areas in poor health, particularly in areas bordering the dieback area.

Mangrove Seedlings

In 2012, seedling density was highest in areas of open forest and in association with the dieback area, as was the case in earlier surveys. There were abundant seedlings and saplings at northern Whyte Island, in association with a small island.

Macrofauna

Macrofaunal abundance was higher in the more seaward mangroves of Whyte Island. There was very little fauna in ponded areas.

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Appendix B Photographic Monitoring

Contents

Tables

Figures

1 Methods

In 1999–2000, 19 permanent photographic monitoring sites were established in the mangrove communities of Fisherman Islands, including the Coal Loader area (Figure 1.1). Sites were marked with a plastic star picket, the co-ordinates were recorded using a GPS unit (Table 1.1), and digital photographs were taken in each cardinal direction (WBM Oceanics Australia 2001). These sites were re-photographed in:

- 2000–2001 (WBM Oceanics Australia 2001)
- 2002 (WBM Oceanics Australia 2002)
- 2004 (frc environmental 2004)
- 2006 (frc environmental 2007)
- 2008 (frc environmental 2008)
- 2010 (frc environmental 2010) and,
- 2012 (frc environmental 2012).

PVC pipes were used as a reference point in each photo, with different combinations of coloured tape on the pole indicating the cardinal direction of each photo. Photographs were downloaded to a computer and visually assessed for differences between surveys. Data on the mangrove communities at each site was recorded and incorporated in the mapping described in Appendix A.

Figure 1.1 Photographic monitoring sites at Fisherman Islands.

Figure 1.2 Photographic monitoring sites at Coal Loader area at southern end of Fisherman Islands.

Table 1.1 Position of photographic monitoring sites

Site	Easting [a]	Northing [a]
Coal Loader Area		
1	515535	6969158
2	515635	6969481
3	515823	6969656
4	515924	6969268
5	516100	6969286
6	516258	6969615
8	516323	6969815
Fisherman Islands		
10	516604	6969873
11	516800	6969726
13	517234	6970249
14	517466	6970396
15	517393	6970664
16	517542	6971027
17	518028	6971302
18	518189	6971533
19	517487	6970184
20	517470	6969501
22	518085	6969346
23	518497	6968968
Whyte Island		
No sites photographed		

[a] site position recorded using a GPS (AGD84 Zone 56J)

2 Results

A brief summary of community structure at each of the sites, and changes since the previous surveys, are presented in Table 2.1. In summary, the cover of mangroves and saltmarsh had increased in several areas. There was also evidence of more seagrass wrack in 2012 than in 2010 and substantial ponding in 2012.

2.1 Summary of Structure and Changes

Table 2.1 Mangrove communities at each site, and differences compared to previous monitoring events.

Site	Current Description	Observations
1	Open yellow mangrove (*Ceriops tagal*) forest with grey mangrove (*Avicennia marina*) understorey and sandy substrate, of fair health.	This site was generally similar in 2012 and 2010.
2	Mature *A. marina* forest in good health, with dense cover of *A. marina* seedlings and saplings An area of regrowth nearby, with regrowth noticeable in the immediate understory.	Since 2010, there was a slight increase seedling and sapling density to the south and east of the marker, and the understory to the north of the marker had increased in height and canopy cover. A improvement in health was observed in 2012.
3	Mature, open *A. marina* forest with some river mangrove (*Aegiceras corniculatum*) Good health although there is some epicormic growth on *A. marina* trunks.	This site was generally similar in 2012 and 2010. Since 2010, seedling, sapling and epicormic growth continued with substantially more seedlings to the east of the marker.
4	Mature, open *A. marina* forest with some *A. corniculatum* and red mangrove (*Rhizophora stylosa*), of good health.	This site was generally similar in 2012 and 2010. There was a slight increase in seedling density to the east of the marker. The area had a slight decline in mangrove health, with areas previously recorded as good in 2010, now classified as fair in 2012.
5	Thin fringe of *A. marina* shrubs along sandy shore, of fair health.	Since 2010, pneumatophore density had substantially increased, possibly due to erosion.

Site	Current Description	Observations
6	Low, closed *A. marina* forest, of good health.	Since 2010, seedling density and foliage cover had decreased.
8	Low, closed *A. marina* forest with *R. stylosa* saplings, of good health.	This site was generally similar in 2012 and 2010.
10	Low, closed *C. tagal* forest next to *A. marina* forest, of fair to good health with some yellowing leaves.	This site was generally similar in 2012 and 2010.
11	Low, closed *C. tagal* forest with scattered *A. marina*, of fair health.	This site was generally similar in 2012 and 2010, although there was more pooling water in 2012.
13	Middle of Fisherman Islands claypan, fringed with *A. marina* in poor health or dead, and saltmarsh.	In 2012 and 2010, the area was ponded with dense algal mats, however in 2006 and 2004 it was dry. Since 2010, saltmarsh cover had slightly increased.
14	Dieback area fringed with low, closed *A. marina* forest in poor health, and saltmarsh.	In 2012, 2010 and 2008, this site was ponded with dense algal mats, however, in 2006 and 2004 it was dry and covered with cyanobacterial mats. Dead trees continued to degrade, with more fallen trunks and branches in 2012. Saltmarsh cover had increased substantially since 2010.
15	Low, open *A. marina* forest in poor health due to epicormic growth and leaf damage by insects	Since 2010, regrowth had continued at this site. Most seedlings and saplings were taller, with increased canopy cover in 2012, and there was a substantial increase in saltmarsh cover since 2010.
16	Tall, open *A. marina* forest in fair health, with seagrass wrack and debris on the forest floor.	Since 2012, seedling and sapling density and canopy cover had decreased. In 2012, there was less debris on the forest floor than in 2010.
17	Mature, tall, open *A. marina* forest in good health.	This site was generally similar in 2012 and 2010, although seedlings and saplings appeared to be in worse condition in 2012 in terms of increased leaf loss and smothering by seagrass wrack.
18	Mature, open *A. marina* forest with some *R. stylosa*, of good health	This site was generally similar in 2012 and 2010, although there was more seagrass wrack in 2012.

Site	Current Description	Observations
19	Dieback area fringed with *A. marina* in poor health, and saltmarsh.	In 2012, 2010 and 2008, this site was pooled with dense algal mats, but in 2006 it was dry. Dead trees continued to degrade, with more fallen trunks and branches in 2012. There was an increase in the saltmarsh area since 2010.
20	*A. marina* forest with scattered *R. stylosa*, of good health.	This site was generally similar in 2012 and 2010, although seedlings and saplings appeared to be in worse condition in 2012 in terms of increased leaf loss and smothering by seagrass wrack.
22	Dieback area fringed with *A. marina* forest in poor health and regrowth, with scattered saltmarsh on the claypan.	In 2012, 2010 and 2008, this site was pooled with dense algal mats, but in 2006 it was dry and covered with cyanobacterial mats. Mangrove and saltmarsh cover has increased in 2012.
23	*A. marina* forest in fair to poor health, with scattered *C. tagal.*	Since 2010, seedling, sapling and epicormic growth had increased, with the understorey dominated by regrowth. The area surround the site went from good in 2010, to fair in 2012.

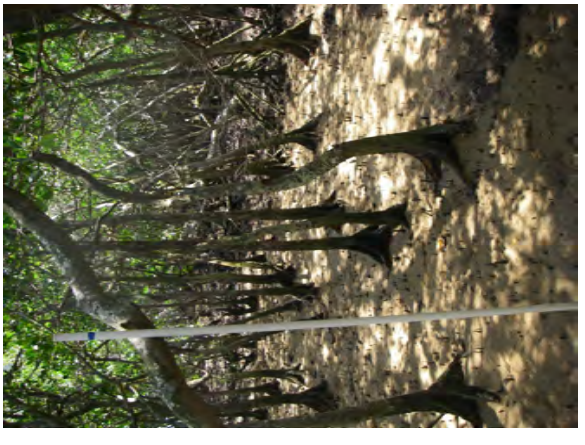
2.2 Photographs

2012 **Site 1 West** **2010**

Site 1 South

Site 1 East

Site 1 North

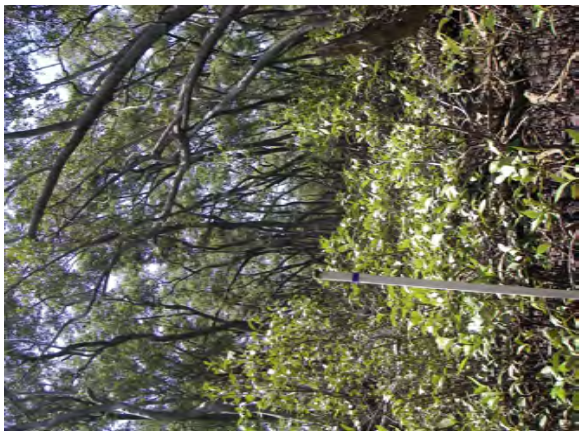


2012 **Site 2 West** **2010**

Site 2 South

Site 2 East

Site 2 North



2012 **Site 3 West** **2010**

Site 3 South

Site 3 East

Site 3 North

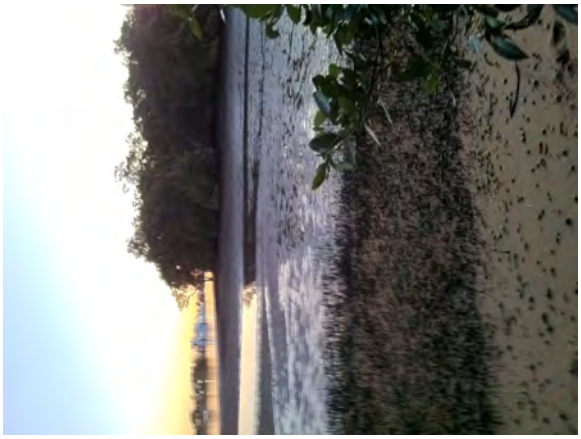
2012 **Site 4 West** **2010**

Site 4 South

Site 4 East

Site 4 North

2012 **Site 5 West** **2010**



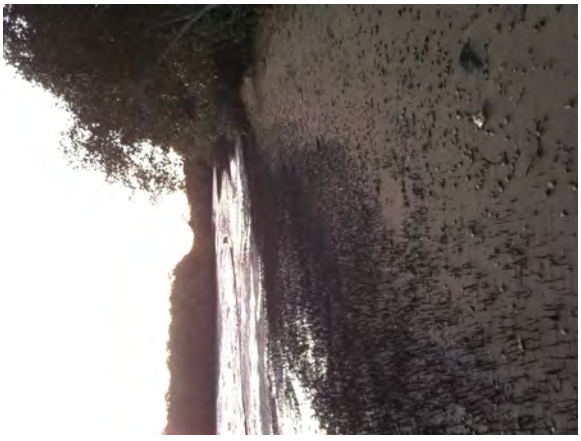
Site 5 South

Site 5 East

NA

NA

Site 5 North



2012

Site 6 West

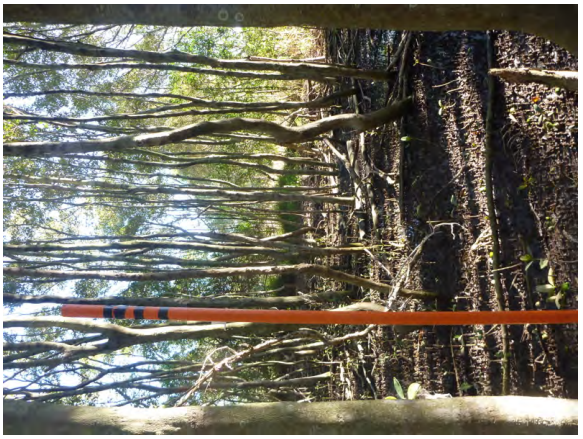
2010

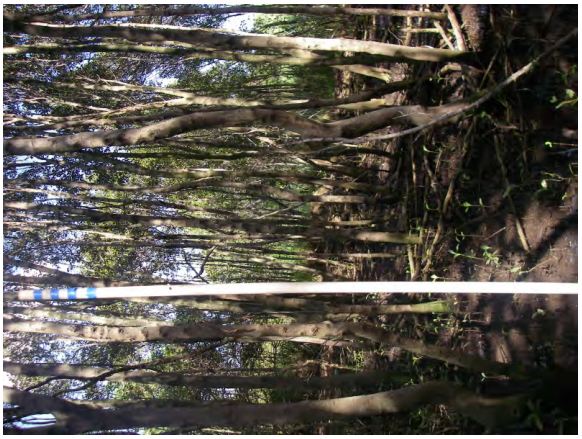
Site 6 South

Site 6 East

Site 6 North

2012 **Site 8 West** **2010**





Site 8 South

Site 8 East

Site 8 North

2012 **Site 10 West** **2010**

Site 10 South

Site 10 East

Site 10 North

2012 Site 11 West **2010**

Site 11 South

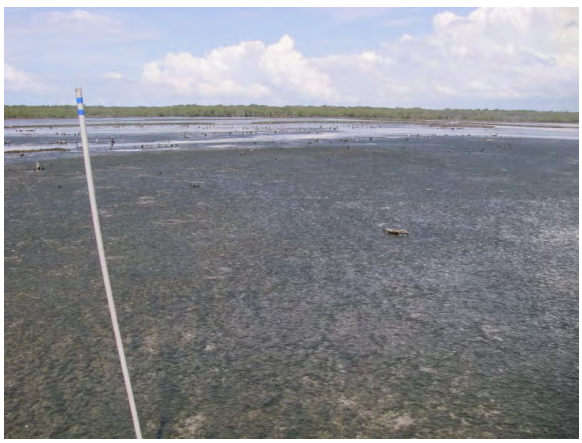
Site 11 East

Site 11 North

2012 **Site 13 West** **2010**

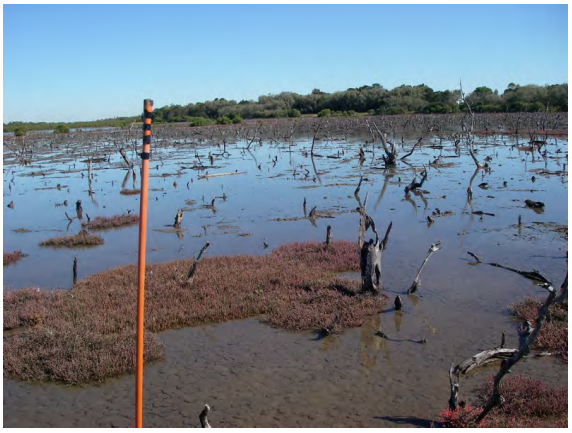
Site 13 South

Site 13 East

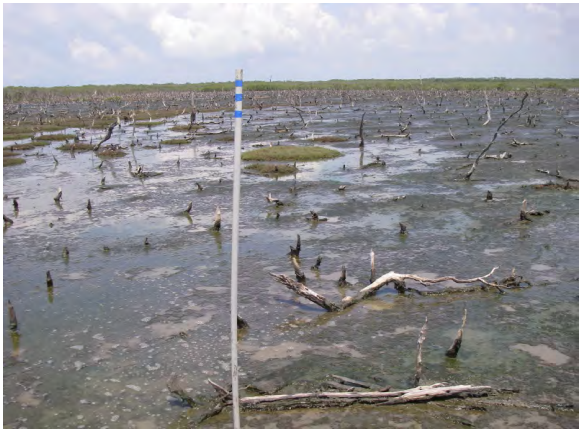


Site 13 North

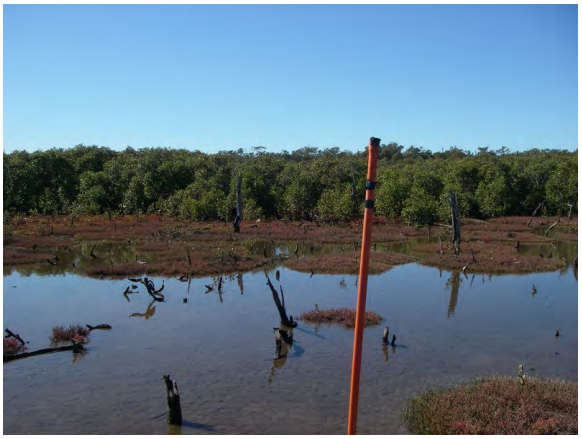
2012 **Site 14 West** **2010**

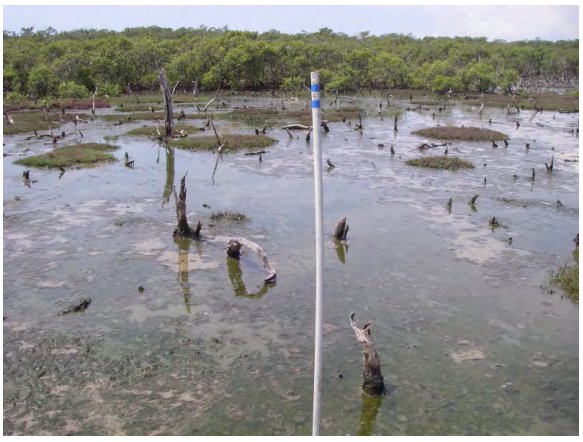


Site 14 South



Site 14 East





Site 14 North

2012 **Site 15 West** **2010**

Site 15 South

Site 15 East

Site 15 North

2012 **Site 16 West** **2010**

Site 16 South

Site 16 East

Site 16 North

2012 **Site 17 West** **2010**

Site 17 South

Site 17 East

Site 17 North

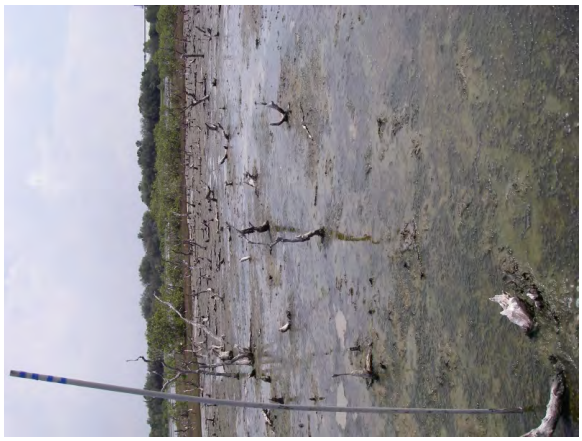
2012 **Site 18 West** **2010**

Site 18 South

Site 18 East

Site 18 North

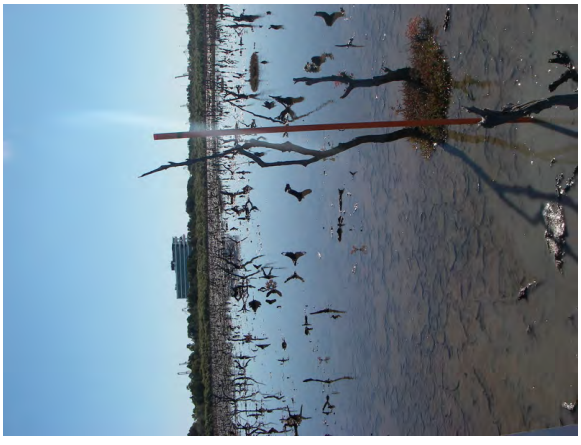
2012 **Site 19 West** **2010**



Site 19 South

Site 19 East

Site 19 North



2012 Site 20 West **2010**

Site 20 South

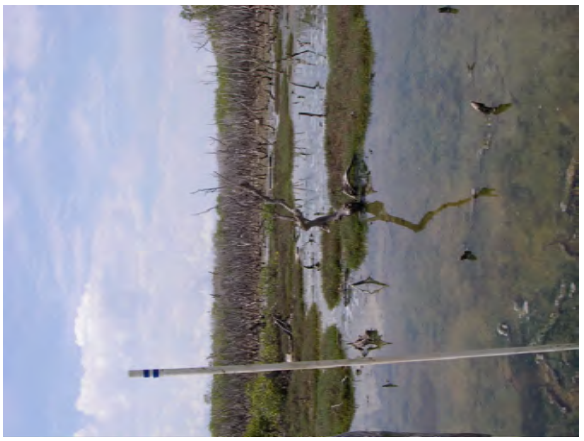
Site 20 East

Site 20 North

2012 **Site 22 West** **2010**

Site 22 South

Site 22 East



Site 22 North

2012 **Site 23 West** **2010**

Site 23 South

Site 23 East

Site 23 North

3 References

frc environmental, 2004, *Fisherman Islands and Whyte Island Mangrove Health Assessment: 2004*, report prepared for Port of Brisbane Corporation.

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Appendix C Sediment Quality

Contents

Tables

Figures

1 Methods

Sediment sampling sites were established and sampled at Fisherman Islands in 1999/2000 (WBM Oceanics Australia 2000) and resampled in 2002 (WBM Oceanics Australia 2002), 2004 (frc environmental 2004), 2006 (frc environmental 2007a), 2008 (frc environmental 2008) and 2010 (frc environmental 2010).

Sediment sampling sites were established at Whyte Island in 2002 (WBM Oceanics Australia 2002), and resampled in 2004, 2006, 2008 and 2010.

In 2012, sediment was resampled from these same sites from 2 to 4 July 2012 (Figure 1.1 to Figure 1.3). As in the previous surveys, samples were collected from the surface sediment (up to 10 cm deep).

In 2012, a field replicate sample was collected at one site for quality assurance / quality control (QA/QC) purposes, as per the guidelines outlined in the National Assessment Guidelines for Dredging (NAGD) 2009 (DEWHA 2009). A laboratory duplicate was also analysed for QA/QC (i.e. a sub-sample taken from the sample provided to the analytical laboratories). Within-site and within-sample variation were assessed by calculating the relative percent difference (RPD) of each sample (i.e. the original sample and the field replicate or laboratory duplicate). A RPD of 35% was considered acceptable for the laboratory duplicate (DEWHA 2009).

Samples were refrigerated and forwarded to Advanced Analytical laboratories (a NATA-accredited laboratory) within one week of collection, and analysed for the whole fraction (including all sediment <2 mm) of:

- metals and metalloids (Cu, Pb, Zn, Cr, Cd, As, Ni, Hg)
- total petroleum hydrocarbons (TPH)
- BTEX (benzene, toluene, ethylene & xylene)
- organochlorine pesticides (total chlordane, oxychlordane, dieldrin, aldrin, heptachlor, heptachlor epoxide, methoxychlor, endrin, DDD, DDE, DDT, alpha and beta BHC, lindane, endosulfan (total alpha, beta and sulfate) and hexachlorobenzene), and
- nutrients (nitrogen oxides, total Kjeldahl nitrogen, total nitrogen and total phosphorus).

Table 1.1 lists the parameters analysed at each site.

Figure 1.1 Sediment sampling sites in the Coal Loader area of Fisherman Islands.

Figure 1.2 Sediment sampling sites, Fisherman Islands.

Figure 1.3 Sediment sampling sites at Whyte Island.

Table 1.1 Sediment analysis schedule for Fisherman and Whyte islands in 2012.

Site	Moisture Content	Nutrients	Metals & Metalloids	TPH & BTEX	OC Pesticides
Fisherman Islands					
FI 1	✓	✓	✓	✓	–
FI 2	✓	–	–	✓	–
FI 3	✓	✓	✓	✓	–
FI 4	✓	–	–	✓	–
FI 6	✓	✓	✓	✓	–
FI 7	✓	–	–	✓	–
FI 9	✓	✓	✓	✓	✓
FI 11	✓	✓	✓	✓	–
FI 13	✓	✓	✓	✓	–
FI 15	✓	✓	✓	✓	–
FI 17	✓	✓	✓	✓	–
FI 18	✓	✓	✓	✓	–
FI 19	✓	✓	✓	✓	✓
FI 22	✓	–	–	✓	–
FI 23	✓	✓	✓	✓	✓
Whyte Island					
WI 1	✓	✓	✓	✓	✓
WI 2	✓	✓	✓	✓	✓
WI 3	✓	✓	✓	✓	✓

Concentrations of metals and metalloids were compared to the low Interim Sediment Quality Guidelines (low-ISQG) (ANZECC & ARMCANZ 2000). In all calculations, any results less than the laboratory limit of reporting and / or Practical Quantification Limit (PQL) were entered as half the value (Environment Australia 2002). The mean value was presented where a field replicate or laboratory duplicate was analysed at that site.

2 Results and Discussion

2.1 Nutrients

Fisherman Islands

In 2012, total nitrogen concentrations in the sediment at Fisherman Islands ranged from 310 mg/kg at site 1 to 10 600 mg/kg at site 6 (Table 2.2). Most sites had a concentration of less than 4 000 mg/kg; there was 4 140 mg/kg at site 9, 6 570 mg/kg at site 3, and 10 6000 mg/kg at site 6. Concentrations in 2012 were substantially lower than in 2010 (less than half) at sites 17 and 23, and substantially higher than in 2010 (at least 25% higher) at sites 6, 9, 11, 18 and 19.

Total nitrogen concentrations in the sediment of mangroves in good health (sites 3, 6, 15, 17 and 18) were highly variable, ranging from one of the lowest concentrations recorded (790 mg/kg at site 17) to the highest concentration recorded (10 600 mg/kg at site 6). In areas of fair health (sites 1 and 11) concentrations were variable, and ranged from the lowest value recorded (310 mg/kg at site 1) to 2 370 mg/kg at site 11. In areas of poor health (site 9 and 23) concentrations were relatively similar, and were moderate compared to other sites (3 220 to 4 140 mg/kg). In the dieback area (sites 13 and 19) total nitrogen concentrations were relatively low (≤2 395 mg/kg). There were no clear trends linking the concentration of total nitrogen to mangrove health.

Phosphorous concentrations at Fisherman Islands in 2012 ranged from 290 mg/kg at sites 1 and 17 to 1 000 mg/kg at sites 3 and 6 (Table 2.2). Concentrations in 2012 were generally similar to those in 2010 and 2008 at most sites, but higher than in 2002 and 1999 (Table 2.3 to Table 2.7).

The concentration of total phosphorus in the sediment of mangroves in good health (sites 3, 6, 15, 17 and 18) was highly variable, ranging from the lowest concentration recorded (290 mg/kg at site 17) to the highest concentration recorded (1 000 mg/kg at sites 3 and 6). In areas of fair health (sites 1 and 11) concentrations were relatively low (≤810 mg/kg). Site 22 had a higher relative concentration of 1 500mg/kg. In areas of poor health (sites 9 and 23) concentrations were relatively similar and moderate compared to other sites (800 to 860 mg/kg). In the dieback areas (sites 13 and 19) total nitrogen concentrations were relatively low (≤860 mg/kg). There were no clear trends linking the concentration of total phosphorus to mangrove health.

The negative impacts of high salinity in the sediment (as discussed in Appendix E) may be exacerbated by high nutrient levels. This interaction between nutrients and salinity may have negatively impacted mangrove health in the dieback area. Analysis of nutrient

concentrations in the pore water, in addition to salinity would assist in determining this (Appendix E).

Whyte Island

In 2012, total nitrogen concentrations in the sediment at Whyte Island ranged from 5 950 mg/kg at site 2 to 22 400 mg/kg at site 3 (Table 2.8). The concentration at site 3 was relatively high compared to other sites and surveys; concentrations were less than 10 000 mg/kg at most sites during most surveys. Concentrations in 2012 were substantially lower than in 2010 (approximately one quarter) at site 2, but substantially higher than in 2010 (approximately three-times higher) at site 3.

In 2012, total phosphorous concentrations in sediment at Whyte Island ranged between 760 mg/kg at site 1 to 1 500 mg/kg at site 3. The concentration at site 2 has progressively increased since 2002 and this trend continued in 2012. The concentration at site 3 was the lowest concentration on record at this site.

The highest total nitrogen and phosphorus concentration was recorded in the sediment of mangroves in good health (site 3); whereas the lowest total nitrogen concentration was recorded in the sediment of the dieback area (site 2) and the lowest total phosphorus concentration was recorded in the sediment of mangroves in poor health (site 1). There were no clear trends linking total nitrogen and phosphorus concentrations in sediment to mangrove health at Whyte Island, as a single contaminant. Increased nutrient availability can negatively impact mangrove health in association with high salinity in the sediment (Lovelock et al. 2009) and an interaction between nutrients and salinity may be negatively impacting mangrove health in the dieback area.

Wynnum Wastewater Treatment Plant (WWTP) discharges into Moreton Bay via a discharge pipe into Crabbe Creek, which is near site 3. In September 2007, the Wynnum WWTP was upgraded to include a water reclamation plant, and biological nutrient removal technology. The main aim of the upgrade was to improve the quality of the treated wastewater, and in particular to remove nitrogen (Brisbane Water Enviro Alliance 2008). A micro-filtration reverse-osmosis plant has since been built and was expected to reduce the volume of effluent by 80%, although more recent discharge data is not available. Treated water from the WWTP is also sold to Caltex for industrial use.

The total amount of nitrogen and phosphorus discharged to water from the WWTP generally decreased from 2004–5 to 2007–8, but increased slightly in 2008–9 and

decreased slightly in 2009–10. The total concentration of ammonia generally increased from 2004–5 to 2008–9 but decreased in 2008–9 and again (substantially) in both 2009–10 and 2010–11 (NPI 2012). [1]

Table 2.1 Wynnum WWTP discharge volumes for 2004 to 2011 financial years. [a]

Financial Year	Total Nitrogen (kg)	Total Phosphorus (kg)	Ammonia (kg)
2004–5	64 000	26 000	3 300
2005–6	58 000	23 000	6 300
2006–7	58 000	22 000	4 900
2007–8	6 300	8 800	5 300
2008–9	9 800	4 300	3 400
2009–10	7 200	5 800	990
2010–11	NA	NA	380

[a] Source: National Pollutant Inventory (2012)

NA denotes not available

The concentration of total nitrogen generally decreased at site 3 (near the WWTP) between 2006 and 2010 (from 11 900 mg/kg to 7 400 mg/kg), however the concentration increased substantially to 22 400 mg/kg in 2012. The reason for this increase is not clear however it may be related to the WWTP discharge (data is not available for 2010–11 or 2011–12) and / or the flooding of the Brisbane River in January 2011. The concentration of total phosphorous at site 3 increased from 1 080 mg/kg in 2002 to 3 200 mg/kg 2010, and decreased substantially to 940 mg/kg (one of the lowest concentrations on record) in 2012. This reduction is to be expected based on the WWTP upgrade.

Regional Perspective

Concentrations of total extractable nitrogen in mangrove sediment vary with sediment type, with higher levels in finer sediment (Alongi et al. 1982). The concentration of total nitrogen in mangrove sediment usually ranges from 600 to 2 000 mg/kg (Clough et al. 1983) and total phosphorous from 100 to 1 600 mg/kg (Table 2.8) (Alongi et al. 1982). In Queensland, a range of concentrations have been recorded, with relatively high values recorded near the Luggage Point WWTP (WBM Oceanics Australia 2000).

[1] TN and TP discharge data is not available for 2010–11 or 2011–12, and ammonia data is not available for 2011–12.

In 2012, nutrient concentrations at Fisherman Islands were generally similar to those at other Queensland sites. The total nitrogen concentration at sites 3 and 6 was above those at most other Queensland sites, as was the case in 2010; these sites were in forests of good health. The concentration at site 6 in 2012 was also higher than the concentration recorded at Luggage Point (located near a sewage discharge area). The total phosphorus concentration at most sites (3, 6, 9, 11, 13, 19 and 23) were above most other Queensland sites; these sites were in forests of good, fair and poor health and the dieback area. Total phosphorus concentrations in this survey were below the concentration recorded at Luggage Point.

In 2012, nutrient concentrations at Whyte Island were often higher than those recorded at other Queensland sites, as was the case in 2010. The nitrogen concentration at sites 1 and 3 was above the concentration recorded at Luggage Point, with site 3 almost three-times higher; those sites were in forests of poor and good health. The phosphorus concentration at site 2 was above the concentration recorded at Luggage Point; this site was next to the dieback area.

Table 2.2 Nutrient concentrations (mg/kg) in sediment from Fisherman Islands in 2012.

Nutrient	Site										
	1	**3**	**6**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**23**
Phosphorus	290	1 000	1 000	860	810	710	580	290	450	860	800
Total Kjeldahl Nitrogen	310	6 570	10 600	4 140	2 370	1 980	1 180	790	2 080	2 395	3 220
Nitrate – N	0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	<0.1	<0.1
Nitrite – N	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	0.3	<0.1	<0.1
Total Nitrogen	310	6 570	10 600	4 140	2 370	1 980	1 170	790	2 080	2 395	3 220

Table 2.3 Nutrient concentrations (mg/kg) in sediment from Fisherman Islands in 2010.

Nutrient	Site										
	1	**3**	**6**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**23**
Phosphorus	400	960	1 200	860	730	650	720	300	310	810	650
Total Kjeldahl Nitrogen	460	5 420	7 970	2 820	1 580	1 430	1 230	1 800	1 550	1 360	9 450
Nitrate – N	2	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrite – N	0.4	0.4	0.3	0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.2	0.1
Total Nitrogen	460	5 420	7 970	2 820	1 580	1 430	1 230	1 800	1 550	1 360	9 450

Table 2.4 Nutrient concentrations (mg/kg) in sediment from Fisherman Islands in 2008.

Nutrient	Site										
	1	**3**	**6**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**23**
Phosphorus	490	1 100	690	780	670	690	780	350	420	690	930
Total Kjeldahl Nitrogen	700	4 100	9 200	1 900	1 500	3 100	10 000	1 600	3 000	1 100	13 000
Nitrate & Nitrite – N	0.1	0.1	0.2	0.1	0.1	0.5	0.6	0.2	0.1	0.1	0.5
Total Nitrogen	700	4 100	9 200	1 900	1 500	3 100	10 000	1 600	3 000	1 100	13 000

Table 2.5 Nutrient concentrations (mg/kg) in sediment from Fisherman Islands in 2006.

Nutrient	Site										
	1	**3**	**6**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**23**
Phosphorus	460	930	770	660	980	460	580	690	470	690	650
Total Kjeldahl Nitrogen	700	5 070	8 900	6 400	1 440	1 130	580	8 780	2 180	5 180	8 960
Nitrate – N	1.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5
Nitrite – N	<0.5	<0.5	0.5	1.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Nitrogen	700	5 070	8 900	6 400	1 440	1 130	580	8 780	2 180	5 180	8 960

Table 2.6 Nutrient concentrations (mg/kg) in sediment from Fisherman Islands in 2002 (WBM Oceanics Australia 2002).

Nutrient	Site										
	1	**3**	**6**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**23**
Phosphorus	494	555	348	223	338	526	449	219	87	444	139
Total Kjeldahl Nitrogen	993	2 320	2 490	1 890	1 310	1 320	573	1 020	635	772	1 670
Nitrite and Nitrate – N	2.2	4.7	0.4	9.1	0.2	0.6	0.8	0.2	<0.2	0.3	0.4
Total Nitrogen	995	2 320	2 490	1 890	1 310	1 320	573	1 020	635	772	1 670

Table 2.7 Nutrient concentrations (mg/kg) in sediment from Fisherman Islands in 1999 (WBM Oceanics Australia 2000).

Nutrient	Site										
	1	**3**	**6**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**23**
Phosphorus	410	460	170	150	430	360	400	290	380	500	230
Total Kjeldahl Nitrogen	600	1 800	260	430	1 890	1 570	540	1 110	1 580	740	2 540
Nitrite and Nitrate – N	0.15	0.5	0.15	<0.05	0.2	1.2	<0.05	0.1	0.3	0.35	0.15
Total Nitrogen	600	1 800	260	430	1 900	1 570	540	1 110	1 580	740	2 540

Table 2.8 Nutrient concentrations (mg/kg) recorded in sediment from Whyte Island in 2002, 2006, 2008, 2010 and 2012.

	Site / Year														
	1					2					3				
Nutrient	**2002**	**2006**	**2008**	**2010**	**2012**	**2002**	**2006**	**2008**	**2010**	**2012**	**2002**	**2006**	**2008**	**2010**	**2012**
Phosphorus	216	920	780	490	760	134	610	1 000	1 100	1 500	1 080	1 200	2 700	3 200	940
Total Kjeldahl Nitrogen	3 230	4 520	10 000	9 450	8 990	2 520	7 050	18 000	23 200	5 950	2 590	11 900	7 400	7 600	22 400
Nitrate – N	2 [a]	<0.5	0.2 [a]	<0.1	<0.1	2.8 [a]	8.5	0.7 [a]	<0.1	<0.1	6.1 [a]	<0.5	0.7 [a]	<0.1	<0.1
Nitrite – N	NA	<0.5	NA	0.2	<0.1	NA	<0.5	NA	0.2	<0.1	NA	<0.5	NA	<0.1	<0.1
Total Nitrogen	3 320	4 520	10 000	9 450	8 990	2 520	7 060	18 000	23 200	5 950	2 590	11 900	7 400	7 600	22 400

[a] Nitrate and nitrite N

NA denotes not analysed

Table 2.9 Nutrient concentrations (mg/kg) recorded in mangrove sediment in Queensland.

	Luggage Pt*[a]	Wellington Pt[b]	Wellington Pt[c]	Victoria Pt[a]	Deception Bay[a]	Clontarf[c]	Weinam Creek[d]	Qld Estuaries[e]	North Qld[f]
Phosphorus	1 367	656	538	526	250	228	619	100 – 700	50 – 450
Total Nitrogen	8 606	2 566	1 770	3 000	1 043	1 148	NA	200 – 4 000	1 000 – 4 000

* Near sewage discharge

[a] Average of three values (WBM Oceanics Australia 2000)

[b] Average of six samples (frc environmental 2007b)

[c] Average of six samples (frc environmental 2006)

[d] Average of six samples (frc environmental 2009)

[e] Alongi et al. (1982)

[f] Average of 15 values from nine sites (Kaly et al. 1997)

Nutrient concentrations were generally higher at Whyte Island than Fisherman Islands. This is likely to be associated with the discharge from the Wynnum WWTP.

2.2 Petroleum Hydrocarbons and BTEX

Petroleum hydrocarbons are assessed in fractions: petrol is in the C6–C9 fraction, kerosene in the C10–C18 fraction, diesel in C12–C18 and lubricating oils above C18 (DPIW&E 2002). Naturally occurring hydrocarbons are also detected in the analyses, for example sesquiturpenoids in mangrove leaves and roots are in the C10 – C28 fraction. The National Assessment Guidelines for Dredging (NAGD) Screening Level for total petroleum hydrocarbons (TPH) is 550mg/kg (DEWHA 2009).

BTEX (benzene, toluene, ethylene and xylene) are aromatic hydrocarbons, which are commonly highly toxic to aquatic organisms (Connell 1995). There are no NADG (DEWHA 2009) or ANZECC & ARMCANZ (2000) screening level for BTEX in sediment.

Fisherman Islands

In 2012, TPH concentrations at Fisherman Islands were below the Screening Level at most sites, ranging from <120 to 870 mg/kg (Table 2.10). The concentration exceeded the Screening Level at sites 6, 22 and 23; as was the case for sites 6 and 23 in 2010. Concentrations of the C15–C28 and C29–C36 fractions were generally similar in 2012 and 2010; there were some site specific changes but these changes were not clearly related to health, as a single indicator (Table 2.10 and Table 2.11). For example, there was a general decline in health near sites 9 and 11 between 2010 and 2012, however the TPH concentration in the sediment at these sites did not increase between 2010 and 2012.

In 2012, BTEX concentrations at Fisherman Islands were below the laboratory limit of reporting at all sites (Table 2.10).

There were no clear trends linking TPH or BTEX concentrations in sediment to the observed differences in mangrove health at Fisherman Islands

Whyte Island

In 2012, TPH concentrations at Whyte Island were above the Screening Level at sites 1 and 2, which were located in mangrove areas of poor health and dead. TPH concentrations in 2012 were similar to or slightly higher than 2010, for most fractions at most sites, but similar to concentrations recorded in earlier surveys (Table 2.16).

In 2012, BTEX concentrations at Whyte Island were below the laboratory limit of reporting at all sites.

There were no clear trends linking TPH or BTEX concentrations in sediment to the observed differences in mangrove health at Whyte Island.

Table 2.10 TPH and BTEX concentrations (mg/kg) in sediment from Fisherman Islands in 2012. [a]

	Site														
	1	**2**	**3**	**4**	**6**	**7**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**22**	**23**
Total Petroleum Hydrocarbon (TPH) Fractions															
C6–C9	<10	<50	<20	<10	<50	<20	<20	<10	<10	<10	<10	<10	<10	<50	<50
C10–C14	<10	<50	<10	<10	<50	<10	<20	<10	<10	<10	<10	<10	<10	<50	<50
C15–C28	<50	250	120	72	310	130	130	57	92	<50	53	86	<50	390	280
C29–C36	<50	250	130	87	310	180	135	<50	85	53	70	100	<50	430	300
TPH [b]	<120	550	265	169	670	325	285	92	187	88	133	196	<120	870	630
BTEX															
Benzene	<0.20	<1.0	<0.40	<0.20	<1.00	<0.40	<0.40	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<1.0	<1.0
Toluene	<0.20	<1.0	<0.40	<0.20	<1.0	<0.40	<0.40	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<1.0	<1.0
Ethyl Benzene	<0.20	<1.0	<0.40	<0.20	<1.0	<0.40	<0.40	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<1.0	<1.0
m+p xylenes	<0.40	<2.0	<0.80	<0.40	<2.0	<0.80	<0.80	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<2.0	<2.0
o-xylene	<0.20	<1.0	<0.40	<0.20	<1.0	<0.40	<0.40	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<1.0	<1.0
Total BTEX	<1.2	<6.0	<2.4	<1.2	<6.0	<2.4	<2.4	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<6.0	<6.0

[a] Grey shading denotes above the NAGD Screening Level (DEWHA 2009).

[b] Determined by adding the concentration of each fraction. Where site results included values less than the laboratory limit of reporting, those values less than the laboratory limit of reporting were halved (Environment Australia 2002). Where all results were less than the laboratory limit of reporting they were added (not halved).

Table 2.11 TPH and BTEX concentrations (mg/kg) in sediment from Fisherman Islands in 2010. [a]

	Site														
	1	**2**	**3**	**4**	**6**	**7**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**22**	**23**
Total Petroleum Hydrocarbon (TPH) Fractions															
C6–C9	<10	<10	<20	<10	<40	<10	<10	<10	<10	<10	<10	<10	<10	<40	<40
C10–C14	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
C15–C28	<50	200	160	170	540	<50	110	88	<50	<50	82	76	<50	210	240
C29–C36	<50	250	220	180	690	<50	150	120	<50	56	110	99	58	130	600
TPH [b]	<120	460	395	360	1255	<120	270	218	<120	91	202	185	93	365	865
BTEX															
Benzene	<0.20	<0.20	<0.40	<0.20	<0.80	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.80	<0.80
Toluene	<0.20	<0.20	<0.40	<0.20	<0.80	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.80	<0.80
Ethyl Benzene	<0.20	<0.20	<0.40	<0.20	<0.80	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.80	<0.80
m+p xylenes	<0.40	<0.40	<0.80	<0.40	<1.6	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<1.6	<1.6
o-xylene	<0.20	<0.20	<0.40	<0.20	<0.80	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.80	<0.80
Total BTEX	<1.2	<1.2	<2.4	<1.2	<4.8	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<4.8	<4.8

[a] Grey shading denotes above the NAGD Screening Level (DEWHA 2009). Laboratory limit of reporting vary between sites due to the high moisture content of some samples.

[b] Determined by adding the concentration of each fraction. Where site results included values less than the laboratory limit of reporting, those values less than the laboratory limit of reporting were halved (Environment Australia 2002). Where all results were less than the laboratory limit of reporting they were added (not halved).

Table 2.12 TPH and BTEX concentrations (mg/kg) in sediment from Fisherman Islands in 2008. [a]

	Site														
	1	**2**	**3**	**4**	**6**	**7**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**22**	**23**
Total Petroleum Hydrocarbons															
C6–C9	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C10–C14	<5	<5	<5	<5	<5	<5	<2	<2	<2	<2	<5	<5	<2	<2	<2
C15–C28	<10	<10	<10	<10	<10	<10	<4	<4	<4	<4	<10	<10	<2	<2	<2
C29–C36	<5	<5	<5	<5	<5	<5	<2	<2	<2	<2	<5	<5	<2	<2	<2
BTEX															
Benzene	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0019
Toluene	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ethyl	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benzene															
m+p xylenes	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
o-xylene	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total BTEX	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.004

[a] Sites 9, 11, 13, 15, 19, 22 and 23 had a lower laboratory limit of reporting for the TPH fractions C10–C14, C15–C28 and C29–C36 than the remaining samples because the analytical laboratory refined their technique after processing some of the samples (T. Lawlor [Simmonds & Bristow] 2008, pers. comm., 11th of July); the 2008 laboratory limit of reporting was much lower than those of previous surveys and the 2010 survey.

Table 2.13 TPH and BTEX concentrations (mg/kg) in sediment from Fisherman Islands in 2006.

	Site														
	1	**2**	**3**	**4**	**6**	**7**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**22**	**23**
Total Petroleum Hydrocarbons															
C6–C9	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
C10–C14	<10	<10	13	<10	54	<10	12	<10	<10	<10	15	<10	<10	<10	22
C15–C28	58	330	280	100	160	62	150	80	<50	<50	420	100	50	52	120
C29–C36	65	440	250	110	220	91	150	50	<50	<50	400	130	99	68	230
BTEX															
Benzene	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Toluene	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Ethyl Benzene	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
m+p xylenes	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
o-xylene	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Total BTEX	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2

Table 2.14 TPH and BTEX concentrations (mg/kg) sediment from Fisherman Islands in 2002 (WBM Oceanics Australia 2002).

	Site														
	1	**2**	**3**	**4**	**6**	**7**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**22**	**23**
Total Petroleum Hydrocarbons															
C6–C9	<2	<4	<4	<4	<4	<2	<4	<2	<2	<2	<4	<4	<2	<4	<4
C10–C14	<50	<100	<100	<100	<100	<50	<100	<50	<50	<50	<100	<100	<50	<100	<100
C15–C28	<100	<200	<200	<200	<200	<100	<200	<100	<100	<100	<200	<200	<100	<200	<200
C29–C36	<100	<200	<200	<200	<200	<100	<200	<100	<100	<100	<200	<200	<100	<200	<200
BTEX															
Benzene	<0.2	<0.4	<0.4	<0.4	<0.4	<0.2	<0.4	<0.2	<0.2	<0.2	<0.4	<0.4	<0.2	<0.4	<0.4
Toluene	<0.2	<0.4	<0.4	<0.4	<0.4	<0.2	<0.4	<0.2	<0.2	<0.2	<0.4	<0.4	<0.2	<0.4	<0.4
Ethyl Benzene	<0.2	<0.4	<0.4	<0.4	<0.4	<0.2	<0.4	<0.2	<0.2	<0.2	<0.4	<0.4	<0.2	<0.4	<0.4
m+p xylenes	<0.2	<0.4	<0.4	<0.4	<0.4	<0.2	<0.4	<0.2	<0.2	<0.2	<0.4	<0.4	<0.2	<0.4	<0.4
o-xylene	<0.2	<0.4	<0.4	<0.4	<0.4	<0.2	<0.4	<0.2	<0.2	<0.2	<0.4	<0.4	<0.2	<0.4	<0.4
Total BTEX	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2

Table 2.15 TPH and BTEX concentrations (mg/kg) sediment from Fisherman Islands in 1999 (WBM Oceanics Australia 2000).

	Site														
	1	**2**	**3**	**4**	**6**	**7**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**22**	**23**
Total Petroleum Hydrocarbons															
C6–C9	<2	<5	<5	<5	<2	<2	<2	<2	<5	<2	<5	<5	<2	<5	<5
C10–C14	<50	<125	<125	<125	<50	<50	<50	<50	<125	<50	<125	<125	<50	<125	<125
C15–C28	<100	<250	<250	<250	<100	<100	<100	<100	<250	<100	<250	<250	<100	<250	435
C29–C36	<100	<250	<250	<250	<100	<100	<100	<100	<250	<100	<250	<250	<100	<250	565
BTEX															
Benzene	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.5	<0.5	<0.2	<0.5	<0.5
Toluene	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.5	<0.5	<0.2	<0.5	<0.5
Ethyl Benzene	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.5	<0.5	<0.2	<0.5	<0.5
m+p xylenes	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.5	<0.5	<0.2	<0.5	<0.5
o-xylene	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.5	<0.5	<0.2	<0.5	<0.5

Table 2.16 TPH and BTEX concentrations (mg/kg) in sediment from Whyte Island in 2002, 2006, 2008, 2010 and 2012. [a]

	Site / Year														
	1					2					3				
	2002	2006	2008	2010	2012	2002	2006	2008	2010	2012	2002	2006	2008	2010	2012
Total Petroleum Hydrocarbon Fractions															
C6–C9	<4	<10	<1	<20	<50	<4	<10	<1	<40	<50	<4	<10	<1	<20	<50
C10–C14	<100	14	<5	<10	<50	1 030	24	<5	55	<50	332	15	<5	12	<50
C15–C28	<200	130	<10	150	<250	2 600	210	<10	570	570	1 580	320	<10	260	<250
C29–C36	<200	91	<5	190	<250	3 190	140	<5	740	740	1 610	210	<5	300	260
TPH	<504	240	<21	355	<600	6 822	379	<21	1 385	1360	3 524	550	<21	582	435
BTEX															
Benzene	<0.4	<0.2	<0.001	<0.4	<1.0	<0.4	<0.2	<0.001	<0.8	<1.0	<0.4	<0.2	<0.001	<0.4	<1.0
Toluene	<0.4	<0.2	<0.001	<0.4	<1.0	<0.4	<0.2	<0.001	<0.8	<1.0	<0.4	<0.2	<0.001	<0.4	<1.0
Ethyl Benzene	<0.4	<0.2	<0.001	<0.4	<1.0	<0.4	<0.2	<0.001	<0.8	<1.0	<0.4	<0.2	<0.001	<0.4	<1.0
m+p xylenes	<0.4	<0.4	<0.002	<0.8	<2.0	<0.4	<0.4	<0.002	<1.6	<2.0	<0.4	<0.4	<0.002	<0.8	<2.0
o-xylene	<0.4	<0.2	<0.001	<0.4	<1.0	<0.4	<0.2	<0.001	<0.8	<1.0	<0.4	<0.2	<0.001	<0.4	<1.0
Total BTEX	<1.0	<0.6	<0.003	<2.4	<6.0	<1.0	<0.6	<0.003	<4.8	<6.0	<1.0	<0.6	<0.003	<2.4	<6.0

[a] Grey shading denotes above the NAGD Screening Level (DEWHA 2009).

2.3 Metals and Metalloids

Concentrations of metals and metalloids were compared to the ANZECC & ARMCANZ low Interim Sediment Quality Guideline (low-ISQG) level (ANZECC & ARMCANZ 2000) and Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland Environmental Investigation Levels (EILs) and Background Levels (DoE 1998) (Table 2.17).

Table 2.17 Guideline and background levels for metal and metalloids concentrations in sediment.

Metal	Low-ISQG [a]	High-ISQG [a]	DoE [b]	Background Levels [c]
Arsenic	20	70	20	0.2 – 30
Cadmium	1.5	10	3	0.04 – 2
Chromium	80	370	50	0.5 – 110
Copper	65	270	60	1 – 190
Mercury	0.15	1	1	0.001 – 0.1
Nickel	21	52	60	2 – 400
Lead	50	220	300	<2 – 200
Zinc	200	410	200	2 - 180

[a] Recommended Interim Sediment Quality Guidelines (ISQG) for aquatic ecosystems (ANZECC & ARMCANZ 2000)

[b] Department of Environment Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland Environmental Investigation Levels (DoE 1998)

[c] DoE guidelines for sediment background levels (DoE 1998)

Fisherman Islands

In 2012, the concentration of most metals and metalloids was below the low-ISQG level (ANZECC & ARMCANZ 2000) in the sediment at most Fisherman Islands sites. The concentration of nickel was above the low-ISQG level at sites 13 and 19; as was the case at site 13 in 2010. The nickel concentration in the sediment at sites 13 and 19 only slightly exceeded the low ISQG level, and was within the background range and similar to that recorded in previous surveys (Table 2.17 to Table 2.21).

The concentration of several metals and metalloids were higher in 2012 than in 2010 at several sites. In 2012, the concentration of arsenic at each site was similar to that recorded in 2010 at most sites; the concentration at site 18 was almost three-times higher

in 2012 than 2010. The concentration of copper at each site was generally higher in 2012 than in 2010; at sites 1, 9, 17 and 18, the concentration in 2012 was almost twice that recorded in 2010. The concentration of lead at site 18 in 2012 was almost double that recorded in 2010. The concentration of zinc in 2012 was higher than that recorded in 2010 at most sites (sites 3, 6, 11, 13, 15, 18 and 23); it was almost twice that recorded in 2010 at site 18. Mangrove forests at most of these sites were in good health, including site 18; therefore metals are unlikely to be associated with mangroves health at Fisherman Islands, as a single indicator.

Whyte Island

In 2012, the concentration of most metals in the sediment was below the low-ISQG level (ANZECC & ARMCANZ 2000) at most Whyte Island sites; the concentration of nickel was above the low-ISQG level at site 1 (Table 2.24). The concentration of at least one metal was above the low-ISQG value at each site during at least one survey, however there was no clear link between the concentration of metals and mangrove health. Metals are unlikely to be associated with the observed differences in mangrove health at Whyte Island.

Table 2.18 Metal and metalloid concentrations (mg/kg) in sediment from Fisherman Islands in 2012. [a]

Metal	Site										
	1	**3**	**6**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**23**
Arsenic	4.3	6.4	9.1	7.3	15	7	5.6	5.2	11	12	7.6
Cadmium	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1
Chromium	13	35	33	21	34	48	34	16	26	50	36
Copper	3.9	27	34	14	14	25	15	4.7	12	23	22
Mercury	0.01	0.07	0.05	0.05	0.03	0.04	0.05	0.04	0.15	0.07	0.04
Nickel	5.5	16	19	9.9	18	25	17	7.3	14	25	18
Lead	3.3[1]	18	13	8	7.7	12	9.2	3.8	7.3	12	11
Zinc	23	67	96	38	51	77	62	25	54	71	59

[a] Grey shading denotes above the low-ISQG level (ANZECC & ARMCANZ 2000).

Table 2.19 Metal and metalloid concentrations (mg/kg) in sediment from Fisherman Islands in 2010. [a]

Metal	Site										
	1	**3**	**6**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**23**
Arsenic	5.7	7.1	8.3	8.1	14	9	7.3	7.7	3.9	8.2	5.9
Cadmium	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.16
Chromium	20	32	28	35	31	46	30	19	16	42	31
Copper	8.75	21	30	19	12	23	14	6.5	5.45	21	17
Mercury	0.03	0.07	0.04	0.04	0.02	0.04	0.05	0.03	0.03	0.05	0.06
Nickel	9.3	14	16	16	15	24	15	9.7	7.3	21	15
Lead	6	17	11	11	7	11	8.5	4.1	3.9	11	15
Zinc	35	59	87	62	46	68	53	32	28	73	49

[a] Grey shading denotes above the low-ISQG level (ANZECC & ARMCANZ 2000).

Table 2.20 Metal and metalloid concentrations (mg/kg) in sediment from Fisherman Islands in 2008. [a]

Metal	Site										
	1	**3**	**6**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**23**
Arsenic	2.8	2.5	2.2	8.5	8.3	5.1	5.8	3.2	3.1	7.2	4.0
Cadmium	0.50	0.50	0.50	<0.50	<0.50	<0.50	<0.50	0.50	0.50	<0.50	<0.50
Chromium	8.9	14	10	26	20	36	22	9.4	9.5	37	27
Copper	5.3	11	8.3	25	14	28	13	4.6	4.5	22	20
Mercury	0.060	0.10	0.080	<0.010	0.060	0.030	0.080	0.040	0.050	0.060	<0.010
Nickel	4.7	7.0	5.6	13	9.9	22	13	5.3	5.4	19	14
Lead	4.0	8.6	4.7	11	8.9	14	11	3.0	3.0	15	15
Zinc	20	32	26	44	36	73	52	19	22	66	45

[a] Grey shading denotes above the low-ISQG level (ANZECC & ARMCANZ 2000).

Table 2.21 Metal and metalloid concentrations (mg/kg) in sediment from Fisherman Islands in 2006. [a]

Metal	Site										
	1	**3**	**6**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**23**
Arsenic	5	5.8	6.1	2.8	24	6.4	6.7	9.6	7.7	10	3.6
Cadmium	<0.1	<0.1	0.41	<0.1	0.15	<0.1	<0.1	0.15	<0.1	0.1	<0.1
Chromium	22	37	43	21	36	46	29	34	30	49	34
Copper	11	28	20	13	11	23	12	19	13	27	17
Mercury	0.03	0.05	0.08	0.08	0.04	0.05	0.04	0.05	0.02	0.05	0.04
Nickel	11	18	22	11	16	25	16	19	16	26	17
Lead	8.7	20	15	11	10	11	8.6	13	10	15	18
Zinc	43	76	78	39	54	64	49	72	60	72	52

[a] Grey shading denotes above the low-ISQG level (ANZECC & ARMCANZ 2000).

Table 2.22 Metal and metalloid concentrations (mg/kg) in sediment from Fisherman Islands in 2002 (WBM Oceanics Australia 2002). [a]

Metal	Site										
	1	3	6	9	11	13	15	17	18	19	23
Arsenic	7.4	7.5	10.1	5.7	11.5	8.4	11.3	17.5	8.6	7.3	5.3
Cadmium	<0.01	<0.2	<0.2	0.3	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.2
Chromium	25.4	37.8	28.6	20.0	18.5	44.2	33.7	23.1	17.9	43.1	33.9
Copper	12.6	28.3	26.0	14.7	7.4	21.6	12.9	12.2	7.2	20.1	17.7
Mercury	<0.1	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	0.6	0.4	1.1
Nickel	12.3	18.4	16.4	10.0	7.9	25.7	20.9	14.7	10.8	22.5	16.7
Lead	11.9	24.6	15.4	11.2	8.7	14.4	11.5	8.7	6.4	13.3	21.6
Zinc	50.5	83.9	84.7	47.5	27.1	73.7	63.8	47.6	36.0	75.5	50.6

[a] Grey shading denotes above the low-ISQG level (ANZECC & ARMCANZ 2000).

Table 2.23 Metal and metalloid concentrations (mg/kg) in sediment from Fisherman Islands in 1999 (WBM Oceanics Australia 2000). [a]

Metal	Site										
	1	**3**	**6**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**23**
Arsenic	6.8	8.95	3.1	2.8	8.35	9.7	7.65	7.05	6	5.1	4.35
Cadmium	<0.05	<0.05	<0.05	<0.05	0.05	<0.05	0.1	0.05	0.05	<0.05	0.1
Chromium	57.7	59.8	93.1	86	56.4	44.6	39.4	77	57.9	40.7	43.8
Copper	13.7	24.7	5.65	8.2	13.8	19.6	13.6	13.2	9.65	17.6	20.5
Mercury	0.1	0.15	<0.05	<0.05	0.05	<0.05	0.1	0.05	0.05	<0.05	0.1
Nickel	12.4	16.6	9.65	7	13.6	18.6	17.4	15.4	12.8	23.1	19.9
Lead	11.5	24.2	4.05	5.05	12.3	16.3	11	10.4	8.15	11.7	18.9
Zinc	48.3	68.4	23.8	30.2	48.3	65.3	53.8	52.3	43.3	63.3	58

[a] Grey shading denotes above the low-ISQG level (ANZECC & ARMCANZ 2000).

Table 2.24 Metal and metalloid concentrations (mg/kg) in sediment from Whyte Island in 2002, 2006, 2008, 2010 and 2012. [a]

Metal	Site 1					Site 2					Site 3				
	2002	2006	2008	2010	2012	2002	2006	2008	2010	2012	2002	2006	2008	2010	2012
Arsenic	13	10	2.6	0.9	6.5	3.1	1.5	3.5	7	9.7	9.2	5.3	5.0	8.2	8.4
Cadmium	<0.2	<0.1	<0.50	0.13	<0.1	<0.5	<0.1	<0.50	0.14	0.14	0.2	0.11	<0.50	<0.1	<0.1
Chromium	37.1	43	28	27	44	15.4	38	24	12	19	52.1	41	41	42	44
Copper	21.2	21	31	21	31	21.8	17	34	39	43	84.5	84	56	43	40
Mercury	1.7	0.06	2.7	0.05	0.09	1.7	0.07	2.4	0.07	0.11	1.2	0.17	<0.010	0.09	0.15
Nickel	17.4	20	18	14	23	10.3	17	15	11	16	21.2	19	20	20	20
Lead	17	18	18	9.3	17	10.5	26	25	9	16	45.5	31	26	19	18
Zinc	63.2	68	91	63	91	29.6	55	76	62	110	212	120	120	100	120

[a] Grey shading denotes above the low-ISQG level (ANZECC & ARMCANZ 2000).

2.4 Oganochlorine Pesticides

Concentrations of organochloride pesticides were compared to NAGD Screening Level (DEWHA 2009) (Table 2.25).

Table 2.25 Guideline and background levels (µg/kg) for metal concentrations in sediment.

	Screening Level
Aldrin	–
alpha-BHC	–
beta-BHC	–
gamma-BHC (Lindane)	0.32
delta-BHC	–
cis-Chlordane	–
trans-Chlordane	–
p,p'-DDD	2.00
p,p'-DDE	2.20
p,p'-DDT	–
Dieldrin	0.02
alpha-Endosulfan	–
beta-Endosulfan	–
Endosulfan Sulphate	–
Endrin	0.02
Endrin ketone	–
Endrin aldehyde	–
Heptachlor	–
Heptachlor epoxide	–
Hexachlorobenzene	–
Methoxychlor	–
Oxychlordane	–

In 2012, the concentration of all organochlorine pesticides in the sediment at Fisherman Islands and Whyte Island were below the laboratory limits of reporting (Table 2.25 to Table 2.27). Organochlorides are unlikely to be associated with the large dieback areas.

Table 2.26 Organochlorine concentrations (μg/kg) in sediment from Fisherman Islands in 2012, 2010 and 2008. [a]

	Site 9			Site 19			Site 23		
	2008	**2010**	**2012**	**2008**	**2010**	**2012**	**2008**	**2010**	**2012**
Aldrin	<1	<10	<2	<1	<1	<1	<1	<4	<5
alpha-BHC	<1	<10	<2	<1	<1	<1	<1	<4	<5
beta-BHC	<1	<10	<2	<1	<1	<1	<1	<4	<5
gamma-BHC (Lindane)	<1	<10	<2	<1	<1	<1	<1	<4	<5
delta-BHC	<1	<10	<2	<1	<1	<1	<1	<4	<5
cis-Chlordane	<1	<1	<2	<1	<1	<1	<1	<4	<5
trans-Chlordane	<1	<1	<2	<1	<1	<1	<1	<4	<5
p,p'-DDD	<1	<1	<2	<1	<1	<1	<1	<40	<5
p,p'-DDE	<1	<1	<2	<1	<1	<1	<1	<40	<5
p,p'-DDT	<1	<1	<2	<1	<1	<1	<1	<40	<5
Dieldrin	<1	<1	<2	<1	<1	<1	<1	<4	<5
alpha-Endosulfan	<1	<10	<2	<1	<10	<1	<1	<40	<5
beta-Endosulfan	<1	<10	<2	<1	<10	<1	<1	<40	<5
Endosulfan Sulphate	<1	<10	<2	<1	<10	<1	<1	<40	<5
Endrin	<1	<10	<2	<1	<1	<1	<1	<4	<5
Endrin ketone	–	<10	<2	–	<1	<1	–	<4	<5
Endrin aldehyde	–	<10	<2	–	<1	<1	–	<4	<5
Heptachlor	<1	<10	<2	<1	<1	<1	<1	<4	<5

	Site 9			Site 19			Site 23		
	2008	**2010**	**2012**	**2008**	**2010**	**2012**	**2008**	**2010**	**2012**
Heptachlor epoxide	<1	<10	<2	<1	<1	<1	<1	<4	<5
Hexachlorobenzene	<1	<10	<2	<1	<1	<1	<1	<4	<5
Methoxychlor	<1	<10	<2	<1	<10	<1	<1	<40	<5
Oxychlordane	–	<1	<2	–	<1	<1	–	<4	<5

[a] Laboratory limit of reporting vary between sites due to the high moisture content of some samples.

Table 2.27 Organochlorine concentrations (μg/kg) in sediment from Fisherman Islands in 1999, 2002 and 2006. [a]

	Site 9			Site 19			Site 23	
	1999	**2002**	**2006**	**1999**	**2002**	**2006**	**1999**	**2006**
Aldrin	<0.05	<0.05	<1	<0.05	<0.05	<1	<0.1	<1
alpha-BHC	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.1	<1
beta-BHC	<0.1	<0.5*	<1	<0.1	<0.1*	<1	<0.3	<1
gamma-BHC (Lindane)	<0.1	–	<1	<0.1	–	<1	<0.3	<1
delta-BHC	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.1	<1
cis-Chlordane	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.1	<1
trans-Chlordane	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.1	<1
p,p'-DDD	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.1	<1
p,p'-DDE	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.1	<1
p,p'-DDT	<0.2	<1.0	<1	<0.2	<0.2	<1	<0.5	<1
Dieldrin	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.1	<1
alpha-Endosulfan	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.1	<1
beta-Endosulfan	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.1	<1
Endosulfan Sulphate	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.1	<1
Endrin	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.1	<1
Endrin ketone	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.1	<1
Endrin aldehyde	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.1	<1
Heptachlor	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.1	<1

	Site 9			Site 19			Site 23	
	1999	**2002**	**2006**	**1999**	**2002**	**2006**	**1999**	**2006**
Heptachlor epoxide	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.1	<1
Hexachlorobenzene	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.1	<1
Methoxychlor	<0.2	<0.1	<1	<0.2	<0.02	<1	<0.5	<1

[a] Laboratory limit of reporting vary between sites due to the high moisture content of some samples.

Table 2.28 Organochlorine concentrations (μg/kg) in sediment from Whyte Island in 2012, 2010, 2008 and 2006. [a]

	Site 1				Site 2				Site 3			
	2006	**2008**	**2010**	**2012**	**2006**	**2008**	**2010**	**2012**	**2006**	**2008**	**2010**	**2012**
Aldrin	<1	<1	<1	<5	<1	<1	<1	<5	<1	<1	<1	<5
alpha-BHC	<1	<1	<1	<5	<1	<1	<1	<5	<1	<1	<1	<5
beta-BHC	<1	<1	<1	<5	<1	<1	<1	<5	<1	<1	<1	<5
gamma-BHC (Lindane)	<1	<1	<1	<5	<1	<1	<1	<5	<1	<1	<1	<5
delta-BHC	<1	<1	<1	<5	<1	<1	<1	<5	<1	<1	<1	<5
cis-Chlordane	<1	<1	<1	<5	<1	<1	<1	<5	<1	<1	<1	<5
trans-Chlordane	<1	<1	<1	<5	<1	<1	<1	<5	<1	<1	<1	<5
p,p'-DDD	<1	<1	<1	<5	<1	<1	<1	<5	<1	<1	<1	<5
p,p'-DDE	<1	<1	<1	<5	<1	<1	<1	<5	<1	<1	<1	<5
p,p'-DDT	<1	<1	<1	<5	<1	<1	<1	<5	<1	<1	<1	<5
Dieldrin	<1	<1	<1	<5	<1	<1	<1	<5	<1	<1	<1	<5
alpha-Endosulfan	<1	<1	<1	<5	<1	<1	<1	<5	<1	<1	<1	<5
beta-Endosulfan	<1	<1	<1	<5	<1	<1	<1	<5	<1	<1	<1	<5
Endosulfan Sulphate	<1	<1	<1	<5	<1	<1	<1	<5	<1	<1	<1	<5
Endrin	<1	<1	<1	<5	<1	<1	<1	<5	<1	<1	<1	<5
Endrin ketone	<1	–	–	<5	<1	–	–	<5	<1	–	–	<5
Endrin aldehyde	<1	–	–	<5	<1	–	–	<5	<1	–	–	<5
Heptachlor	<1	<1	<1	<5	<1	<1	<1	<5	<1	<1	<1	<5

	Site 1				Site 2				Site 3			
	2006	**2008**	**2010**	**2012**	**2006**	**2008**	**2010**	**2012**	**2006**	**2008**	**2010**	**2012**
Heptachlor epoxide	<1	<1	<1	<5	<1	<1	<1	<5	<1	<1	<1	<5
Hexachlorobenzene	<1	<1	<1	<5	<1	<1	<1	<5	<1	<1	<1	<5
Methoxychlor	<1	<1	<1	<5	<1	<1	<1	<5	<1	<1	<1	<5
Oxychlordane	<1	<1	<1	<5	<1	<1	<1	<5	<1	<1	<1	<5

[a] Laboratory limit of reporting vary between sites due to the high moisture content of some samples.

2.5 Within-site and Laboratory Variation

Nutrients

In 2012, within-site variation for the concentration of nutrients was 14% RPD for phosphorus and 42% RPD for total nitrogen. This indicates that the sediment composition is highly variable at a site, and where possible replicated sampling should be undertaken during future monitoring (to ensure that the variation within-site is less than variation among sites). The RPD for the laboratory duplicates was well below the QA/QC guideline (35%), with no variation for phosphorus and 2% RPD for total nitrogen.

Petroleum Hydrocarbons and BTEX

In 2012, within-site variation for the concentration of TPH and BTEX was zero. The RPD for the laboratory duplicates was below the QA/QC guideline, with 31% RPD for the C15–28 fraction, 22% RPD for the C29–36 fraction and no variation for the other fractions.

Metals and Metalloids

In 2012, within-site variation for the concentration of metals and metalloids was <8% for most metals; the RPD was 46% for mercury and 33% for arsenic. This indicates that the sediment composition is highly variable at a site in terms of mercury and arsenic concentrations, and where possible replicated sampling should be undertaken during future monitoring. The RPD for the laboratory duplicates was below the QA/QC guideline for all metals.

Oganochlorine Pesticides

In 2012, within-site variation for the concentration of organochlorine pesticides was zero. The RPD for the laboratory duplicates was below the QA/QC guideline, with no variation for all pesticides.

3 Laboratory Certificates

REPORT OF ANALYSIS

Laboratory Reference: A12/3375 [R00]

Client: FRC Environmental
185 Main Rd
Wellington Point QLD 4160

Contact: Kylie McPherson

Order No:
Project: PoB Mangrove Assesment
Sample Type: Marine Sediment
No. of Samples: 19
Date Received: 09/07/2012
Date Completed: 27/07/2012

Laboratory Contact Details:

Client Services Manager: Trent Biggin
Technical Enquiries: Andrew Bradbury
Telephone: +61 7 3268 1228
Fax: +61 7 3268 1238
Email: brisbane@advancedanalytical.com.au
andrew.bradbury@advancedanalytical.com.au

Attached Results Approved By:

Ian Eckhard
Technical Director

Comments:
All samples tested as submitted by client. All attached results have been checked and approved for release.
This is the Final Report and supersedes any reports previously issued with this batch number.
This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025. This document shall not be reproduced, except in full.

Accreditation No. 15109

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Batch Number: A12/3375 [R00]
Project Reference: PoB Mangrove Assesment

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/1** **FI 1**	**/2** **FI 2**	**/3** **FI 3**	**/4** **FI 4**
Moisture Content						
Moisture Content	04-004	%	21.7	72.1	68.6	54.3
Trace Elements						
Arsenic	04-001	mg/kg	4.2	[NA]	6.4	[NA]
Cadmium	04-001	mg/kg	<0.1	[NA]	<0.1	[NA]
Chromium	04-001	mg/kg	13	[NA]	35	[NA]
Copper	04-001	mg/kg	3.9	[NA]	27	[NA]
Lead	04-001	mg/kg	3.2	[NA]	18	[NA]
Mercury	04-002	mg/kg	0.01	[NA]	0.07	[NA]
Nickel	04-001	mg/kg	5.5	[NA]	16	[NA]
Phosphorus*	04-001	mg/kg	290	970	1,000	950
Zinc	04-001	mg/kg	22	[NA]	67	[NA]
BTEX						
Benzene	04-021	mg/kg	<0.20	<1.0	<0.4	<0.20
Toluene	04-021	mg/kg	<0.20	<1.0	<0.4	<0.20
Ethyl Benzene	04-021	mg/kg	<0.20	<1.0	<0.4	<0.20
m+p xylenes	04-021	mg/kg	<0.40	<2.0	<0.8	<0.40
o-xylene	04-021	mg/kg	<0.20	<1.0	<0.4	<0.20
Total BTEX	04-021	mg/kg	<1.2	<6.0	<2.4	<1.2
Surrogate 1 Recovery	04-021	%	81	49	44	61
Surrogate 2 Recovery	04-021	%	78	46	42	59
Surrogate 3 Recovery	04-021	%	90	45	49	63
Date Extracted	04-021	-	11/07/2012	11/07/2012	11/07/2012	11/07/2012
Date Analysed	04-021	-	12/07/2012	12/07/2012	12/07/2012	12/07/2012
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	<10	<50	<20	<10
TPH C10-14	04-020	mg/kg	<10	<50	<20	<10
TPH C15-28	04-020	mg/kg	<50	<250	120	72
TPH C29-36	04-020	mg/kg	<50	<250	130	87
Surrogate Recovery	04-020	%	106	99	104	116
Date Extracted	04-020	-	12/07/2012	12/07/2012	12/07/2012	12/07/2012
Date Analysed	04-020	-	16/07/2012	16/07/2012	16/07/2012	16/07/2012

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Batch Number: A12/3375 [R00]
Project Reference: PoB Mangrove Assesment

Laboratory Reference:	-	-	/1	/2	/3	/4
Client Reference:	-	-	FI 1	FI 2	FI 3	FI 4
Date Sampled:	-	-				
Analysis Description	Method	Units				
Organochlorine Pesticides						
Subcontract Analysis						
Total Organic Carbon	SUB	%	0.33	[NA]	9.7	[NA]
Nitrate as N	SUB	mg/kg	0.8	[NA]	<0.1	[NA]
Nitrite as N	SUB	mg/kg	<0.1	[NA]	<0.1	[NA]
Total Kjeldahl Nitrogen	SUB	mg/kg	310	[NA]	6,570	[NA]
Total Nitrogen	SUB	mg/kg	310	[NA]	6,570	[NA]

Laboratory Reference:	-	-	/5	/6	/7	/8
Client Reference:	-	-	FI 6	FI 7	FI 9	FI 11
Date Sampled:	-	-				
Analysis Description	Method	Units				
Moisture Content						
Moisture Content	04-004	%	76.6	63.9	60.9	40.9
Trace Elements						
Arsenic	04-001	mg/kg	9.1	[NA]	7.3	15
Cadmium	04-001	mg/kg	<0.1	[NA]	<0.1	<0.1
Chromium	04-001	mg/kg	33	[NA]	21	34
Copper	04-001	mg/kg	34	[NA]	14	14
Lead	04-001	mg/kg	13	[NA]	8.0	7.7
Mercury	04-002	mg/kg	0.05	[NA]	0.05	0.03
Nickel	04-001	mg/kg	19	[NA]	9.9	18
Phosphorus*	04-001	mg/kg	1,000	820	860	810
Zinc	04-001	mg/kg	96	[NA]	38	51
BTEX						
Benzene	04-021	mg/kg	<1.0	<0.4	<0.4	<0.20
Toluene	04-021	mg/kg	<1.0	<0.4	<0.4	<0.20
Ethyl Benzene	04-021	mg/kg	<1.0	<0.4	<0.4	<0.20
m+p xylenes	04-021	mg/kg	<2.0	<0.8	<0.8	<0.40
o-xylene	04-021	mg/kg	<1.0	<0.4	<0.4	<0.20
Total BTEX	04-021	mg/kg	<6.0	<2.4	<2.4	<1.2
Surrogate 1 Recovery	04-021	%	64	57	49	79

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/5** **FI 6**	**/6** **FI 7**	**/7** **FI 9**	**/8** **FI 11**
Surrogate 2 Recovery	04-021	%	55	57	47	77
Surrogate 3 Recovery	04-021	%	62	58	48	84
Date Extracted	04-021	-	12/07/2012	11/07/2012	11/07/2012	11/07/2012
Date Analysed	04-021	-	13/07/2012	12/07/2012	12/07/2012	13/07/2012
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	<50	<20	<20	<10
TPH C10-14	04-020	mg/kg	<50	<10	<20	<10
TPH C15-28	04-020	mg/kg	310	130	150	57
TPH C29-36	04-020	mg/kg	310	180	150	<50
Surrogate Recovery	04-020	%	99	111	99	114
Date Extracted	04-020	-	12/07/2012	12/07/2012	12/07/2012	12/07/2012
Date Analysed	04-020	-	16/07/2012	16/07/2012	16/07/2012	17/07/2012
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	[NA]	[NA]	<2	[NA]
alpha-BHC	04-024	µg/kg	[NA]	[NA]	<2	[NA]
beta-BHC	04-024	µg/kg	[NA]	[NA]	<2	[NA]
gamma-BHC (Lindane)	04-024	µg/kg	[NA]	[NA]	<2	[NA]
delta-BHC	04-024	µg/kg	[NA]	[NA]	<2	[NA]
cis-Chlordane	04-024	µg/kg	[NA]	[NA]	<2	[NA]
trans-Chlordane	04-024	µg/kg	[NA]	[NA]	<2	[NA]
p,p'-DDD	04-024	µg/kg	[NA]	[NA]	<2	[NA]
p,p'-DDE	04-024	µg/kg	[NA]	[NA]	<2	[NA]
p,p'-DDT	04-024	µg/kg	[NA]	[NA]	<2	[NA]
Dieldrin	04-024	µg/kg	[NA]	[NA]	<2	[NA]
alpha-Endosulfan	04-024	µg/kg	[NA]	[NA]	<2	[NA]
beta-Endosulfan	04-024	µg/kg	[NA]	[NA]	<2	[NA]
Endosulfan Sulphate	04-024	µg/kg	[NA]	[NA]	<2	[NA]
Endrin	04-024	µg/kg	[NA]	[NA]	<2	[NA]
Endrin ketone	04-024	µg/kg	[NA]	[NA]	<2	[NA]
Endrin aldehyde	04-024	µg/kg	[NA]	[NA]	<2	[NA]
Heptachlor	04-024	µg/kg	[NA]	[NA]	<2	[NA]
Heptachlor epoxide	04-024	µg/kg	[NA]	[NA]	<2	[NA]
Hexachlorobenzene	04-024	µg/kg	[NA]	[NA]	<2	[NA]

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Laboratory Reference:	-	-	**/5**	**/6**	**/7**	**/8**
Client Reference:	-	-	**FI 6**	**FI 7**	**FI 9**	**FI 11**
Date Sampled:	-	-				
Analysis Description	**Method**	**Units**				
Methoxychlor	04-024	µg/kg	[NA]	[NA]	<2	[NA]
Oxychlordane*	04-024	µg/kg	[NA]	[NA]	<2	[NA]
Surrogate Recovery	04-024	%	[NA]	[NA]	99	[NA]
Date Extracted	04-024	-	[NA]	[NA]	12/07/2012	[NA]
Date Analysed	04-024	-	[NA]	[NA]	13/07/2012	[NA]
Subcontract Analysis						
Total Organic Carbon	SUB	%	16.9	[NA]	6.7	3.8
Nitrate as N	SUB	mg/kg	<0.1	[NA]	<0.1	<0.1
Nitrite as N	SUB	mg/kg	<0.1	[NA]	<0.1	<0.1
Total Kjeldahl Nitrogen	SUB	mg/kg	10,600	[NA]	4,140	2,370
Total Nitrogen	SUB	mg/kg	10,600	[NA]	4,140	2,370

Laboratory Reference:	-	-	**/9**	**/10**	**/11**	**/12**
Client Reference:	-	-	**FI 13**	**FI 15**	**FI 17**	**FI 18**
Date Sampled:	-	-				
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	52.3	50.3	55.2	55.9
Trace Elements						
Arsenic	04-001	mg/kg	7.0	5.6	5.1	11
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	48	34	16	26
Copper	04-001	mg/kg	25	15	4.7	12
Lead	04-001	mg/kg	12	9.2	3.7	7.3
Mercury	04-002	mg/kg	0.04	0.05	0.04	0.05
Nickel	04-001	mg/kg	25	17	7.3	14
Phosphorus*	04-001	mg/kg	710	580	290	450
Zinc	04-001	mg/kg	77	62	25	54
BTEX						
Benzene	04-021	mg/kg	<0.20	<0.20	<0.20	<0.20
Toluene	04-021	mg/kg	<0.20	<0.20	<0.20	<0.20
Ethyl Benzene	04-021	mg/kg	<0.20	<0.20	<0.20	<0.20

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/9** **FI 13**	**/10** **FI 15**	**/11** **FI 17**	**/12** **FI 18**
m+p xylenes	04-021	mg/kg	<0.40	<0.40	<0.40	<0.40
o-xylene	04-021	mg/kg	<0.20	<0.20	<0.20	<0.20
Total BTEX	04-021	mg/kg	<1.2	<1.2	<1.2	<1.2
Surrogate 1 Recovery	04-021	%	62	60	51	57
Surrogate 2 Recovery	04-021	%	66	60	52	59
Surrogate 3 Recovery	04-021	%	72	65	54	66
Date Extracted	04-021	-	11/07/2012	11/07/2012	11/07/2012	11/07/2012
Date Analysed	04-021	-	13/07/2012	13/07/2012	13/07/2012	13/07/2012
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	<10	<10	<10	<10
TPH C10-14	04-020	mg/kg	<10	<10	<10	<10
TPH C15-28	04-020	mg/kg	92	<50	53	86
TPH C29-36	04-020	mg/kg	85	53	70	100
Surrogate Recovery	04-020	%	99	109	104	110
Date Extracted	04-020	-	12/07/2012	12/07/2012	12/07/2012	12/07/2012
Date Analysed	04-020	-	17/07/2012	17/07/2012	17/07/2012	17/07/2012
Organochlorine Pesticides						
Subcontract Analysis						
Total Organic Carbon	SUB	%	1.7	1.6	1.2	3.3
Nitrate as N	SUB	mg/kg	<0.1	<0.1	<0.1	0.5
Nitrite as N	SUB	mg/kg	0.1	<0.1	<0.1	0.3
Total Kjeldahl Nitrogen	SUB	mg/kg	1,980	1,170	790	2,080
Total Nitrogen	SUB	mg/kg	1,980	1,170	790	2,080

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/13** **FI 19 r1**	**/14** **FI 19 r2**	**/15** **FI 22**	**/16** **WI 1**
Moisture Content						
Moisture Content	04-004	%	58.8	53.0	79.7	72.0
Trace Elements						
Arsenic	04-001	mg/kg	14	10	[NA]	6.5
Cadmium	04-001	mg/kg	<0.1	<0.1	[NA]	<0.1
Chromium	04-001	mg/kg	50	50	[NA]	44
Copper	04-001	mg/kg	23	23	[NA]	31
Lead	04-001	mg/kg	12	12	[NA]	17
Mercury	04-002	mg/kg	0.05	0.08	[NA]	0.09
Nickel	04-001	mg/kg	25	24	[NA]	23
Phosphorus*	04-001	mg/kg	920	800	1,500	760
Zinc	04-001	mg/kg	73	68	[NA]	91
BTEX						
Benzene	04-021	mg/kg	<0.20	<0.20	<1.0	<1.0
Toluene	04-021	mg/kg	<0.20	<0.20	<1.0	<1.0
Ethyl Benzene	04-021	mg/kg	<0.20	<0.20	<1.0	<1.0
m+p xylenes	04-021	mg/kg	<0.40	<0.40	<2.0	<2.0
o-xylene	04-021	mg/kg	<0.20	<0.20	<1.0	<1.0
Total BTEX	04-021	mg/kg	<1.2	<1.2	<6.0	<6.0
Surrogate 1 Recovery	04-021	%	53	61	48	49
Surrogate 2 Recovery	04-021	%	53	66	45	49
Surrogate 3 Recovery	04-021	%	61	70	46	53
Date Extracted	04-021	-	11/07/2012	11/07/2012	11/07/2012	11/07/2012
Date Analysed	04-021	-	13/07/2012	13/07/2012	13/07/2012	13/07/2012
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	<10	<10	<50	<50
TPH C10-14	04-020	mg/kg	<10	<10	<50	<50
TPH C15-28	04-020	mg/kg	<50	<50	390	<250
TPH C29-36	04-020	mg/kg	<50	<50	430	<250
Surrogate Recovery	04-020	%	94	114	85	110
Date Extracted	04-020	-	12/07/2012	12/07/2012	12/07/2012	12/07/2012
Date Analysed	04-020	-	17/07/2012	17/07/2012	17/07/2012	17/07/2012
Organochlorine Pesticides						

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Batch Number: A12/3375 [R00]
Project Reference: PoB Mangrove Assesment

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/13** **FI 19 r1**	**/14** **FI 19 r2**	**/15** **FI 22**	**/16** **WI 1**
Aldrin	04-024	µg/kg	<1.0	<1.0	[NA]	<5
alpha-BHC	04-024	µg/kg	<1.0	<1.0	[NA]	<5
beta-BHC	04-024	µg/kg	<1.0	<1.0	[NA]	<5
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	<1.0	[NA]	<5
delta-BHC	04-024	µg/kg	<1.0	<1.0	[NA]	<5
cis-Chlordane	04-024	µg/kg	<1.0	<1.0	[NA]	<5
trans-Chlordane	04-024	µg/kg	<1.0	<1.0	[NA]	<5
p,p'-DDD	04-024	µg/kg	<1.0	<1.0	[NA]	<5
p,p'-DDE	04-024	µg/kg	<1.0	<1.0	[NA]	<5
p,p'-DDT	04-024	µg/kg	<1.0	<1.0	[NA]	<5
Dieldrin	04-024	µg/kg	<1.0	<1.0	[NA]	<5
alpha-Endosulfan	04-024	µg/kg	<1.0	<1.0	[NA]	<5
beta-Endosulfan	04-024	µg/kg	<1.0	<1.0	[NA]	<5
Endosulfan Sulphate	04-024	µg/kg	<1.0	<1.0	[NA]	<5
Endrin	04-024	µg/kg	<1.0	<1.0	[NA]	<5
Endrin ketone	04-024	µg/kg	<1.0	<1.0	[NA]	<5
Endrin aldehyde	04-024	µg/kg	<1.0	<1.0	[NA]	<5
Heptachlor	04-024	µg/kg	<1.0	<1.0	[NA]	<5
Heptachlor epoxide	04-024	µg/kg	<1.0	<1.0	[NA]	<5
Hexachlorobenzene	04-024	µg/kg	<1.0	<1.0	[NA]	<5
Methoxychlor	04-024	µg/kg	<1.0	<1.0	[NA]	<5
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	[NA]	<5
Surrogate Recovery	04-024	%	108	109	[NA]	100
Date Extracted	04-024	-	12/07/2012	12/07/2012	[NA]	12/07/2012
Date Analysed	04-024	-	13/07/2012	13/07/2012	[NA]	13/07/2012
Subcontract Analysis						
Total Organic Carbon	SUB	%	1.9	3.1	[NA]	15.4
Nitrate as N	SUB	mg/kg	<0.1	<0.1	[NA]	<0.1
Nitrite as N	SUB	mg/kg	<0.1	<0.1	[NA]	<0.1
Total Kjeldahl Nitrogen	SUB	mg/kg	1,890	2,900	[NA]	8,990
Total Nitrogen	SUB	mg/kg	1,890	2,900	[NA]	8,990

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/17** **WI 2**	**/18** **WI 3**	**/19** **FI 23**
Moisture Content					
Moisture Content	04-004	%	86.1	71.4	78.3
Trace Elements					
Arsenic	04-001	mg/kg	9.7	8.4	7.6
Cadmium	04-001	mg/kg	0.14	<0.1	<0.1
Chromium	04-001	mg/kg	19	44	36
Copper	04-001	mg/kg	43	40	22
Lead	04-001	mg/kg	16	18	11
Mercury	04-002	mg/kg	0.11	0.15	0.04
Nickel	04-001	mg/kg	16	20	18
Phosphorus*	04-001	mg/kg	1,500	940	800
Zinc	04-001	mg/kg	110	120	59
BTEX					
Benzene	04-021	mg/kg	<1.0	<1.0	<1.0
Toluene	04-021	mg/kg	<1.0	<1.0	<1.0
Ethyl Benzene	04-021	mg/kg	<1.0	<1.0	<1.0
m+p xylenes	04-021	mg/kg	<2.0	<2.0	<2.0
o-xylene	04-021	mg/kg	<1.0	<1.0	<1.0
Total BTEX	04-021	mg/kg	<6.0	<6.0	<6.0
Surrogate 1 Recovery	04-021	%	44	53	50
Surrogate 2 Recovery	04-021	%	40	50	48
Surrogate 3 Recovery	04-021	%	39	52	51
Date Extracted	04-021	-	11/07/2012	11/07/2012	11/07/2012
Date Analysed	04-021	-	13/07/2012	13/07/2012	13/07/2012
Total Petroleum Hydrocarbons					
TPH C6-C9	04-021	mg/kg	<50	<50	<50
TPH C10-14	04-020	mg/kg	<50	<50	<50
TPH C15-28	04-020	mg/kg	570	<250	280
TPH C29-36	04-020	mg/kg	740	260	290
Surrogate Recovery	04-020	%	109	86	108
Date Extracted	04-020	-	12/07/2012	12/07/2012	12/07/2012
Date Analysed	04-020	-	17/07/2012	17/07/2012	17/07/2012
Organochlorine Pesticides					

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Laboratory Reference:	-	-	/17	/18	/19
Client Reference:	-	-	WI 2	WI 3	FI 23
Date Sampled:	-	-			
Analysis Description	**Method**	**Units**			
Aldrin	04-024	µg/kg	<5	<5	<5
alpha-BHC	04-024	µg/kg	<5	<5	<5
beta-BHC	04-024	µg/kg	<5	<5	<5
gamma-BHC (Lindane)	04-024	µg/kg	<5	<5	<5
delta-BHC	04-024	µg/kg	<5	<5	<5
cis-Chlordane	04-024	µg/kg	<5	<5	<5
trans-Chlordane	04-024	µg/kg	<5	<5	<5
p,p'-DDD	04-024	µg/kg	<5	<5	<5
p,p'-DDE	04-024	µg/kg	<5	<5	<5
p,p'-DDT	04-024	µg/kg	<5	<5	<5
Dieldrin	04-024	µg/kg	<5	<5	<5
alpha-Endosulfan	04-024	µg/kg	<5	<5	<5
beta-Endosulfan	04-024	µg/kg	<5	<5	<5
Endosulfan Sulphate	04-024	µg/kg	<5	<5	<5
Endrin	04-024	µg/kg	<5	<5	<5
Endrin ketone	04-024	µg/kg	<5	<5	<5
Endrin aldehyde	04-024	µg/kg	<5	<5	<5
Heptachlor	04-024	µg/kg	<5	<5	<5
Heptachlor epoxide	04-024	µg/kg	<5	<5	<5
Hexachlorobenzene	04-024	µg/kg	<5	<5	<5
Methoxychlor	04-024	µg/kg	<5	<5	<5
Oxychlordane*	04-024	µg/kg	<5	<5	<5
Surrogate Recovery	04-024	%	101	99	106
Date Extracted	04-024	-	12/07/2012	12/07/2012	12/07/2012
Date Analysed	04-024	-	13/07/2012	13/07/2012	13/07/2012
Subcontract Analysis					
Total Organic Carbon	SUB	%	8.1	28.1	4.7
Nitrate as N	SUB	mg/kg	<0.1	<0.1	<0.1
Nitrite as N	SUB	mg/kg	<0.1	<0.1	<0.1
Total Kjeldahl Nitrogen	SUB	mg/kg	5,950	22,400	3,220
Total Nitrogen	SUB	mg/kg	5,950	22,400	3,220

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Method	Method Description
04-004	Moisture by gravimetric, %
04-001	Metals by ICP-OES, mg/kg
04-002	Mercury by CVAAS, mg/kg
04-021	TRH C6-9 & BTEX by P&T GCMS, mg/kg
04-020	TRH by GC-FID, mg/kg
04-024	OC & OP Pesticides by GCMS
SUB	Subcontracted Analyses

Result Comments
[<] Less than
[INS] Insufficient sample for this test
[NA] Test not required
- Matrix spike not reported for selected OC due to matrix interference
LOR raised for organic analytes due to high moisture content in selected samples
Solid sample results are reported on a dry weight basis.
Analysis was subcontracted to Sydney Analytical Laboratories (NATA Number 1884); reference SAL report number SAL24251B.

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QUALITY ASSURANCE REPORT

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Arsenic	mg/kg	<0.4	A12/3375-1	4.2 || 4.4 || RPD: 5	A12/3375-1	101%
Cadmium	mg/kg	<0.1	A12/3375-1	<0.1 || <0.1	A12/3375-1	102%
Chromium	mg/kg	<0.1	A12/3375-1	13 || 13 || RPD: 0	A12/3375-1	101%
Copper	mg/kg	<0.1	A12/3375-1	3.9 || 3.9 || RPD: 0	A12/3375-1	101%
Lead	mg/kg	<0.5	A12/3375-1	3.2 || 3.3 || RPD: 3	A12/3375-1	92%
Mercury	mg/kg	<0.01	A12/3375-1	0.01 || 0.01 || RPD: 0	A12/3375-1	100%
Nickel	mg/kg	<0.1	A12/3375-1	5.5 || 5.5 || RPD: 0	A12/3375-1	95%
Phosphorus*	mg/kg	<1	A12/3375-1	290 || 290 || RPD: 0	A12/3375-1	105%
Zinc	mg/kg	<0.5	A12/3375-1	22 || 23 || RPD: 4	A12/3375-1	95%

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Benzene	mg/kg	<0.20	A12/3375-7	<0.4 || <0.4	A12/3375-7	56%
Toluene	mg/kg	<0.20	A12/3375-7	<0.4 || <0.4	A12/3375-7	56%
Ethyl Benzene	mg/kg	<0.20	A12/3375-7	<0.4 || <0.4	A12/3375-7	56%
m+p xylenes	mg/kg	<0.40	A12/3375-7	<0.8 || <0.8	A12/3375-7	56%
o-xylene	mg/kg	<0.20	A12/3375-7	<0.4 || <0.4	A12/3375-7	56%
Total BTEX	mg/kg	<1.2	A12/3375-7	<2.4 || <2.4	A12/3375-7	[NA]
Surrogate 1 Recovery	%	90	A12/3375-7	49 || 53 || RPD: 8	A12/3375-7	57%
Surrogate 2 Recovery	%	92	A12/3375-7	47 || 53 || RPD: 12	A12/3375-7	56%
Surrogate 3 Recovery	%	100	A12/3375-7	48 || 54 || RPD: 12	A12/3375-7	56%

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
TPH C6-C9	mg/kg	<10	A12/3375-7	<20 || <20	A12/3375-7	48%
TPH C10-14	mg/kg	<10	A12/3375-7	<20 || <20	A12/3375-7	119%
TPH C15-28	mg/kg	<50	A12/3375-7	150 || 110 || RPD: 31	A12/3375-7	113%
TPH C29-36	mg/kg	<50	A12/3375-7	150 || 120 || RPD: 22	A12/3375-7	97%
Surrogate Recovery	%	107	A12/3375-7	99 || 101 || RPD: 2	A12/3375-7	88%

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aldrin	µg/kg	<1.0	A12/3375-7	<2 || <2	A12/3375-7	108%
alpha-BHC	µg/kg	<1.0	A12/3375-7	<2 || <2	A12/3375-7	122%
beta-BHC	µg/kg	<1.0	A12/3375-7	<2 || <2	A12/3375-7	143%
gamma-BHC (Lindane)	µg/kg	<1.0	A12/3375-7	<2 || <2	A12/3375-7	134%
delta-BHC	µg/kg	<1.0	A12/3375-7	<2 || <2	A12/3375-7	#
cis-Chlordane	µg/kg	<1.0	A12/3375-7	<2 || <2	A12/3375-7	120%

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TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
trans-Chlordane	µg/kg	<1.0	A12/3375-7	<2 || <2	A12/3375-7	127%
p,p'-DDD	µg/kg	<1.0	A12/3375-7	<2 || <2	A12/3375-7	132%
p,p'-DDE	µg/kg	<1.0	A12/3375-7	<2 || <2	A12/3375-7	123%
p,p'-DDT	µg/kg	<1.0	A12/3375-7	<2 || <2	A12/3375-7	114%
Dieldrin	µg/kg	<1.0	A12/3375-7	<2 || <2	A12/3375-7	127%
alpha-Endosulfan	µg/kg	<1.0	A12/3375-7	<2 || <2	A12/3375-7	120%
beta-Endosulfan	µg/kg	<1.0	A12/3375-7	<2 || <2	A12/3375-7	#
Endosulfan Sulphate	µg/kg	<1.0	A12/3375-7	<2 || <2	A12/3375-7	#
Endrin	µg/kg	<1.0	A12/3375-7	<2 || <2	A12/3375-7	131%
Endrin ketone	µg/kg	<1.0	A12/3375-7	<2 || <2	A12/3375-7	121%
Endrin aldehyde	µg/kg	<1.0	A12/3375-7	<2 || <2	A12/3375-7	106%
Heptachlor	µg/kg	<1.0	A12/3375-7	<2 || <2	A12/3375-7	114%
Heptachlor epoxide	µg/kg	<1.0	A12/3375-7	<2 || <2	A12/3375-7	121%
Hexachlorobenzene	µg/kg	<1.0	A12/3375-7	<2 || <2	A12/3375-7	104%
Methoxychlor	µg/kg	<1.0	A12/3375-7	<2 || <2	A12/3375-7	153%
Oxychlordane*	µg/kg	<1.0	A12/3375-7	<2 || <2	A12/3375-7	[NA]
Surrogate Recovery	%	104	A12/3375-7	99 || 95 || RPD: 4	A12/3375-7	101%

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results
Total Organic Carbon	%	<0.01	A12/3375-10	1.6 || 1.5 || RPD: 6
Total Nitrogen	mg/kg	<20	A12/3375-10	1170 || 1190 || RPD: 2

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Arsenic	mg/kg	[NT]	A12/3375-11	5.1 || 5.2 || RPD: 2
Cadmium	mg/kg	[NT]	A12/3375-11	<0.1 || <0.1
Chromium	mg/kg	[NT]	A12/3375-11	16 || 16 || RPD: 0
Copper	mg/kg	[NT]	A12/3375-11	4.7 || 4.7 || RPD: 0
Lead	mg/kg	[NT]	A12/3375-11	3.7 || 3.8 || RPD: 3
Mercury	mg/kg	[NT]	A12/3375-11	0.04 || 0.03 || RPD: 29
Nickel	mg/kg	[NT]	A12/3375-11	7.3 || 7.3 || RPD: 0
Phosphorus*	mg/kg	[NT]	A12/3375-11	290 || 290 || RPD: 0
Zinc	mg/kg	[NT]	A12/3375-11	25 || 25 || RPD: 0

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Benzene	mg/kg	[NT]	A12/3375-19	<1.0 || <1.0	External	89%
Toluene	mg/kg	[NT]	A12/3375-19	<1.0 || <1.0	External	91%
Ethyl Benzene	mg/kg	[NT]	A12/3375-19	<1.0 || <1.0	External	93%
m+p xylenes	mg/kg	[NT]	A12/3375-19	<2.0 || <2.0	External	93%
o-xylene	mg/kg	[NT]	A12/3375-19	<1.0 || <1.0	External	94%
Total BTEX	mg/kg	[NT]	A12/3375-19	<6.0 || <6.0	External	[NA]
Surrogate 1 Recovery	%	[NT]	A12/3375-19	50 || 48 || RPD: 4	External	88%
Surrogate 2 Recovery	%	[NT]	A12/3375-19	48 || 50 || RPD: 4	External	95%

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Surrogate 3 Recovery	%	[NT]	A12/3375-19	51 || 56 || RPD: 9	External	99%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
TPH C6-C9	mg/kg	[NT]	A12/3375-19	<50 || <50	External	89%
TPH C10-14	mg/kg	[NT]	A12/3375-19	<50 || <50	External	115%
TPH C15-28	mg/kg	[NT]	A12/3375-19	280 || 280 || RPD: 0	External	115%
TPH C29-36	mg/kg	[NT]	A12/3375-19	290 || 310 || RPD: 7	External	101%
Surrogate Recovery	%	[NT]	A12/3375-19	108 || 104 || RPD: 4	External	101%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aldrin	µg/kg	[NT]	[NT]	[NT]	External	108%
alpha-BHC	µg/kg	[NT]	[NT]	[NT]	External	113%
beta-BHC	µg/kg	[NT]	[NT]	[NT]	External	109%
gamma-BHC (Lindane)	µg/kg	[NT]	[NT]	[NT]	External	111%
delta-BHC	µg/kg	[NT]	[NT]	[NT]	External	114%
cis-Chlordane	µg/kg	[NT]	[NT]	[NT]	External	124%
trans-Chlordane	µg/kg	[NT]	[NT]	[NT]	External	118%
p,p'-DDD	µg/kg	[NT]	[NT]	[NT]	External	105%
p,p'-DDE	µg/kg	[NT]	[NT]	[NT]	External	121%
p,p'-DDT	µg/kg	[NT]	[NT]	[NT]	External	92%
Dieldrin	µg/kg	[NT]	[NT]	[NT]	External	124%
alpha-Endosulfan	µg/kg	[NT]	[NT]	[NT]	External	128%
beta-Endosulfan	µg/kg	[NT]	[NT]	[NT]	External	117%
Endosulfan Sulphate	µg/kg	[NT]	[NT]	[NT]	External	109%
Endrin	µg/kg	[NT]	[NT]	[NT]	External	118%
Endrin ketone	µg/kg	[NT]	[NT]	[NT]	External	107%
Endrin aldehyde	µg/kg	[NT]	[NT]	[NT]	External	80%
Heptachlor	µg/kg	[NT]	[NT]	[NT]	External	101%
Heptachlor epoxide	µg/kg	[NT]	[NT]	[NT]	External	116%
Hexachlorobenzene	µg/kg	[NT]	[NT]	[NT]	External	102%
Methoxychlor	µg/kg	[NT]	[NT]	[NT]	External	117%
Oxychlordane*	µg/kg	[NT]	[NT]	[NT]	External	[NA]
Surrogate Recovery	%	[NT]	[NT]	[NT]	External	103%

Comments:
RPD = Relative Percent Deviation
[NT] = Not Tested
[N/A] = Not Applicable
'#' = Spike recovery data could not be calculated due to high levels of contaminants
Acceptable replicate reproducibility limit or RPD: Results < 10 times LOR: no limits
Results >10 times LOR: 0% - 50%
Acceptable matrix spike & LCS recovery limits: Trace elements 70-130%
Organic analyses 50-150%
SVOC & speciated phenols 10-140%
Surrogates 10-140%
When levels outside these limits are obtained, an investigation into the cause of the deviation is performed before the batch is accepted or rejected, and results are released.

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4 References

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Appendix D Salinity of Pore Water

Contents

Tables

Figures

1 Introduction

Worldwide studies of the salinity of pore water and of the grey mangrove (*Avicennia marina*) indicate that stunted *A. marina* forests (i.e. mature plants under approximately 2.5 m high) are often associated with sediment that has pore water with a high salinity (up to 115 practical salinity units [PSU]), while taller forests are associated with pore water that has a lower salinity (Lovelock, Adame & Amir [University of Queensland School of Integrative Biology] pers. comm. 2007, Naidoo 2006). Therefore, stunting of *A. marina* is likely to be a response to the high salinity of sediment pore water.

Previous work on Whyte Island indicated that the salinity of sediment pore water was higher in areas of mangrove dieback, and in areas of poor health, than in healthy tall forest. Salinities were higher again in scrub forests, and highest in the algal mats and central areas that had no mangroves (i.e. claypan) (Lovelock, Adame & Amir [University of Queensland School of Integrative Biology] pers. comm. 2007).

In this survey we further investigated the salinity of pore water, and mangrove health.

2 Methods

2.1 Sample Collection

Pore water samples were collected from the sediment along transects through mangroves in good, fair and poor condition, and dead mangroves. Samples were collected from each of five transects on Fisherman Islands and Whyte Island (Table 2.1). Along each transect, one pore water sample was collected from each category of mangrove health present on that transect. A total of 47 samples were collected from Fisherman Islands and Whyte Island:

- ten samples from dieback areas (including dead and recently dead mangroves)
- nine samples for areas of poor health
- nine samples from areas of fair health, and
- ten samples from areas of good health.

Pore water samples were also collected from healthy forests without large dieback areas, to control for the effect of distance from the seaward margin. Two transects were surveyed at Wellington Point (Figure 2.3) and one transect at Mooroondu Point, Thorneside (Figure 2.4). A total of nine samples were collected from the comparative locations:

- five samples from areas of fair health, and
- four samples from areas of good health.

Pore water samples were collected using an apparatus based on McKee et al. (1988). The apparatus consisted of an outer rigid plastic tube (15 mm diameter and sealed at the lower end) and an inner plastic tube (5 mm diameter), both of which were perforated by small holes and connected to a 50 mL syringe (Figure 2.5). The plastic tube was inserted into the sediment, next to mangrove roots, to a depth of approximately 20 cm. The perforated section of the outer tube was buried at least 3 cm below the sediment surface to prevent surface water entering the apparatus. Suction was applied using the syringe.

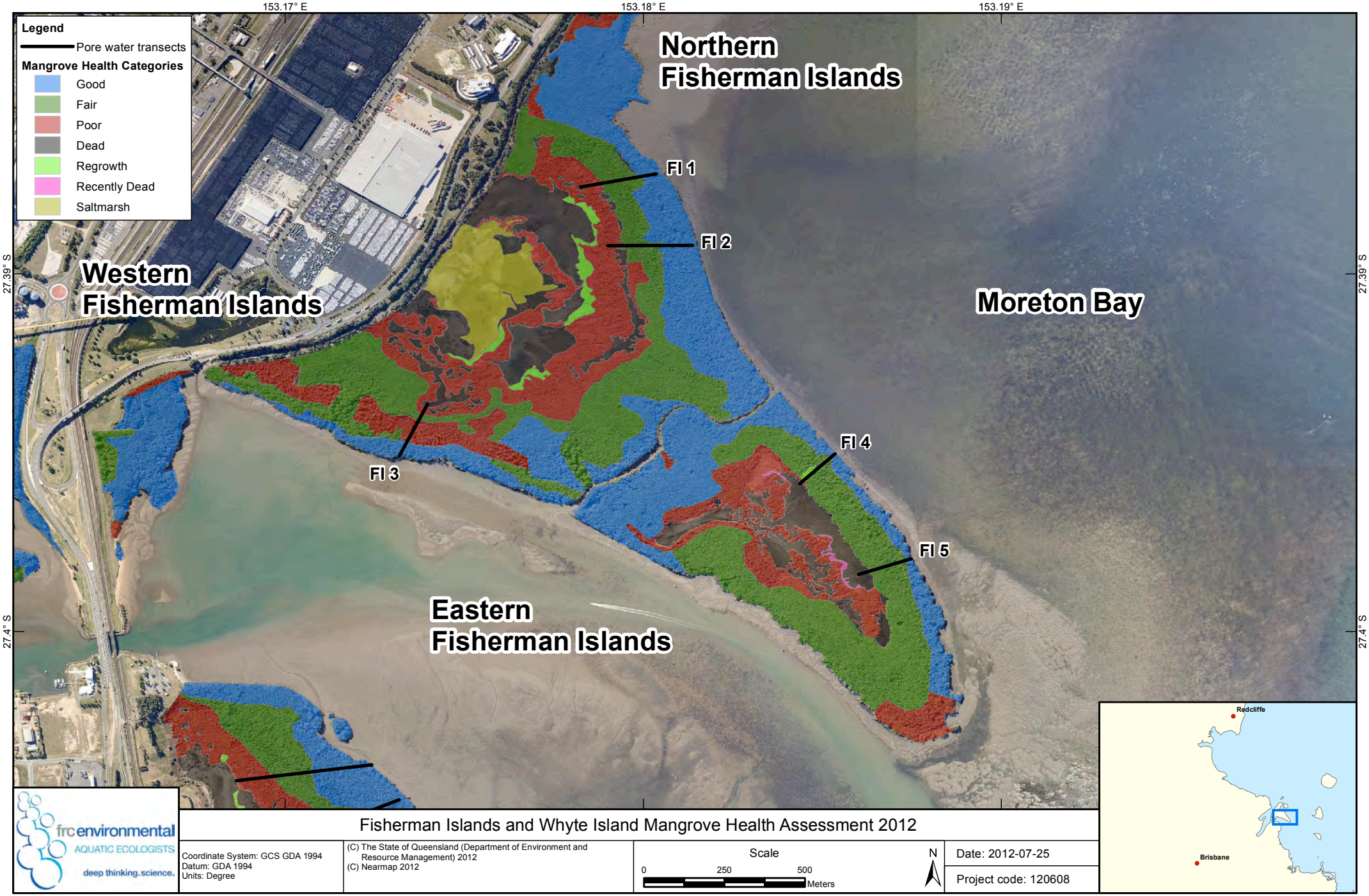

Figure 2.1 Location of pore water sampling transects at Fisherman Island in 2012.

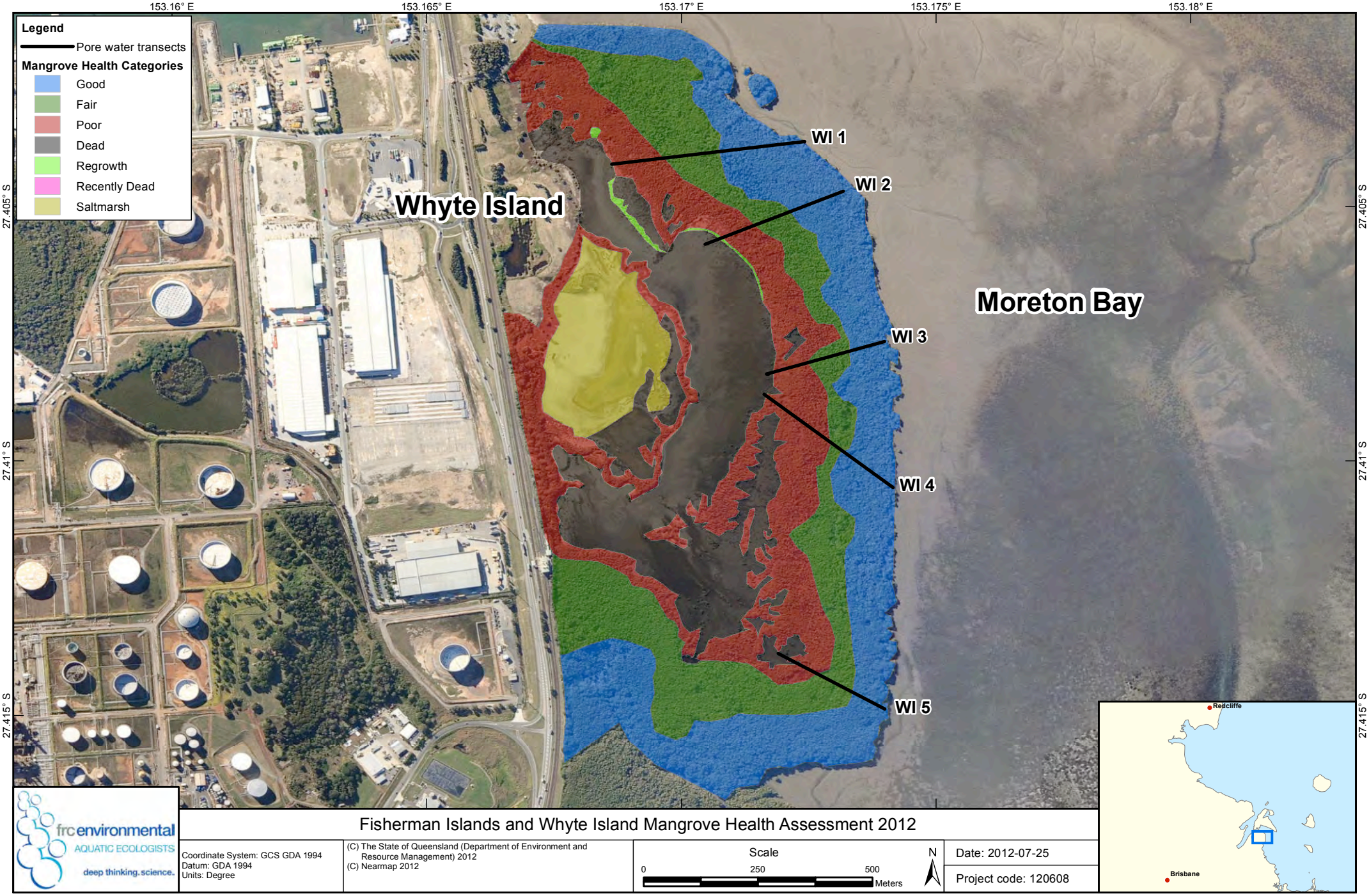

Figure 2.2 Location of pore water sampling transects at Whyte Island in 2012.

Table 2.1 Position of pore water transects.

Site	Start of Transect		End of Transect	
	Easting [a]	Northing [a]	Easting [a]	Northing [a]
Coal Loader				
No transects surveyed				
Fisherman Islands				
FI 1	517 601	6 970 465	517 729	6 970 476
FI 2	517 669	6 970 246	517 777	6 970 229
FI 3	517 085	6 969 755	517 027	6 969 603
FI 4	518 115	6 969 515	518 181	6 969 604
FI 5	518 278	6 969 244	518 374	6 969 328
Whyte Island				
WI 1	516 587	6 968 611	516 741	6 968 859
WI 2	516 677	6 968 551	516 846	6 968 690
WI 3	516 886	6 968 181	517 099	6 968 155
WI 4	516 949	6 967 990	517 101	6 967 997
WI 5	516 912	6 967 512	517 084	6 967 396
Wellington Point				
WP 1	525 201	6 959 707	525 536	6 960 030
WP 2	525 473	6 959 426	525 657	6 959 273
Mooroondu Point				
MP 1	519 865	6 960 981	520 014	6 961 130

[a] transect position recorded using a GPS (AGD84 Zone 56J)

Figure 2.3 Location of pore water sampling transects at Wellington Point in 2012.

Figure 2.4 Location of pore water sampling transects at Mooroondu Point in 2012.

Figure 2.5

The pore water sampling apparatus in use.

2.2 Data Analysis

The salinity of each pore water sample was measured in practical salinity units (PSU) using a Quanta Hydrolab water quality meter, in the frc environmental laboratory.

A PERMANOVA test was used to test for differences in the salinity of pore water between health categories and locations.

3 Results

Overall, the mean salinity of the pore water in the sediment was lower in 2012 than in earlier surveys. The difference in salinity between categories was less in 2012 than in earlier surveys; however there was still a significant difference in the salinity of each health category ($p = 0.00$), as was the case in earlier surveys (Figure 3.1 and Table 3.1 to Table 3.3).

In 2012, the salinity of pore water in dieback areas was significantly different to that of mangroves in good and fair health. The salinity of pore water in forests of good health was also significantly different to that of forest in fair or poor health.

The lower salinity of pore water in 2012 is likely to be related to heavy rainfall prior to the survey. There was heavy regional rainfall only days before the survey and relatively substantial rainfall during many of the months leading into the survey (Figure 3.2). There was also substantial surface water pooling in the survey area (e.g. Figure 3.3 to Figure 3.5).

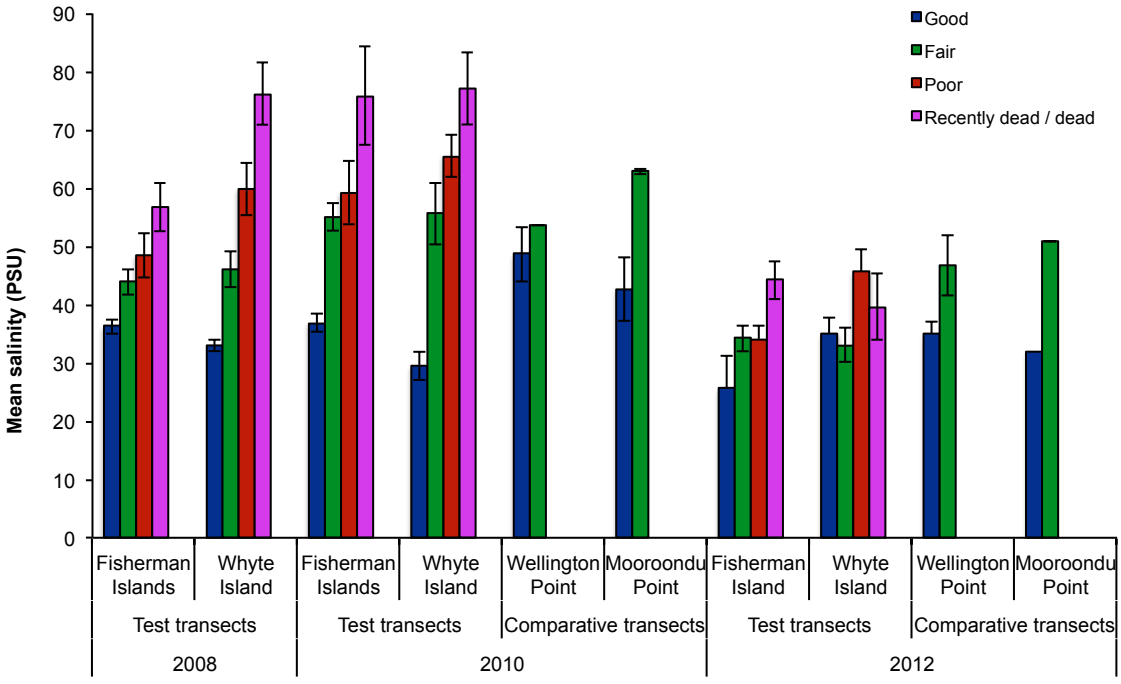

Figure 3.1 Mean salinity of pore water (± SE) in each area surveyed in 2008. 2010 and 2012.

Table 3.1 PERMANOVA results for the salinity of pore water in 2012.

	DF	Mean Squares	p Values
Location	3	195	0.07
Health	3	430	0.00
Location x Health	5	131	0.14
Error	35	72	–

Table 3.2 PERMANOVA results for the salinity of pore water in 2010.

	DF	Mean Squares	p Values
Location	3	120	0.52
Health	3	3278	0.00
Location x Health	5	97	0.72
Error	48	164	–

Table 3.3 PERMANOVA results for the salinity of pore water in 2008.

	DF	Mean Squares	p Values
Location	1	648	0.00
Health	3	2283	0.00
Location x Health	3	306	0.00
Error	42	58	–

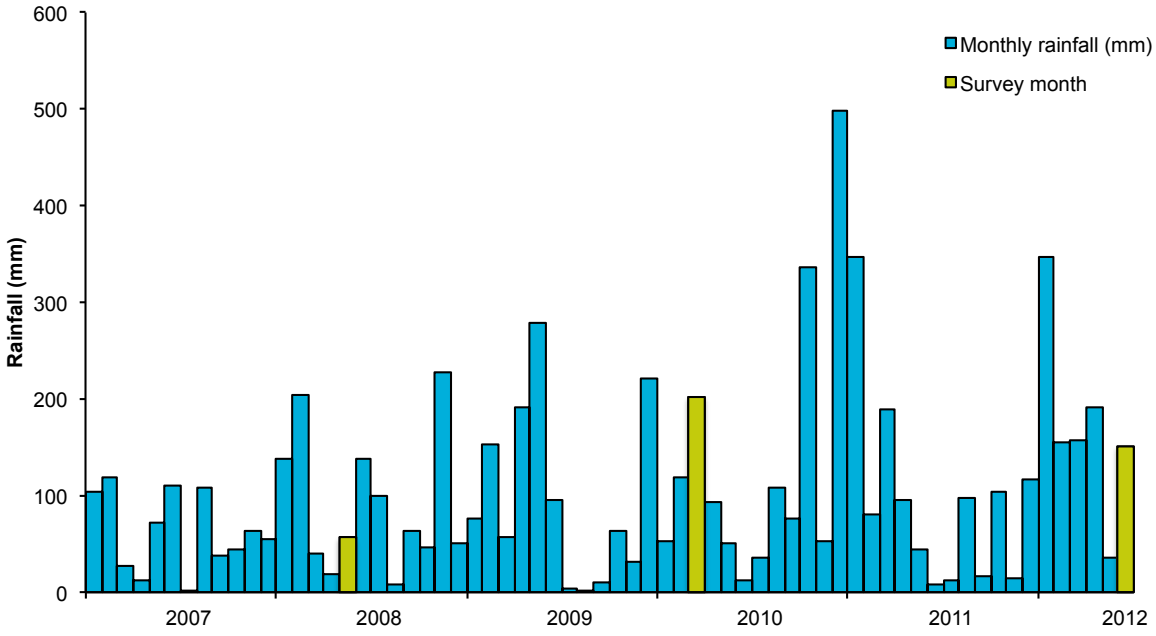

Figure 3.2 Mean monthly rainfall at Brisbane Airport, and the month in which the survey occurred in 2008, 2010 and 2012 (green bar).

Figure 3.3

Pooling water at Whyte Island in June 2012.

Figure 3.4

Pooling water at Whyte Island in June 2012.

Figure 3.5

Pooling water at Fisherman Island in June 2012.

4 Discussion and Recommendations

In 2012, the salinity of pore water in the mangrove forests was generally lower for all health categories at all locations, than in earlier surveys. This was likely to be related to large freshwater inputs leading into the survey (i.e. rainfall). This overall decrease in salinity was likely to be associated with the overall reduction in total area of recently dead mangroves on Fisherman Islands and Whyte Island (as discussed in Appendix A); however salinity is unlikely to be the only factor contributing to mangrove health and dieback.

Inclusion of the salinity of pore water assessment in future mangrove health monitoring, including the comparative transects, will further our understanding of the relationship between the salinity of pore water and mangrove health. Increasing the number of samples per sampling point will reduce the variability in the data set, particularly in the poor and dieback areas (where variability is highest), and provide a more robust data set. Collecting pore water data from the areas that have been dead for some time, and from areas where saltmarsh is colonising will also provide valuable data related to the more extreme environmental conditions in the Port of Brisbane mangrove forests.

Increasing the frequency of surveys (to bi-annually) will also provide information about seasonal variations associated with influences such as rainfall.

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Appendix E Potential Causes of Mangrove Dieback

Contents

Figures

1 Introduction

1.1 Historical Context

In the past 200 years, there have been major changes to coastal landscapes in south-east Queensland, including significant changes to wetland communities. Historical changes to mangrove communities at Fisherman Islands and Whyte Island are discussed in more detail in the 2006 monitoring report (frc environmental 2007a).

In summary, observed changes to wetlands in the area include:

- direct and intended change (e.g. as reclamation or intentional clearing for roads)
- direct and unintended change (e.g. oils spills)
- indirect and unintended changes (e.g. increases in nutrient run-off and discharges, or erosion due to boat wash), and
- less obvious human-related impacts (e.g. as storm damage and climate change).

Reclamation of tidal wetlands, to make way for the construction of the Port of Brisbane, began in 1958 (Duke et al. 2003).

Observed long- and short-term changes to mangrove communities near the Port of Brisbane are likely to be the cumulative response to a number of anthropogenic and natural processes. Anthropogenic changes include:

- major changes to mangrove communities in the area resulting from reclamation and construction
- significantly increased nutrient loads, and
- significantly increased sediment loads (Neil & Yu 1996 in Duke et al. 2003).

These anthropogenic changes have happened against a background of natural change associated with variations in climate and sea level, which also impact mangrove distribution.

The canopy cover of mangroves on Fisherman Islands (including the Coal Loader area) and Whyte Island all increased from the 1950s to the early 1970s. Mangroves also colonised new areas over this period.

From 1972 to 1978, mangroves were reclaimed to the west of the road at Fisherman Islands, with subsequent colonisation to the east, due to unconfined dredge spoil deposition (WBM Oceanics Australia 2000). Between 1978 and 1987, unconfined spoil on the central saltpan area appeared to have moved north, killing the mangroves along

the edge (WBM Oceanics Australia 2000). In 1991, there were dead mangroves in the vicinity of stockpiled dredge material near the access road on the southern end of Fisherman Islands (WBM Oceanics Australia 2000). By 1994, the area of bare mud, and mangroves in poor health had increased, particularly around the periphery of the central bare area.

From 1972 to 2002, mangroves at Whyte Island decreased in area by 73 ha (WBM Oceanics Australia 2002). Sixty percent of this was due to the intentional and authorised removal of mangroves due to construction of Port Drive in the late 1970s and subsequent development to the west of the road. The remaining loss was unintentional (WBM Oceanics Australia 2002).

1.2 Summary of Potential Causes of Mangrove Damage

In a historical context, the major damage to the mangroves of Fisherman Island and Whyte Island has been direct reclamation, and the impacts of unconfined dredge material spreading out over mangrove communities. However, some decades since reclamation in these areas has ceased, large areas of mangroves continue to decline in health. While this may in part be due to the forests reaching a new equilibrium with the newly created morphology and hydrology, there are likely to be other factors involved.

The majority of trees that have died on Fisherman Islands and Whyte Island were the grey mangrove (*Avicennia marina*), the dominant species in the area. However, yellow mangrove (*Ceriops tagal*) trees have also died in some areas of Fisherman Islands.

A number of interacting factors impact mangrove health in the vicinity of the Port of Brisbane. Some areas of dieback have been predominantly impacted by erosion, sediment accretion and wind. These areas are relatively small, and typically include characteristics such as undermining of roots, sediment deposition on roots, and circular holes in the canopy.

Of more concern is the larger scale dieback in the middle of large areas of Fisherman Islands and Whyte Island, including in the middle of the eastern section of Fisherman Islands. The cause of dieback in these larger areas is less readily identified, and was likely to be a combination of factors, including:

- changes to climate, including wet and dry cycles in rainfall
- changes to hydrology and morphology in the area
- sediment pore water salinity levels
- the historical distribution and health of these communities, and
- increased nutrient supply;

- while other factors, such as contaminants, may also be involved, testing to date does not support this.

Our assessment of impacts likely to be causing mangrove dieback focuses on the larger areas of dieback at Fisherman Islands and Whyte Island, but also includes a brief discussion of the overall decline in health in parts of Fisherman Islands and Whyte Island.

1.3 Major Flooding of the Brisbane River

There was major flooding of the Brisbane River in January 2011, which is likely to have impacted the mangroves in the survey area to some extent. The flood caused an almost complete destruction of mangroves upstream of the Indooroopilly Bridge to the Moggill Ferry. Downstream of the Indooroopilly Bridge, impacts were less evident and mainly dependent on the level of siltation. As of June 2011, no impacts due to flooding had been recorded for the survey area (DERM 2012).

The flooding caused the death, destruction or partial destruction of 76 km of mangroves along the Brisbane River. This represents 92% of the mangroves along the Brisbane River from Breakfast Creek to the Bremer River prior to January 2011. As a result of siltation, an additional 2.4 km of mangroves were dead or dying in June 2011. Further losses are expected, of *Avicennia marina* (the grey mangrove) in particular, with a predicted loss of approximately 95% of mangroves in this section of the river by December 2012. The recovery of mangrove communities along the river is predicted to take up to 10 years, and will be dependent on seasonal factors (DERM 2012).

There was a similar, but somewhat larger, flood in January 1974. Mangrove loss due to this flood was much less, as there were only mangroves near the mouth of the river at that time (DERM 2012).

Impacts of riverine flooding on mangrove communities include:

- prolonged inundation
- lower salinity
- siltation
- strong currents associated with the flood water
- higher wave action on the edge of the mangrove forest due to higher water levels
- wind, waves and current associated with the storms, and
- damage by debris.

In a number of species, including *A. marina*, prolonged flooding with brackish water can impede photosynthetic processes such as leaf water potential whereas flooding with freshwater can enhance the same processes (Naidoo 1983; 1985; Pezeshki et al. 1990; Krauss et al. 2006).

While the mangroves in the survey area may not have been subjected to the strong currents associated with the floodwater, it is likely that they may have been impacted by waves and currents and the movement of debris. Changes to inundation and salinity regimes may also have had some impact.

2 Summary of Mangrove Health in 2012

In 2012, there were fewer recently dead mangroves and a larger total area of regrowth associated with dieback areas than in 2010. The total area of recently dead mangroves was 2.5 ha (0.9% of the total mangrove area) in 2008 [1] and only 0.2 ha (0.1% of the total mangrove area) in 2012. The total area of dead mangroves has slightly decreased from 52.9 ha (19.1% of the total mangrove area) in 2008 to 51.5 ha (17.7% of the total mangrove area) in 2012.

Between 2010 and 2012, the total area of mangroves in poor and fair health increased while the total area of mangroves in good health decreased. This was likely to be related to a number of interacting factors including the drought conditions leading into the 2010 survey, followed by severe flooding in early 2011.

2.1 Fisherman Islands

Western Area

Between 2010 and 2012, the total area of dead mangroves decreased and there were no recently dead mangroves in this area in 2012. There was a relatively large area of regrowth along the margin of the dead area (i.e. extensive epicormic shoots and dense seedlings). This was likely to be related to increased rainfall (effectively diluting the salinity of the pooling water, and creating more favourable conditions for mangrove growth).

There was an increase in the total area of forest in poor health in this area, mostly due to reduced health in the area of forest near the south-western shore. Evidence of poor health in this area included epicormic shoots, deformed pneumatophores, yellowing leaves, insect damage and a decrease in canopy cover. This may be related to potential impacts to water quality in the drain adjacent to northern Fisherman Islands, which drains into the small inlet between western Fisherman Islands and the eastern Coal Loader area, and / or the early 2011 flooding.

[1] The recently dead mangrove category was first recorded in 2008; prior to 2008 the recently dead mangroves were included in the dead category.

The flooding was likely to have caused this drain to overflow into the mangroves for an extended period of time, and may have introduced contaminants from upstream [2]. Assessment of water quality in this drain would assist in determining whether the decline in mangrove health is related to water quality in this drain, and stormwater run-off from the port area.

Seagrass wrack had accumulated along the landward edge of the dieback area in 2012, as was the case during earlier surveys (and at eastern Fisherman Islands, the Coal Loader area and Whyte Island in 2012 and earlier surveys). This indicated that there had been strong water movements through the area at times, including the 2011 flooding of the Brisbane River. The seagrass wrack was likely to have impeded tidal drainage and contributed to water pooling and possibly the decrease in mangrove health in the area.

Eastern Area

In 2012, the total area of dead mangroves decreased slightly, primarily because there had been some improved health along the margin of the dieback area and mangroves. The total area of recently dead mangroves also decreased. This was likely to be related to increased rainfall.

While not associated with the dieback area, the most eastern tip of the peninsula was in fair to good health in 2010, but in fair to poor health in 2012. This decline in health was mostly evident via reduced canopy cover, leaf loss and yellowing of leaves, which may be related to damage associated with flooding in early 2011 (as large volumes of water would have rapidly moved over the peninsula).

Seagrass wrack had accumulated in areas of eastern Fisherman Islands in 2012. This indicated that there had been strong water movements through the area at times, including the 2011 flooding of the Brisbane River. These berms of seagrass wrack were consolidated and likely to have severely impeded tidal drainage and contributed to water pooling and possibly mangrove health in the area.

[2] The concentration of most contaminants was below the laboratory limit of reporting and / or trigger values at the sediment quality sites in 2012; however potential contaminants were likely to have been introduced to the water and / or sediment of the survey area at some stage between January 2011 and the 2012 survey, given the extent of flooding.

Northern Area

In 2012, there was an overall decline in mangrove health at northern Fisherman Islands. The most substantial change was an increase in the area of forest in poor health near the landward margin. These areas of poor health were characterised by patches of very soft sediment with macroalgal mats and slicks on the water surface, together with reduced canopy cover, leaf damage by insects and deformed pneumatophores. This may be related to potential impacts to water quality in the drain adjacent to northern Fisherman Islands and / or the early 2011 flooding. The flooding was likely to have caused this drain to overflow into the mangrove for an extended period of time and may have introduced contaminants from upstream. Assessment of water quality in this drain would assist in determining whether the decline in mangrove health is related to water quality in this drain, and with strormwater run-off from the port area.

Since 2004 the relatively large area of dead mangroves in the northern area has progressively decreased in size, with mangroves in poor health growing into this area.

Coal Loader Area

Erosion and deposition of sediment has reduced the health of this area since 2008. In 2012, several large trees had been undermined by erosion, primarily along the western (lining the main channel of the Brisbane River) and south-eastern shore of the forest to the east of Port Drive, and along the northern shore of the forest to the west of Port Drive (lining the inlet that receives the water from the drain lining the western Fisherman Islands forest). An assessment of flow data from the gauging station at the downstream end of the drain lining the western Fisherman Islands forest and the establishment of permanent photographic points along the eroding shores would assist in determining the extent and potential cause of erosion. The potential causes are likely to include influences such as fast water flow in the Brisbane River (including that of the early 2011 floods) and the drain adjoining the western Fisherman Islands forest (although we understand that there is a gate on this drain), and boat wash.

2.2 Whyte Island

There were no recently dead mangroves in this area in 2012, and regrowth continued. This was likely to be related to the higher rainfall, and consequent lower pore water salinity.

Health decreased from good to fair in areas of the forest along the northern shore, and from fair to poor throughout much of the forest. This general decline in health may have

been related to contaminants and / or physical damage associated with the 2011 flooding. Seagrass wrack had also accumulated in some areas in 2012. This indicated that there had been strong water movements through the area at times, including the 2011 flooding. These berms of seagrass wrack were consolidated and likely to have severely impeded tidal drainage and contributed to water pooling and possibly mangrove health in the area.

3 Possible Causes of Dieback

3.1 Salinity

Increased salinity levels associated with low rainfall have been implicated as the causal agent of dieback of *A. marina* mangrove communities in many cases, including:

- the Embley estuary in far north Queensland, an area remote from human intervention (Conacher et al. 1996)
- the arid Pilbara coast of Western Australia (Gordon 1987), and
- commonly in West African mangrove ecosystems (Marius & Lucas 1991).

High salinity levels are associated with:

- impeded photosynthetic processes such as
  - reduced leaf photosynthesis (Sobrado 1999; Li et al. 2008)
  - reduced leaf ion concentration and
  - hydraulic conductivity (Lovelock & Ellison 2007), and
- reduced mangrove growth (Cintron et al. 1978; Ball 1988; Kahn & Aziz 2001; Naidoo 2006; Yan et al. 2007; Li et al. 2008) and death (Perdomo et al. 1998).

In 2008, 2010 and 2012, the pore water salinity in the sediment was generally higher in dieback areas than from forests in good health. In 2012, the salinity of pore water in the mangrove forests was generally lower for all health categories at all locations, than in earlier surveys. This was likely to be related to high rainfall prior to the survey. This overall decrease in salinity was likely to be associated with the overall reduction in total area of recently dead mangroves on Fisherman Islands and Whyte Island; however salinity is unlikely to be the only factor contributing to mangrove health and dieback.

3.2 Rainfall

Between 1955 and 1998, the Moreton Bay region saw a net expansion of mangroves in the intertidal zone (frc environmental 2001). It has been suggested that this was due to wetter conditions in the region and increased sedimentation over this period (Duke et al. 2003). Mangroves that colonised over this period would not need to adapt to high salt concentrations in the sediment. With decreasing rainfall, pore water salinity would rise, and these mangroves would have been under increasing stress. In contrast, stunted mangroves that developed in highly saline areas may have been able to survive.

Similarly, the landward expansion of mangroves in south east Queensland has been correlated with rainfall, with more rapid expansion in wetter years, and large gaps appearing in mangroves in dryer periods (Eslami-Andagoli et al. 2009).

In 1999, rainfall was above average, but decreased again in 2000, and was below average from 2000 to 2007 (Figure 3.1). It was likely that this increased soil salinity, particularly in marginal mangrove habitats, and increased physiological stress on the mangroves. Over this time, a number of areas of mangrove dieback were recorded in Moreton Bay, including Whyte Island, Fisherman Islands, Luggage Point, the Caboolture River, Boondall Wetlands, (Pedersen 2002; frc environmental 2007b), Cobby Cobby Island, Coombabah Lake, and Hayes Inlet.

In 2008, there was an increase in annual rainfall, and rainfall has generally remained above the long-term annual average since 2008 (BOM 2012). Higher rainfall is likely to have reduced the salinity of surface and pore waters. This is also likely to have increased regrowth of mangrove in areas that were dying in 2008 and 2010, and decreased the rate of dieback.

3.3 Potential Contaminants

Sediments at Fisherman and Whyte Islands have been tested for contaminants including nutrients, TPH, BTEX and Organochlorides and heavy metals. There were no clear trends between the concentration of potential contaminants and mangrove health.

Increased nutrient availability in association with high salinity in the sediment can negatively impact mangrove health (Lovelock et al. 2009). The interaction between nutrients and salinity may be contributing to changes in mangrove health in the dieback area. Assessment of nutrient concentrations along the pore water transects would assist in determining whether this is the case.

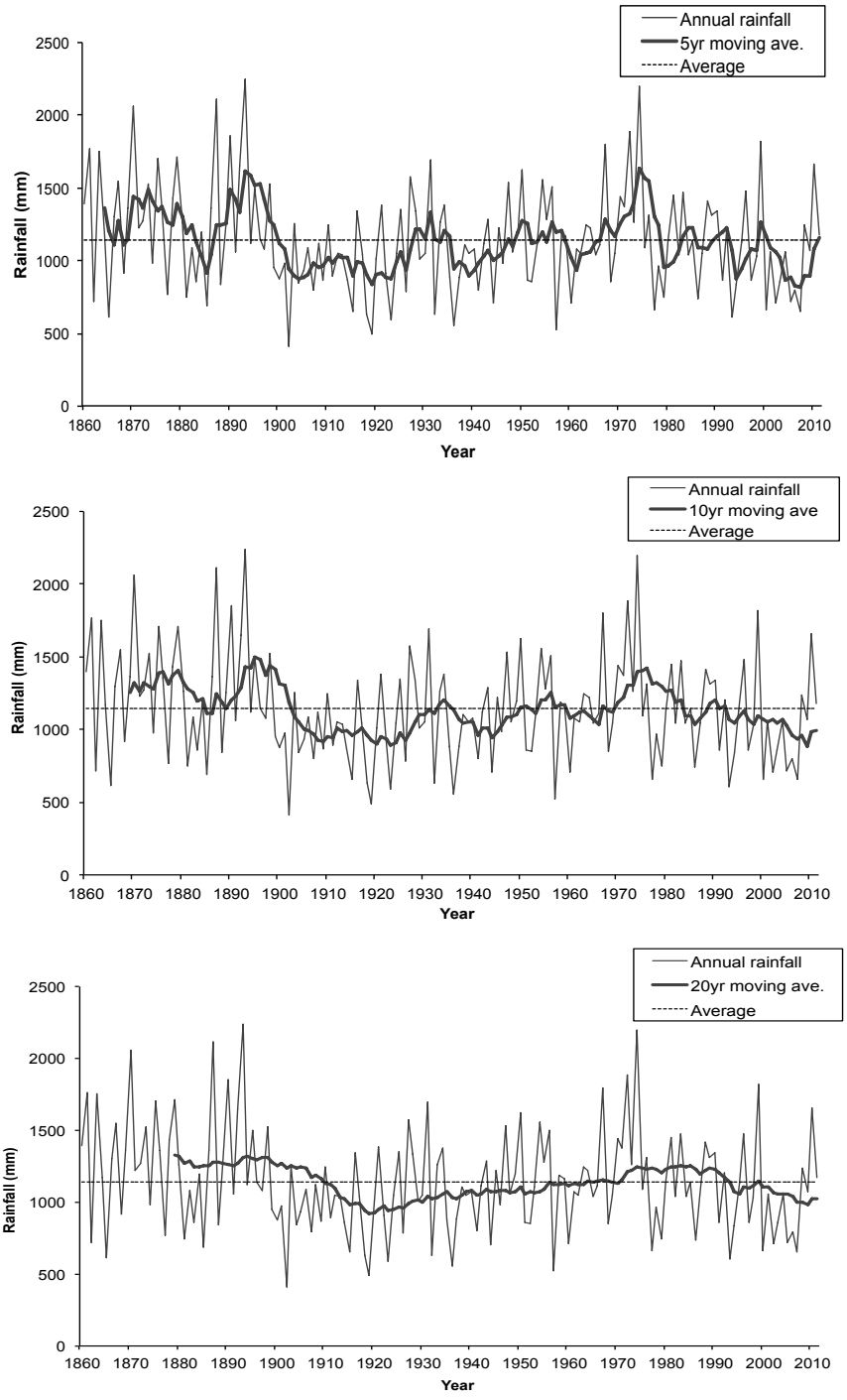

Figure 3.1 Average annual rainfall between 1860 and 2009, showing 5, 10 and 20 year rolling averages. [3]

[3] Updated from from Duke et al. (2003b) based on Bureau of Meterology (2012).

3.4 Ponding of Water

Recent dieback at both Fisherman Islands and Whyte Island was often associated with the ponding of water. Similar dieback associated with the ponding of water has also been recorded in other areas of Moreton Bay, in particular Nudgee, Nundah and Burpengary Creeks (frc environmental 2007b; 2008). A detailed discussion of this process was provided in the 2010 monitoring report (frc environmental 2010).

4 Conclusions and Recommendations

Longer-term changes in rainfall appear to have an over-riding influence on patterns of mangrove dieback and recolonisation in Moreton Bay. However several influences also appear to be influencing the mangroves associated with the port, such as major regional flooding and boat wash.

Continued monitoring is recommended, and could be enhanced by further investigations such as:

- ongoing measurement of pore water salinity in sediment from dieback and healthier areas, including
  - an assessment of potential contaminants, particularly nutrients, along a sub-set of transects
  - increasing the number of samples per sampling point, particularly in the poor and dieback areas
  - collecting pore water data from the areas that have been dead for some time, and from areas where saltmarsh is colonising, and
  - increasing the frequency of surveys (to bi-annually) will also provide information about seasonal variations associated with influences such as rainfall
- assessment of water quality and flow in the drain that lines the western Fisherman Islands mangrove forest
- assessment of additional permanent photographic points, particularly in areas with high erosion
- a dye run to establish which way the water flows out of the dieback areas, particularly in the new dieback area on Fisherman Islands
- laser survey or similar of dieback areas, to establish benchmark for sediment height, and
- measurement of nutrients, salinity and dissolved oxygen levels in ponded areas.

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Appendix F Survey Data from Fisherman Islands in 2012

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
GPS6																									
03/07/12	151	515535.00	6969158.01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
03/07/12	152	515529.67	6969157.15	70	2.5	–	–	90	10	0	5	5	0	1	1	0	1	1	3	0	A	1	0	F	Photos - 18-21
03/07/12	153	515532.93	6969201.29	30	12	–	–	–	Bg (100)	1	1	1	1	1	1	0	0	0	1	0	A	0	0	F	Photos - 22-23
03/07/12	154	515534.55	6969220.59	5	10	70	–	–	Bg (30)	1	1	1	1	1	1	0	0	0	0	0	A	0	0	P	Sandy berm
03/07/12	155	515542.44	6969239.07	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
03/07/12	156	515540.92	6969248.85	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
03/07/12	157	515546.35	6969282.55	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
03/07/12	158	515583.44	6969279.57	40	6	–	–	100	–	5	1	1	1	1	1	0	1	1	3	0	P	1	1	P	Photo 28 looking W
03/07/12	159	515597.89	6969272.75	80	0.7	100	–	–	–	1	1	1	1	1	1	0	0	1	3	0	P	3	1	RG	Photo 30
03/07/12	160	515638.52	6969271.41	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	161	515644.17	6969273.64	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	RG area
03/07/12	162	515661.52	6969271.77	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	163	515658.67	6969285.31	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	164	515601.42	6969190.68	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	165	515622.22	6969191.56	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	166	515639.64	6969207.47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	167	515655.48	6969221.27	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	168	515674.23	6969247.11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	169	515671.53	6969250.56	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	170	515664.28	6969256.02	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	171	515657.52	6969271.40	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	172	515664.13	6969278.78	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	173	515654.41	6969292.61	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	174	515625.76	6969287.72	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	175	515630.58	6969303.47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	176	515635.84	6969312.35	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	177	515637.02	6969314.22	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	178	515647.90	6969314.19	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	179	515658.72	6969310.85	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	180	515672.06	6969306.12	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	181	515686.99	6969297.40	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	182	515696.77	6969294.08	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	183	515704.98	6969295.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	184	515713.48	6969297.51	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
03/07/12	185	515714.94	6969320.92	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	186	515712.98	6969336.75	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	187	515686.80	6969357.49	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	188	515664.18	6969373.66	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	189	515670.28	6969417.40	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	190	515650.78	6969420.47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	191	515644.11	6969442.06	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	192	515649.11	6969456.37	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	193	515687.68	6969488.51	10	12	100	–	–	–	1	1	1	1	1	1	0	0	1	3	0	P	0	1	P	Photo 37
03/07/12	194	515625.59	6969556.94	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	RG zone next to Coal Loader
03/07/12	195	515644.30	6969555.74	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	196	515660.78	6969546.59	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	197	515677.32	6969541.53	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	198	515691.68	6969553.81	80	4	100	–	–	–	1	1	1	1	1	1	0	0	1	3	0	P	1	1	F	Old RG
03/07/12	199	515701.78	6969537.13	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
03/07/12	200	515705.06	6969550.73	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
03/07/12	201	517579.44	6970995.26	40	2	100	–	–	–	1	1	1	1	1	1	0	1	2	1	0	P	3	1	P	photo 43
03/07/12	202	517592.48	6970986.10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
03/07/12	203	517594.02	6970982.47	80	7	98		1	1 Bg(1)	1	1	1	1	1	1	0	0	1	2	0	P	3	1	F	44
03/07/12	204	517598.22	6970991.22	30	6	100	–	–	–	1	1	1	1	1	1	0	0	2	1	0	P	2	0	P	45
03/07/12	205	517626.41	6970992.34	40	8	100	–	–	–	1	1	1	1	1	1	1	1	1	1	0	P	1	0	P	
03/07/12	206	517634.80	6971018.37	60	5	100	–	–	–	1	1	1	1	1	1	0	0	1	1	0	P	3	0	P	
03/07/12	207	517644.20	6971018.25	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
03/07/12	208	517642.82	6971018.94	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	RS PRESENT
03/07/12	209	517650.91	6971036.63	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
03/07/12	210	517640.04	6971045.65	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	EDGE OF DEAD AREA
03/07/12	211	517635.86	6971051.16	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	EDGE OF DEAD AREA
03/07/12	212	517632.09	6971057.06	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	EDGE OF DEAD AREA
03/07/12	213	517629.74	6971056.91	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	EDGE OF DEAD AREA
03/07/12	214	517623.62	6971058.37	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	EDGE OF DEAD AREA
03/07/12	215	517606.88	6971068.31	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	EDGE OF DEAD AREA

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
03/07/12	216	517602.26	6971069.92	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	EDGE OF DEAD AREA
03/07/12	217	517603.74	6971071.60	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	DEAD ON BOTH SIDES
03/07/12	218	517607.99	6971077.04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	EDGE OF DEAD AREA
03/07/12	219	517613.63	6971086.34	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	EDGE OF DEAD AREA
03/07/12	220	517620.83	6971093.74	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	MILKY WHITE PRECIPITATE IN WATER
03/07/12	221	517644.76	6971057.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	poor
03/07/12	222	517642.39	6971060.36	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	poor
03/07/12	223	517638.79	6971066.10	60	8	90	–	–	10	0	1	1	2	2	2	1	1	1	1	0	P	1	1	P	PHOTO 50
03/07/12	224	517637.07	6971070.50	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	poor
03/07/12	225	517637.56	6971072.74	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	poor
03/07/12	226	517636.16	6971081.48	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	poor
03/07/12	227	517641.94	6971084.40	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	poor
03/07/12	228	517650.49	6971094.46	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	poor
03/07/12	229	517653.86	6971098.73	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	poor
03/07/12	230	517666.69	6971126.83	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	poor
03/07/12	231	517675.71	6971130.31	20	12	100	–	–	–	1	5	5	1	2	1	1	0	2	1	0	P	0	0	P	PHOTO 52
03/07/12	232	517724.34	6971163.89	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	poor
04/07/12	233	517015.00	6970060.02	40	1.5	100	–	–	–	5	1	1	1	1	1	0	0	1	0	0	A	1	1	P	54
04/07/12	234	517025.28	6970018.58	30	1	100	–	–	–	1	0	0	1	1	1	0	0	1	0	0	P	2	1	RG	55
04/07/12	235	517030.96	6970037.15	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Boundary of dead and poor
04/07/12	236	517035.54	6970039.09	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Seaward = poor
04/07/12	237	517039.66	6970028.02	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Boundary of D and P
04/07/12	238	517039.37	6970021.71	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	239	517032.17	6970011.96	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	240	517019.27	6970008.02	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	241	517008.63	6970013.36	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	242	517004.34	6970025.99	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	243	516993.50	6970022.23	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	244	516991.01	6970008.52	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	245	516985.88	6970000.55	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	246	516990.58	6969989.25	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	247	516995.51	6969986.49	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	248	517006.30	6969977.71	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	249	517002.07	6969975.54	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	250	516992.37	6969971.61	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	251	516989.21	6969966.70	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	252	516985.67	6969958.68	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	253	516988.12	6969953.50	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	254	517001.70	6969947.72	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	255	517007.99	6969943.38	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	256	517017.54	6969934.74	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	257	517026.39	6969924.14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	258	517030.09	6969919.94	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	259	517043.87	6969916.41	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	260	517054.96	6969912.83	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	261	517063.31	6969905.96	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	262	517077.16	6969891.72	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	263	517076.10	6969875.56	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	264	517078.93	6969865.22	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	LOTS OF ALGAE FLOATING
04/07/12	265	517082.27	6969861.30	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	266	517102.41	6969856.99	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	267	517102.86	6969841.75	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	268	517108.40	6969833.53	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	269	517120.57	6969830.07	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	270	517128.55	6969833.18	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	271	517131.90	6969830.80	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	272	517130.35	6969819.19	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	273	517122.26	6969813.33	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	274	517120.23	6969802.44	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	275	517120.85	6969786.73	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	276	517122.96	6969777.34	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	277	517115.19	6969773.13	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	278	517102.51	6969772.47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	279	517095.66	6969776.26	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	280	517087.34	6969776.39	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	281	517081.90	6969769.47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	282	517085.79	6969761.79	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	283	517095.59	6969755.28	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	284	517100.83	6969756.32	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	285	517102.39	6969753.35	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	286	517106.87	6969756.25	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	287	517117.94	6969757.52	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	288	517129.74	6969760.54	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	289	517143.92	6969767.01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	290	517151.14	6969769.67	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	291	517162.75	6969771.71	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	292	517169.45	6969771.40	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	293	517179.24	6969769.72	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	294	517193.46	6969772.69	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	295	517202.32	6969777.82	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	296	517214.49	6969784.31	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	297	517215.08	6969791.77	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	298	517207.10	6969795.20	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	299	517210.69	6969796.32	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	300	517221.71	6969806.16	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	301	517225.12	6969815.76	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	302	517217.96	6969821.67	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	303	517212.89	6969826.34	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	304	517210.62	6969829.97	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	305	517214.95	6969834.77	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	306	517211.50	6969842.17	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	307	517183.26	6969848.83	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	308	517166.85	6969860.77	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	309	517169.55	6969871.41	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	310	517166.69	6969877.79	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	311	517156.40	6969872.67	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	312	517141.21	6969873.99	80	15	100	–	–	–	1	1	1	1	1	1	0	1	1	1	2	A	1	1	F	FEW SAPLINGS ADJACENT TO DEAD FOREST
04/07/12	313	517139.00	6969876.78	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	314	517113.52	6969881.72	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	315	517106.83	6969885.47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	316	517113.89	6969888.26	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	317	517122.73	6969888.15	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	318	517111.47	6969888.74	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	319	517097.49	6969891.32	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	320	517093.36	6969892.21	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	321	517092.87	6969896.27	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	322	517082.70	6969905.46	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	323	517084.18	6969915.96	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	324	517082.34	6969919.72	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	325	517080.18	6969925.02	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	326	517076.17	6969928.72	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	327	517074.30	6969935.37	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	328	517102.31	6969941.90	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	329	517100.96	6969934.27	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	330	517102.61	6969929.02	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	331	517106.77	6969921.55	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	332	517115.17	6969914.27	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	333	517119.10	6969911.98	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	334	517124.61	6969901.98	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	335	517127.59	6969895.14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	336	517135.79	6969891.02	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	337	517141.73	6969888.64	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	338	517145.86	6969891.39	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	339	517146.37	6969896.34	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	340	517138.44	6969901.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	341	517135.95	6969904.09	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	342	517136.76	6969907.54	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	343	517137.80	6969911.78	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	344	517147.61	6969921.87	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	345	517147.26	6969920.24	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	346	517156.64	6969924.66	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	EDGE OF DEAD AND REGROWTH PHOTO 60
04/07/12	347	517170.16	6969914.42	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	
04/07/12	348	517176.80	6969913.90	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	
04/07/12	349	517188.36	6969912.58	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	
04/07/12	350	517199.86	6969904.85	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	
04/07/12	351	517216.65	6969898.45	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	352	517251.12	6969928.15	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	EDGE OF RG AND BARE
04/07/12	353	517273.91	6969952.11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	
04/07/12	354	517277.74	6969954.56	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	
04/07/12	355	517292.31	6969969.36	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	
04/07/12	356	517296.02	6969977.37	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	
04/07/12	357	517296.30	6970006.56	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	
04/07/12	358	517300.07	6970017.21	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	
04/07/12	359	517308.91	6970026.61	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	
04/07/12	360	517315.04	6970027.13	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	
04/07/12	361	517336.28	6970035.14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	
04/07/12	362	517349.24	6970043.07	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	
04/07/12	363	517356.33	6970046.59	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	
04/07/12	364	517366.58	6970055.22	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	
04/07/12	365	517388.80	6970066.58	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	
04/07/12	366	517408.21	6970076.04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	
04/07/12	367	517419.29	6970079.46	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	
04/07/12	368	517432.06	6970079.12	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	
04/07/12	369	517438.57	6970072.99	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	CROSSED THIN STRIP OF F TO GET TO DEAD
04/07/12	370	517414.55	6970046.89	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Boundary of dead and poor
04/07/12	371	517418.73	6970032.86	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	372	517409.03	6970012.66	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	373	517403.61	6970008.85	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	374	517368.84	6970011.81	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	375	517350.20	6970015.58	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	376	517343.55	6970014.32	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	377	517331.74	6970010.73	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	378	517329.60	6970012.56	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	379	517327.11	6970018.02	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	380	517322.28	6970018.16	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	381	517316.12	6970011.27	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	382	517317.59	6970003.73	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	383	517323.38	6969991.69	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	384	517326.02	6969983.36	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	385	517330.86	6969979.36	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	386	517334.02	6969963.39	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	387	517326.07	6969951.80	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	388	517325.89	6969945.73	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	389	517326.57	6969935.92	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	390	517323.70	6969907.92	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	391	517322.00	6969905.64	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	392	517313.83	6969904.20	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	393	517306.86	6969901.80	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	394	517297.28	6969897.62	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	395	517293.59	6969897.60	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	396	517282.99	6969899.25	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	397	517279.72	6969896.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	398	517283.65	6969890.82	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	399	517297.27	6969872.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	400	517301.22	6969865.90	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	401	517304.69	6969858.24	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	402	517306.04	6969850.30	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	403	517308.48	6969844.81	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	404	517313.53	6969837.21	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	405	517318.65	6969829.50	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	406	517332.21	6969825.81	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	407	517345.23	6969827.90	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	408	517348.04	6969830.01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	409	517352.12	6969835.12	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	410	517356.14	6969847.66	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	411	517359.58	6969850.93	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	412	517364.30	6969859.40	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	413	517366.48	6969862.39	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	414	517371.06	6969870.21	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	415	517377.59	6969872.57	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	416	517390.38	6969885.51	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	417	517394.70	6969882.25	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	418	517397.76	6969876.70	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	419	517404.87	6969865.74	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	420	517407.55	6969862.18	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	421	517414.79	6969861.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	422	517422.00	6969870.91	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	423	517419.70	6969877.19	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	424	517415.44	6969887.30	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	425	517421.86	6969887.75	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	426	517429.97	6969897.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	427	517449.90	6969919.49	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	428	517480.25	6969929.42	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	429	517506.66	6969955.28	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	430	517503.60	6969972.99	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	431	517483.18	6969993.63	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	432	517473.93	6970007.10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Boundary of dead and poor
04/07/12	433	517486.97	6970036.76	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	434	517495.84	6970045.26	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	435	517520.28	6970066.08	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	436	517531.54	6970088.18	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	437	517520.07	6970099.71	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	438	517519.09	6970111.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	439	517529.15	6970147.68	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	440	517493.46	6970188.38	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	441	517518.76	6970202.65	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	442	517510.68	6970245.29	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	443	517497.72	6970276.55	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	444	517524.20	6970272.14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	445	517536.39	6970266.07	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	446	517545.92	6970262.46	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	447	517552.74	6970265.40	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	448	517559.92	6970278.30	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	449	517555.44	6970292.78	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	450	517549.70	6970317.81	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	451	517549.91	6970325.99	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	452	517534.69	6970356.51	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	453	517523.93	6970372.79	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	454	517511.45	6970379.85	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	455	517494.36	6970384.99	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	456	517475.66	6970393.11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	457	517425.30	6970777.05	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	SMALL PATCH OF RG 10 X 3M

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	458	517697.78	6970441.87	80	15	80	–	–	20	1	1	1	1	1	1	0	0	1	3	0	P	2	1	G	PW1
04/07/12	459	517635.49	6970437.52	60	10	100	–	–	–	1	1	1	1	1	2	0	2	1	1	0	A	1	1	F	PW1
04/07/12	460	517597.78	6970461.36	80	3	100	–	–	–	1	1	1	1	1	1	0	2	1	2	0	A	1	1	RG	PHOTO 70
04/07/12	461	517528.01	6970439.68	40	3	100	–	–	–	1	3	3	1	1	1	0	3	2	1	0	A	1	1	P	PW1
04/07/12	462	517483.44	6970413.10	5	0.3	100	–	–	–	50	1	1	1	1	1	0	0	–	–	–	P	2	1	D	PW1
04/07/12	463	517629.23	6970248.97	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	LARGE START OF DEAD PATCH
04/07/12	464	517678.94	6970254.63	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	SMALL DEAD PATCH
04/07/12	465	517711.98	6970262.65	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/RG	FAIR / RG BORDER
04/07/12	466	517691.71	6970275.94	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/RG	
04/07/12	467	517684.62	6970249.61	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/RG	
04/07/12	468	517647.17	6970203.28	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/RG	
04/07/12	469	517688.57	6970207.85	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/RG	
04/07/12	470	517690.12	6970189.76	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/RG	
04/07/12	471	517695.87	6970176.28	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/RG	
04/07/12	472	517697.35	6970173.17	60	7	100	–	–	–	1	1	1	1	1	1	0	1	1	2	2	P	2	1	F	seaward fair
04/07/12	473	517713.89	6970148.73	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	POOR BOUNDARY
04/07/12	474	517691.67	6970138.64	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	
04/07/12	475	517675.71	6970138.24	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	
04/07/12	476	517673.78	6970134.12	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	
04/07/12	477	517671.94	6970108.96	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	
04/07/12	478	517668.88	6970099.85	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	
04/07/12	479	517673.23	6970087.35	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	
04/07/12	480	517676.09	6970078.61	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	
04/07/12	481	517677.26	6970065.90	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	
04/07/12	482	517702.28	6970033.85	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	
04/07/12	483	517698.72	6969968.26	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	
04/07/12	484	517720.54	6969954.37	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	
04/07/12	485	517703.69	6969940.83	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	
04/07/12	486	517693.55	6969929.07	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	
04/07/12	487	517575.26	6969905.83	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/F	DEAD/FAIR BOUNDARY
04/07/12	488	517555.27	6969827.73	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P/F	POOR/ FAIR BOUNDARY

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	489	517527.85	6969793.09	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	POOR BOUNDARY PHOTO 72
04/07/12	490	517459.27	6969720.46	80	2.5	80	–	20	–	1	5	5	1	2	2	0	3	2	2	0	A	4	0	P	POOR BOUNDARY
04/07/12	491	517314.52	6969639.14	30	6	50	–	50	–	70	5	5	1	2	2	1	2	2	1	0	0	3	0	P	/DEAD
04/07/12	492	517248.38	6969661.58	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	493	517183.29	6969706.13	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	EDGE OF CT DOMINATED FOREST
04/07/12	494	517099.96	6969708.35	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	DEAD PATCH 10M WIDE 30M LONG
04/07/12	495	517087.22	6969688.14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	Ct DOMINATED RG
GPS 8																									
03/07/12	107	518019.49	6971350.88	70	15	90	–	–	10	2	5	5	1	1	1	0	1	0	3	0	A	2	1	G	SEAWARD= GOOD
03/07/12	108	518015.49	6971357.11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	109	518036.33	6971365.49	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	110	518074.77	6971383.17	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	111	518089.56	6971390.23	85	20	50	–	–	50	3	2	1	0	0	1	0	1	0	3	0	A	4	1	G/RG	TRANSITION GOOD - RG
03/07/12	112	518098.89	6971378.47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/RG	SEAWARD = GOOD LANDWARD = RG
03/07/12	113	518116.11	6971355.59	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/RG	SEAWARD = GOOD LANDWARD = RG
03/07/12	114	518124.59	6971357.23	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/RG	SEAWARD = GOOD LANDWARD = RG
03/07/12	115	518145.06	6971371.72	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/RG	SEAWARD = GOOD LANDWARD = RG
03/07/12	116	518155.72	6971395.85	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/RG	SEAWARD = GOOD LANDWARD = RG
03/07/12	117	518164.88	6971410.02	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/RG	SEAWARD = GOOD LANDWARD = RG

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
03/07/12	118	518177.09	6971416.93	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/RG	SEAWARD = GOOD LANDWARD = RG
03/07/12	119	518192.65	6971443.18	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/RG	SEAWARD = GOOD LANDWARD = RG
03/07/12	120	518199.24	6971453.22	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/RG	SEAWARD = GOOD LANDWARD = RG
03/07/12	121	518217.72	6971465.68	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/RG	SEAWARD = GOOD LANDWARD = RG
03/07/12				–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
03/07/12	122	518227.60	6971493.88	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/RG	SEAWARD = GOOD LANDWARD = RG
03/07/12	123	518202.11	6971519.83	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/RG	SEAWARD = GOOD LANDWARD = RG
03/07/12	124	518183.29	6971539.46	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/RG	SEAWARD = GOOD LANDWARD = Fair
03/07/12	125	518066.97	6971570.84	60	10	90		10		2	3	4	1	2	2	0	2	1	3	0	A	4	1	F	PHOTO 48
03/07/12	126	518065.27	6971575.71	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
03/07/12	127	518072.15	6971601.70	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
03/07/12	128	518078.63	6971616.90	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
03/07/12	129	518091.63	6971623.84	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
03/07/12	130	518048.90	6971541.74	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
03/07/12	131	518039.20	6971518.48	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
03/07/12	132	518042.03	6971503.49	90	4	85		15		5	5	7	1	2	1	0	2	1	1	0	A	3	1	P	LANDWARD = POOR
03/07/12	133	518045.90	6971489.20	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	LANDWARD = POOR
03/07/12	134	518048.43	6971477.05	90	6	90		10		10	5	5	1	1	2	0	2	1	2	0	A	4	1	RG	LANDWARD =RG
03/07/12	135	518048.43	6971477.06	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	LANDWARD =RG
03/07/12	136	518043.81	6971452.66	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	LANDWARD =RG
03/07/12	137	518027.01	6971436.58	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	138	518010.71	6971422.98	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
03/07/12	139	518005.36	6971422.72	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG/P	SEAWARD = RG LANDWARD = POOR
03/07/12	140	517993.90	6971420.57	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG/P	
03/07/12	141	517978.11	6971422.96	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG/P	
03/07/12	142	517968.63	6971422.68	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG/P	
03/07/12	143	517967.89	6971426.80	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG/P	
03/07/12	144	517967.78	6971435.89	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P/D	SEAWARD=POOR/DEAD LANDWARD = POOR
03/07/12	145	517967.77	6971435.94	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P/D	SEAWARD=POOR/DEAD LANDWARD = POOR
03/07/12	146	517967.28	6971439.72	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P/D	SEAWARD=POOR/DEAD LANDWARD = POOR
03/07/12	147	517959.08	6971446.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P/D	SEAWARD=POOR/DEAD LANDWARD = POOR
03/07/12	148	517951.86	6971445.99	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P/D	SEAWARD=POOR/DEAD LANDWARD = POOR
03/07/12	149	517934.84	6971442.04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P/D	SEAWARD=POOR/DEAD LANDWARD = POOR
03/07/12	150	517923.52	6971432.60	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	POOR
03/07/12	151	517915.80	6971424.06	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
03/07/12	152	517909.75	6971421.87	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
03/07/12	153	517904.30	6971412.73	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
03/07/12	154	517902.49	6971391.47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
03/07/12	155	517899.47	6971376.70	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
03/07/12	156	517891.55	6971356.71	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
03/07/12	157	517887.04	6971350.33	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	158	516492.36	6969857.32	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD = POOR

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	159	516571.70	6969817.91	70	3.5	60	–	10	30	2	1	1	1	1	1	0	1	1	3	1	A	1	1	F	
04/07/12	160	516589.80	6969806.69	80	4	80		20		1	2	2	1	1	1	0	1	0	4	0	A	1	1	F	
04/07/12	161	516623.43	6969800.96	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
04/07/12	162	516642.08	6969788.92	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
04/07/12	163	516642.86	6969787.70	75	8	30		30	40	1	1	1	1	1	1	0	1	0	4	0	A	2	2	G	
04/07/12	164	516651.92	6969780.92	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	165	516664.33	6969778.35	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	166	516676.44	6969765.40	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	167	516677.42	6969765.56	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	168	516697.07	6969756.44	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	169	516705.63	6969754.02	75	10	60	–	–	20	2	2	2	1	1	1	0	0	0	4	0	A	3	2	G	
04/07/12	170	516709.10	6969756.48	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	171	516720.82	6969741.99	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	172	516742.20	6969730.22	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	173	516758.04	6969743.64	80	2.5	10	–	90		1	1	1	1	2	2	0	0	1	0	0	A	1	2	G	Ac Rs Ct SAPLINGS SHOREWARD with Ct FOREST LANDWARD
04/07/12	174	516767.14	6969751.21	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	175	516779.99	6969733.77	90	10	90	–	5	5	10	5	5	2	2	1	0	2	0	3	0	A	4	1	P/RG	
04/07/12	176	516782.44	6969730.11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	177	516796.86	6969725.24	40	15	90	–		10	2	1	1	1	1	1	0	2	0	3	0	A	3	1	F	
04/07/12	178	516806.79	6969720.10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
04/07/12	179	516810.10	6969718.15	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	pw
04/07/12	180	517028.04	6969693.03	60	6	20	–	60	20	5	3	3	1	1	1	0	1	2	1	0	A	3	1	P/RG	pw
04/07/12	181	517005.62	6969664.80	90	15	70	–	30		2	1	1	1	1	1	0	2	0	3	0	A	0	1	F	pw
04/07/12	182	517022.29	6969604.23	90	15	90	–	5	5	1	1	1	1	1	2	0	2	1	3	0	A	2	1	G	pw
04/07/12	183	517046.20	6969611.43	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	184	517084.45	6969606.47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	185	517119.83	6969595.04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	186	517146.97	6969601.74	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	187	517186.31	6969606.71	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	188	517202.93	6969595.72	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	189	517262.55	6969549.23	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	190	517342.60	6969511.74	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	191	517381.02	6969515.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
04/07/12	192	517396.33	6969509.28	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/RG	

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	193	517401.25	6969504.76	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/RG	
04/07/12	194	517420.58	6969491.49	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/RG	
04/07/12	195	517450.84	6969494.80	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/RG	
04/07/12	196	517468.36	6969485.35	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/RG	
04/07/12	197	517504.94	6969466.56	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/RG	
04/07/12	198	517493.84	6969432.90	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/RG	
04/07/12	199	517533.27	6969403.38	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	200	517543.65	6969402.08	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	201	517571.65	6969391.23	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	202	517600.28	6969372.85	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	203	517649.39	6969342.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	204	517663.06	6969336.26	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	205	517723.48	6969331.74	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	206	517732.48	6969330.51	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT
04/07/12	207	517728.94	6969330.95	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT
04/07/12	208	517724.29	6969343.19	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT
04/07/12	209	517726.08	6969349.96	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT
04/07/12	210	517744.20	6969362.97	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT
04/07/12	211	517750.66	6969368.20	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT
04/07/12	212	517756.97	6969382.66	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT
04/07/12	213	517755.18	6969395.19	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT
04/07/12	214	517770.44	6969396.09	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT
04/07/12	215	517783.61	6969396.02	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT
04/07/12	216	517811.36	6969401.30	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT
04/07/12	217	517839.55	6969411.59	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT
04/07/12	218	517868.71	6969426.96	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	219	517876.65	6969440.01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT
04/07/12	220	517886.48	6969444.19	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT
04/07/12	221	517894.56	6969454.02	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT
04/07/12	222	517898.95	6969469.09	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT
04/07/12	223	517900.13	6969473.94	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT
04/07/12	224	517907.35	6969467.44	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT
04/07/12	225	517923.57	6969450.85	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT
04/07/12	226	517926.90	6969450.78	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT
04/07/12	227	517933.51	6969443.09	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT
04/07/12	228	517944.82	6969435.97	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT
04/07/12	229	517957.94	6969440.43	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT POOR ON LEFT
04/07/12	230	517969.12	6969443.40	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	231	517979.09	6969451.37	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	232	517993.37	6969460.39	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	233	517994.32	6969462.19	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
04/07/12	234	518009.23	6969473.71	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
04/07/12	235	518026.35	6969486.32	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
04/07/12	236	518034.97	6969492.99	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
04/07/12	237	518039.79	6969496.43	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
04/07/12	238	518039.59	6969496.52	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	239	518053.99	6969506.68	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	240	518063.33	6969511.19	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	241	518068.17	6969512.84	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
04/07/12	242	518068.46	6969514.09	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
04/07/12	243	518075.31	6969517.93	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
04/07/12	244	518085.87	6969525.51	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
04/07/12	245	518092.67	6969528.73	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
04/07/12	246	518110.94	6969532.84	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	247	518113.32	6969533.69	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	SHOREWARD = FAIR LANDSIDE - DEAD
04/07/12	248	518113.05	6969532.05	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	SHOREWARD = FAIR LANDSIDE - DEAD
04/07/12	249	518120.75	6969522.04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	SHOREWARD = FAIR LANDSIDE - DEAD
04/07/12	250	518126.32	6969515.96	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	SHOREWARD = FAIR LANDSIDE - DEAD
04/07/12	251	518122.69	6969512.29	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	pw
04/07/12	252	518143.18	6969534.98	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	pw
04/07/12	253	518141.92	6969542.23	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
04/07/12	254	518149.42	6969544.08	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
04/07/12	255	518158.74	6969556.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
04/07/12	256	518167.36	6969565.14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
04/07/12	257	518169.60	6969573.73	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	pw
04/07/12	258	518175.19	6969579.78	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
04/07/12	259	518180.16	6969581.41	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
04/07/12	260	518195.81	6969594.50	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
04/07/12	261	518209.42	6969598.99	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	pw
04/07/12	262	518210.07	6969598.73	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	263	518212.52	6969588.71	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	264	518209.97	6969569.84	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	265	518219.35	6969550.49	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	266	518228.45	6969542.10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	267	518240.86	6969527.49	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	268	518251.26	6969517.81	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	269	518272.42	6969495.19	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	270	518280.66	6969475.42	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	271	518290.29	6969464.98	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	272	518299.54	6969440.45	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	273	518325.30	6969417.66	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	

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04/07/12	274	518333.94	6969413.58	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	275	518340.86	6969394.11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	276	518347.48	6969386.85	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	277	518357.34	6969372.15	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	278	518369.71	6969352.41	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	279	518379.11	6969326.69	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	280	518402.85	6969313.79	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	281	518408.91	6969297.08	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	282	518417.02	6969277.30	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	pw
04/07/12	283	518396.80	6969257.69	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	pw
04/07/12	284	518277.29	6969240.18	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	pw
04/07/12	285	518314.00	6969249.41	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	pw
04/07/12	286	518317.05	6969245.95	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/F	DEAD / FAIR BOUNDARY
04/07/12	287	518321.35	6969237.93	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/F	DEAD / FAIR BOUNDARY
04/07/12	288	518325.46	6969209.48	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/F	DEAD / FAIR BOUNDARY
04/07/12	289	518305.73	6969195.30	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/F	DEAD / FAIR BOUNDARY
04/07/12	290	518291.51	6969189.08	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/F	DEAD / FAIR BOUNDARY
04/07/12	291	518284.99	6969185.41	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/F	DEAD / FAIR BOUNDARY
04/07/12	292	518280.39	6969185.19	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/F	DEAD / FAIR BOUNDARY
04/07/12	293	518277.02	6969187.28	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/F	DEAD / FAIR BOUNDARY
04/07/12	294	518270.57	6969194.01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RD	DEAD ON RIGHT LEFT - RD FOR APPROX 10M THEN POOR
04/07/12	295	518268.98	6969196.69	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	296	518260.73	6969201.24	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	297	518256.84	6969201.88	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	298	518250.97	6969210.01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	299	518248.17	6969215.91	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	300	518242.97	6969225.44	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	301	518241.80	6969233.86	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	302	518238.79	6969247.70	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	303	518241.61	6969255.92	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	304	518245.63	6969261.84	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	305	518246.70	6969266.69	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	306	518243.15	6969278.12	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	307	518234.86	6969282.49	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	308	518226.62	6969283.19	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	309	518220.13	6969281.86	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	310	518216.32	6969287.46	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	311	518220.56	6969293.96	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	312	518221.87	6969300.05	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	313	518215.20	6969308.65	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	314	518208.48	6969325.65	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	315	518210.99	6969337.17	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	316	518212.85	6969349.30	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	317	518207.91	6969355.37	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	318	518203.88	6969357.80	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	319	518191.26	6969359.23	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	320	518182.66	6969359.96	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	321	518176.59	6969360.47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	322	518170.18	6969359.82	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	323	518161.90	6969369.16	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	324	518157.30	6969375.47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	325	518148.36	6969377.85	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	326	518140.53	6969380.69	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	327	518131.75	6969382.22	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	328	518123.18	6969379.76	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	329	518110.65	6969370.98	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	330	518089.57	6969347.92	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	331	518024.12	6969387.96	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	332	518050.37	6969403.91	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	333	518063.17	6969407.35	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	334	518073.56	6969410.61	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	335	518084.05	6969426.57	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	336	518086.83	6969432.24	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	337	518082.91	6969457.62	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	338	518083.95	6969464.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	339	518081.97	6969477.39	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	340	518096.76	6969487.39	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	341	518094.73	6969510.29	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	342	518097.15	6969514.35	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	343	518090.76	6969525.61	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	344	518083.85	6969532.83	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD ON RIGHT LEFT - POOR
04/07/12	345	518080.47	6969538.54	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RD	RD 10M EACH SIDE OF LINE
04/07/12	346	518078.45	6969540.37	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RD	RD 10M EACH SIDE OF LINE
04/07/12	347	518070.74	6969550.59	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RD	RD 10M EACH SIDE OF LINE
04/07/12	348	518059.63	6969555.97	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RD	RD 10M EACH SIDE OF LINE
04/07/12	349	518046.99	6969555.92	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RD	RD 10M EACH SIDE OF LINE
04/07/12	350	518033.26	6969551.11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RD	RD 10M EACH SIDE OF LINE
04/07/12	351	518028.02	6969548.90	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RD	RD 10M EACH SIDE OF LINE
04/07/12	352	518019.76	6969544.14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	D 20M EACH SIDE
04/07/12	353	518013.62	6969540.26	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	D 20M EACH SIDE
04/07/12	354	518005.68	6969529.67	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	D 20M EACH SIDE
04/07/12	355	518003.09	6969521.95	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	D 20M EACH SIDE
04/07/12	356	518003.26	6969516.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	D 20M EACH SIDE
04/07/12	357	518001.68	6969511.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	D 20M EACH SIDE
04/07/12	358	517999.55	6969503.99	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	D 20M EACH SIDE
04/07/12	359	518000.96	6969502.55	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	5-10M STRIP
04/07/12	360	518001.50	6969502.79	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD TO LEFT POOR TO RIGHT (EAST)

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	361	517998.82	6969489.10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD TO LEFT POOR TO RIGHT (EAST)
04/07/12	362	517995.27	6969482.35	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD TO LEFT POOR TO RIGHT (EAST)
04/07/12	363	517993.31	6969478.49	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD TO LEFT POOR TO RIGHT (EAST)
04/07/12	364	517987.31	6969466.34	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD TO LEFT POOR TO RIGHT (EAST)
04/07/12	365	517983.62	6969459.79	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	366	517977.36	6969451.99	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	367	517972.00	6969446.79	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	368	517959.97	6969440.12	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	369	517950.82	6969436.41	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD TO LEFT POOR TO RIGHT (EAST)
04/07/12	370	517932.38	6969427.35	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD TO LEFT POOR TO RIGHT (EAST)
04/07/12	371	517924.43	6969413.63	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD TO LEFT POOR TO RIGHT (EAST)
04/07/12	372	517915.71	6969403.14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD TO LEFT POOR TO RIGHT (EAST)
04/07/12	373	517907.21	6969402.70	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD TO LEFT POOR TO RIGHT (EAST)
04/07/12	374	517895.20	6969403.51	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD TO LEFT POOR TO RIGHT (EAST)
04/07/12	375	517881.50	6969402.56	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD TO LEFT POOR TO RIGHT (EAST)
04/07/12	376	517871.03	6969398.07	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD TO LEFT POOR TO RIGHT (EAST)
04/07/12	377	517866.08	6969398.02	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD TO LEFT POOR TO RIGHT (EAST)

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	378	517853.75	6969388.35	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD TO LEFT POOR TO RIGHT (EAST)
04/07/12	379	517841.70	6969383.64	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD TO LEFT POOR TO RIGHT (EAST)
04/07/12	380	517834.59	6969381.67	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD TO LEFT POOR TO RIGHT (EAST)
04/07/12	381	517819.70	6969376.25	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD TO LEFT POOR TO RIGHT (EAST)
04/07/12	382	517803.91	6969361.74	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD TO LEFT POOR TO RIGHT (EAST)
04/07/12	383	517794.02	6969353.63	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD TO LEFT POOR TO RIGHT (EAST)
04/07/12	384	517789.06	6969344.81	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	DEAD TO LEFT POOR TO RIGHT (EAST)
04/07/12	385	517781.14	6969339.89	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/F	DEAD TO WEST POOR TO RIGHT (EAST)
04/07/12	386	517771.65	6969330.27	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/F	DEAD TO WEST POOR TO RIGHT (EAST)
04/07/12	387	517763.51	6969325.31	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/F	DEAD TO WEST POOR TO RIGHT (EAST)
04/07/12	388	517753.14	6969323.39	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/F	DEAD TO WEST POOR TO RIGHT (EAST)
GPS 10																									
04/07/12	114	517097.61	6970146.42	0	0	–	–	–	–	100	0	–	–	–	–	–	–	2	0	1	P	0	0	D	EAST=DEAD WEST = SALTMARSH
04/07/12	115	517100.40	6970116.40	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
04/07/12	116	517111.31	6970104.17	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
04/07/12	117	517116.85	6970101.86	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
04/07/12	118	517125.51	6970085.92	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
04/07/12	119	517121.68	6970058.32	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	120	517132.84	6970036.76	0	0	–	–	–	–	0	0	–	–	–	–	–	–	–	0	0	P	0	0	S/M	
04/07/12	121	517209.63	6970008.86	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	S/M	
04/07/12	122	517206.44	6969959.47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	S/M	
04/07/12	123	517223.11	6969916.92	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	S/M	
04/07/12	124	517210.75	6969899.41	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	S/M	
04/07/12	125	517216.53	6969898.63	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	S/M	
04/07/12	126	517279.65	6969955.41	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	S/M	
04/07/12	127	517293.83	6969999.61	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	S/M	
04/07/12	128	517291.23	6970026.51	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	S/M	
04/07/12	129	517298.05	6970070.30	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	S/M	
04/07/12	130	517295.05	6970124.22	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	S/M	
04/07/12	131	517332.57	6970096.65	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	S/M	
04/07/12	132	517335.17	6970092.72	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	S/M	
04/07/12	133	517342.57	6970077.28	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	S/M	
04/07/12	134	517381.40	6970080.82	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	S/M	
04/07/12	135	517445.05	6970101.58	0	0	–	–	–	–	95	0	–	0	0	1	0	0	0	0	0	A	1	1	D	
04/07/12	136	517450.44	6970139.99	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
04/07/12	137	517411.34	6970190.36	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
04/07/12	138	517387.07	6970202.57	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
04/07/12	139	517232.75	6970310.32	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
04/07/12	140	517217.90	6970296.33	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
04/07/12	141	517239.06	6970250.08	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	PHOTO 1-4 PHOTOGRAPHIC SURVEY AND SEDIMENT SITE
04/07/12	142	517240.63	6970250.05	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
04/07/12	143	517283.35	6970453.71	70	3	100	–	–	–	1	1	1	2	2	1	0	2	3	0	0	A	0	1	P	PHOTO 5 LOTS OF DEBRIS AND RUBBISH
04/07/12	144	517295.32	6970461.34	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	145	517317.66	6970473.46	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	146	517328.32	6970471.70	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	147	517335.49	6970473.34	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	148	517373.89	6970465.59	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	149	517379.37	6970470.97	85	2	100	–	–	–	1	1	1	2	2	2	0	1	2	0	0	P	1	2	P	PHOTO 6
04/07/12	150	517393.08	6970466.59	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	151	517404.43	6970447.04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	152	517423.74	6970443.05	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	153	517435.77	6970433.29	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	154	517437.78	6970428.72	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	155	517439.02	6970422.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	156	517445.05	6970440.18	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	157	517439.23	6970453.52	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	158	517435.45	6970461.67	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	159	517443.47	6970456.90	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	160	517450.06	6970446.55	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	161	517472.88	6970428.16	75	2.5	100	–	–	–	2	2	1	1	1	1	0	2	2	0	0	A	1	2	P	PHOTO 7 north
04/07/12	161	517472.88	6970428.16	10	0.5	100	–	–	–	30	0	0	1	2	1	0	0	–	–	1	P	1	1	RG	PHOTO 8 south
04/07/12	162	517489.34	6970407.89	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	END OF RG SOUTH - MATCH UP WITH WPT 456 GPS #6 AL
04/07/12	163	517469.72	6970397.18	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	PHOTO 9-12 photographic survey 14
04/07/12	164	517426.47	6970803.63	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	PHOTO 13-14 NORTH = DEAD PATCH
04/07/12	165	517435.53	6970796.16	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	166	517434.21	6970795.65	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	167	517433.40	6970794.82	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	168	517430.12	6970792.57	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
04/07/12	169	517431.91	6970788.09	85	4.5	100	–	–	–	0	0	2	1	1	1	0	1	1	1	0	A	2	1	F	
04/07/12	170	517433.65	6970775.65	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
04/07/12	171	517432.57	6970773.51	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
04/07/12	172	517433.76	6970771.75	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
04/07/12	173	517435.97	6970769.58	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
04/07/12	174	517437.09	6970769.47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
04/07/12	175	517438.84	6970767.34	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
04/07/12	176	517442.62	6970768.66	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
04/07/12	177	517559.68	6970248.36	0	0	–	–	–	–	100	100	–	–	–	–	–	–	–	–	–	P	–	1	D pw	
04/07/12	178	517598.36	6970253.82	60	2.5	100	–	–	–	50	5	5	1	2	1	0	3	3	0	0	A	1	0	P pw	
04/07/12	179	517705.29	6970261.89	80	6	100	–	–	–	5	1	1	1	1	2	0	1	1	0	0	P	2	1	F pw	
04/07/12	180	517757.97	6970241.09	70	12	100	–	–	–	0	1	1	1	1	1	0	1	0	3	0	P	4	2	G pw	

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	181	517689.64	6970469.17	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	START OF SEAWARD = GOOD
04/07/12	182	517656.88	6970423.66	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
04/07/12	183	517660.03	6970418.77	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
04/07/12	184	517692.28	6970359.83	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P/F	LANDWARD POOR AFTER 20M FAIR
04/07/12	185	517693.31	6970358.69	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
04/07/12	186	517712.75	6970309.45	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
04/07/12	187	517744.20	6970266.96	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
04/07/12	188	517734.68	6970227.71	90	3	100	–	–	–	0	2	2	1	1	1	0	1	1	3	0	P	2	1	RG/F	PHOTO 16-17
04/07/12	189	517747.76	6970237.96	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	190	517749.74	6970238.54	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	191	517750.00	6970236.91	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	192	517750.48	6970234.75	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	193	517750.45	6970232.15	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	194	517750.38	6970230.09	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	195	517749.55	6970228.46	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	196	517748.91	6970227.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	197	517748.95	6970224.80	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	198	517747.87	6970221.14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	199	517746.37	6970216.17	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	200	517745.70	6970214.38	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	201	517744.94	6970211.81	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	202	517743.65	6970208.14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	203	517742.05	6970205.84	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	204	517743.79	6970202.80	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	205	517745.99	6970196.60	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	206	517748.38	6970195.70	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	207	517749.78	6970193.98	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	208	517752.59	6970191.80	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	209	517748.26	6970158.59	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	SEAWARD = GOOD
04/07/12	210	517752.22	6970107.25	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
04/07/12	211	517736.09	6970047.91	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
04/07/12	212	517740.65	6970043.18	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
04/07/12	213	517744.68	6970038.91	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	

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04/07/12	214	517754.36	6970017.11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
04/07/12	215	517748.01	6969986.30	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
04/07/12	216	517760.31	6969957.44	80	5	100	–	–	–	1	1	1	0	1	1	0	1	1	3	0	P	4	1	G/F	SEAWARD =GOOD
04/07/12	216	517760.31	6969957.44	85	5	100	–	–	–	1	1	1	1	2	1	0	2	2	3	0	P	4	1	G/F	LANDWARD = FAIR
04/07/12	217	517799.12	6969936.81	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
04/07/12	218	517808.43	6969933.43	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
04/07/12	219	517832.04	6969876.97	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
04/07/12	220	517835.49	6969867.05	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
04/07/12	221	517871.33	6969851.11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
04/07/12	222	517922.95	6969832.04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
04/07/12	223	517925.26	6969830.94	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
04/07/12	224	517922.08	6969810.08	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	REGROWTH
04/07/12	225	517925.81	6969796.98	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	GOOD WITH MASS SEEDLINGS
04/07/12	226	517928.40	6969795.92	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	PHOTOS 20-22
04/07/12	227	517929.49	6969793.58	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	228	517931.81	6969790.82	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	229	517931.95	6969787.75	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	230	517931.30	6969783.87	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	231	517928.71	6969778.70	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	232	517923.56	6969777.07	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	233	517920.13	6969776.33	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	234	517918.51	6969775.92	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	SEAWARD = GOOD
04/07/12	235	517915.79	6969770.36	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	236	517915.10	6969766.14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	237	517901.70	6969750.37	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	238	517902.59	6969751.32	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	239	517928.72	6969741.76	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	240	517935.22	6969732.19	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	241	517924.41	6969715.26	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	242	517828.88	6969761.27	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	243	517822.64	6969765.95	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	244	517802.41	6969771.34	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	245	517783.98	6969777.47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	246	517773.33	6969776.17	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	247	517762.18	6969778.38	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	248	517735.17	6969773.43	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	249	517680.42	6969789.32	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	250	517634.17	6969791.52	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	SEAWARD = GOOD
04/07/12	251	517634.12	6969792.23	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	252	517625.70	6969769.23	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	253	517645.73	6969752.71	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	254	517681.91	6969730.57	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	255	517696.89	6969702.93	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	256	517682.76	6969675.38	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	257	517676.79	6969669.34	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	258	517641.41	6969651.99	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	259	517634.62	6969644.50	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	260	517634.45	6969633.24	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	261	517635.49	6969599.74	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	262	517626.65	6969581.58	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	263	517602.19	6969578.36	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/RG	RIVERSIDE = GOOD/RG
04/07/12	264	517599.51	6969577.17	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/RG	
04/07/12	265	517587.03	6969562.52	50	10	50	50	–	–	0	1	1	1	1	1	0	0	0	4	0	P	3	3	G/RG	PHOTOS 27-29
04/07/12	266	517523.08	6969590.52	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	GOOD
04/07/12	267	517539.13	6969633.90	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	268	517497.22	6969683.60	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	269	517464.65	6969674.78	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	270	517440.30	6969681.04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	271	517399.22	6969722.94	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	272	517373.83	6969730.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	273	517356.03	6969720.65	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	274	517343.34	6969698.37	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	275	517290.72	6969649.14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
04/07/12	276	517290.71	6969649.28	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P/D	SOUTH = POOR /DEAD
04/07/12	277	517259.64	6969658.74	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P/D	
04/07/12	278	517233.54	6969666.34	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/F	5M SOUTH
04/07/12	279	517178.30	6969711.41	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	280	517178.16	6969711.34	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
04/07/12	281	517172.78	6969743.92	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
GPS 14																									
03/07/12	18	515827.06	6969656.07	75	18	100	–	–	–	5	10	5	1	1	1	0	1	1	3	0	P	3	2	G	PHOTO AND SEDIMENT POINT 3
03/07/12	19	515823.25	6969581.09	60	20	95	–	–	5	10	5	5	1	1	2	0	1	1	3	0	P	2	2	G	578-9 SOME DEAD TREES BUT APPEARS TO BE DUE TO AGE
03/07/12	20	515775.74	6969514.01	60	22	100	–	–	–	0	5	5	1	1	1	0	2	1	3	0	P	3	2	G	580
03/07/12	21	515806.65	6969471.04	50	6	100	–	–	–	5	5	2	1	1	1	0	1	2	2	0	A	1	2	F	581-4 OPENING IN FOREST
03/07/12	22	515786.03	6969421.49	60	22	100	–	–	–	0	5	5	1	1	1	0	2	1	3	0	A	3	2	G	585-6
03/07/12	23	515765.69	6969398.69																						587 HUMAN DISTURBANCE
03/07/12	24	515762.00	6969350.37	80	20	100	–	–	–	5	5	5	1	1	2	0	0	1	4	0	A	1	1	G	
03/07/12	25	515773.15	6969316.00	60	24	95	–	–	5	5	30	10	1	1	2	0	1	1	3	0	A	4	1	F	588-9 MATURE TREES WITH SOME DEAD BRANCHES, OPENING UP IN FOREST
03/07/12	26	515810.32	6969286.97	65	22	100	–	–	–	2	10	5	1	1	2	0	0	1	2	0	P	2	2	G	
03/07/12	27	515810.67	6969286.90																					G	
03/07/12	28	515835.26	6969273.30	20	18	100	–	–	–	5	30	30	2	2	2	0	1	1	0	0	A	1	1	P	590-4 SALTMARSH CLEARING
03/07/12	29	515863.32	6969256.72	70	16	100	–	–	–	5	10	10	1	2	2	0	1	2	0	0	A	1	0	F	595-LOTS OF LITTER
03/07/12	30	515874.00	6969239.01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		SEDIMENT (SAND) ACCUMULATING AND SEAGRASS TRAPPING LITTER LANDWARD
03/07/12	31	515928.78	6969267.45	85	24	95	–	–	5	2	5	2	1	1	1	0	1	1	2	0	A	3	1	G	PHOTO AND SEDIMENT POINT 4 PHOTOS 602-605

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
03/07/12	32	515819.84	6969223.40	40	20	95	–	5	–	20	20	15	2	2	2	0	2	2	0	0	A	0	0	P	610-13 SALMARSH HIGHER GROUND
03/07/12	33	515810.01	6969227.66	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	614-8 BG AMONGST SALT MARSH AND POOR FOREST
03/07/12	34	515801.75	6969235.43	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		619-24 CASUARINA AND CORAL TREE WITH TERRESTRIAL GRASS UNDERSTOREY
03/07/12	35	515785.82	6969217.93	20	18	95	–	5	–	20	30	20	2	2	2	0	2	1	0	0	A	0	0	P	625-8 SALTMARSH AND CAUSARINE ON HIGHER GROUND
03/07/12	36	515762.47	6969229.75	90	22	90	–	10	–	5	5	2	1	1	2	0	1	1	2	0	P	1	2	G	
03/07/12	37	515728.35	6969228.89	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		TERRESTRIAL VEG ON HIGHER GROUND ADJACENT TO THE CREEK SPLITTING COAL LOADER IN HALF
03/07/12	38	515743.57	6969202.32	40	20	100	–	–	–	5	5	5	1	1	1	0	0	2	1	0	A	2	1	F	633-4 EROSION
03/07/12	39	515827.51	6969212.65	70	18	90	10	–	–	2	5	5	1	1	2	0	2	1	1	0	A	0	1	F	635-7 ACCRETION
03/07/12	40	515874.64	6969219.43	55	24	50	50	–	–	5	30	20	1	2	2	0	2	2	1	0	P	0	1	F	638-40 EROSION
03/07/12	41	515984.52	6969263.25	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	THIN STRIP OF FAIR ALL THE WAY ALONG THE SHORELINE FROM WP 37
03/07/12	42	515888.22	6969317.49	80	22	100	–	–	–	5	10	5	1	2	1	1	1	1	2	0	P	1	2	G	641-4
03/07/12	43	515860.82	6969407.85	70	24	100	–	–	–	5	5	5	1	1	1	0	0	0	3	0	P	4	2	G	
03/07/12	44	515890.80	6969561.21	86	20	95	5	–	–	5	2	5	1	1	1	0	1	0	3	0	P	2	1	G	
03/07/12	45	515930.53	6969645.96	80	20	40	60	–	–	5	5	5	1	1	1	0	0	0	3	0	A	4	3	G	645-6

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
03/07/12	46	515896.09	6969759.46	85	18	70	30	–	–	5	5	5	1	1	1	0	1	1	3	0	P	4	2	G	
03/07/12	47	516260.21	6969613.75	80	16	100	–	–	–	2	5	2	1	1	1	0	0	0	3	0	A	2	2	G	PHOTO AND SEDIMENT POINT 6 PHOTOS 649-652
03/07/12	48	516338.03	6969524.46	80	18	100	–	–	–	5	5	10	1	1	2	0	1	1	1	0	P	1	3	G	SEDIMENT POINT 7
03/07/12	49	516325.97	6969515.93																						656-7 SAND ACRETION /BANK/BERM
03/07/12	50	516271.04	6969467.05	90	12	100	–	–	–	1	5	2	1	0	1	0	1	1	1	0	P	0	2	G	
03/07/12	51	516259.18	6969472.00	85	12	100	–	–	–	5	10	10	1	1	2	0	1	1	1	0	A	1	1	G/F	LAND SAND AND SEAGRASS BERM WITH TERRESTRIAL VEG
03/07/12	51	516259.18	6969472.00	90	10	40	–	–	60	2	10	5	1	1	1	0	1	1	0	0	A	1	1	G	661 SEAWARD
03/07/12	52	516244.88	6969420.20	60	7	60	25	–	15	5	15	10	2	1	2	0	1	2	0	0	P	0	0	P	662-70
03/07/12	53	516239.00	6969365.94	55	6	100	–	–	–	2	20	15	1	1	2	0	2	2	0	0	A	0	0	F	
03/07/12	54	516236.53	6969532.95	70	12	70	15	10	BG-5	2	20	20	1	2	2	0	1	2	3	0	P	2	1	F	
03/07/12	55	516240.33	6969578.27	85	8	50	5	20	5 (BG 20)	5	30	20	1	2	2	0	1	1	2	0	P	2	1	F	668-75 REMAP THIS BOUNDARY AS MIXED FOREST WITH AM CANOPY AND BG,AC,CT,RS UNDERSTOREY
03/07/12	56	516242.30	6969622.96	85	18	85	5	–	10	2	10	5	1	1	1	0	1	0	3	0	A	2	1	G	
03/07/12	57	516207.98	6969623.89	40	1.5	5	–	95	–	2	15	10	2	2	1	0	2	1	0	0	A	1	1	F	676-78
03/07/12	58	516203.58	6969661.14	60	5	60	10	20	10	15	15	20	2	2	2	0	1	1	0	0	A	1	1	F	
03/07/12	59	516287.45	6969670.95	85	14	100	–	–	–	1	5	5	1	1	1	0	0	0	3	0	A	2	1	G	
03/07/12	60	516378.78	6969683.42	80	22	100	–	–	–	1	5	5	1	1	1	0	1	0	2	0	A	0	1	G	
03/07/12	61	516354.90	6969754.83	90	24	100	–	–	–	5	5	5	1	1	1	0	0	0	2	0	A	2	2	G	
03/07/12	62	516309.54	6969764.87	60	10	100	–	–	–	5	20	10	1	2	2	0	2	2	0	0	A	1	1	P	LANDWARD 279-81 SAND/SEAGRASS /WOODY DEBRIS BERM
03/07/12	62	516309.54	6969764.87	90	16	90	–	5	5	5	5	5	1	1	2	0	1	1	1	0	A	3	2	G	283 SEAWARD
03/07/12	63	516322.96	6969810.83	75	18	90	–	–	10	15	10	10	1	1	2	0	1	1	1	0	A	3	1	P	PHOTO POINT 8 PHOTOS 284-8

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
03/07/12	64	516418.21	6969828.07	70	24	100	–	–	–	50	10	10	1	1	2	1	1	2	1	0	A	0	3	P	691-99 EROSION
03/07/12	65	516449.97	6969863.34	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	THIN STRIP OF POOR HEALTH DUE TO EROSION FROM WPT 65 TO 300M SEAWARD
04/07/12	66	516601.86	6969870.09	90	1.5	20	20	60	–	5	10	10	2	2	2	0	0	1	1	0	P	0	2	F	PHOTO POINT 10 PHOTOS 701-704
04/07/12	67	516687.25	6969813.14	40	1.5	–	–	100	–	20	30	20	2	2	2	–	–	–	0	0	A	0	1	P	705-6
04/07/12	68	516800.82	6969769.70	70	2	30	–	70	–	15	15	10	2	1	2	0	2	1	1	0	A	1	2	F/P	SEDIMENT AND PHOTO POINT 11 PHOTOS 707-10
04/07/12	69	517468.87	6969484.85	40	18	100	–	–	–	2	5	10	1	1	1	0	1	1	3	0	P	1	2	F	716-8 PHOTO POINT 20 PHOTOS 712-15
04/07/12	70	517531.50	6969411.01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	DEAD TURTLE - BOAT STRIKE PHOTOS 724-5
04/07/12	71	517815.09	6969237.74	40	14	95	–	–	5	5	10	10	1	1	2	0	1	1	2	0	A	1	1	F	726-8
04/07/12	72	517853.43	6969235.32	60	10	5	–	95	–	40	30	20	1	1	1	0	1	2	1	1	A	0	0	P	729-30 EROSION
04/07/12	73	517969.85	6969179.14	60	10	90	10	–	–	5	25	20	1	2	1	0	1	1	1	0	P	1	1	F	731 SEAWARD 733 BERM BETWEEN TWO
04/07/12	73	517969.85	6969179.14	85	10	100	–	–	–	5	5	5	1	1	1	0	1	1	1	1	P	2	2	G	732LANDWARD
04/07/12	74	518175.10	6968998.63	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	THROUGH TO 76 STRIP OF POOR ALONG SHORE
04/07/12	75	518250.88	6968900.66	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
04/07/12	76	518318.83	6968832.94	70	18	100	–	–	–	5	10	10	1	1	1	0	2	0	2	0	P	1	2	F	
04/07/12	77	518426.85	6968757.27	70	16	90	–	5	5	10	10	10	1	1	2	0	2	1	3	0	A	3	2	F	
04/07/12	78	518417.86	6968808.70	60	10	60	10	–	30	10	10	10	2	1	1	0	2	1	2	0	P	2	2	F	PHOTO AND SEDIMENT POINT 23
04/07/12	79	518479.71	6968886.37	70	14	100	–	–	–	5	10	10	2	2	2	0	1	1	2	0	P	1	2	F	
04/07/12	80	518484.95	6968996.64	70	18	70	–	–	30	5	5	5	1	1	1	0	1	0	2	0	P	2	2	G	
04/07/12	81	518408.70	6969075.45	90	0.8	100	–	–	–	1	1	0	1	2	2	0	0	1	2	2	P	4	1	RG	738-9 20M2 PATCH
04/07/12	82	518357.95	6969073.60	0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	P	0	1	D	740-4 200M X 30M

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	83	518355.38	6969157.42	0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	P	0	0	D	100X 40M
04/07/12	84	518334.27	6969194.18	75	8	100	–	–	–	5	5	5	1	1	1	0	3	1	1	0	P	3	2	F	
04/07/12	85	518286.21	6969206.23	0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	P	0	0	RD	745-7 RD EXTENDS ALONG SOUTHERN BOUNDARY OF DEAD PATCH
04/07/12	86	518181.63	6969255.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P/D	PATCH OF POOR FOREST WITH THIN STRIP OF DEAD FOREST TO THE EAST AND SOUTH MAP AS POOL
04/07/12	87	518126.71	6969230.63	0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0	P	0	0	D	30 X 40M PATCH
04/07/12	88	518079.87	6969282.99	0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	P	0	0	D	
04/07/12	89	518088.95	6969346.85	20	1.5	100	–	–	–	40	2	2	0	1	1	0	0	2	0	0	P	1	1	F	PHOTO AND SEDIMENT POINT 22 PHOTOS 749-752 LOTS OF CHANGE TO SALTMARSH (LESS COVER BUT MORE MANGROVE COVER I.E SHIFT FROM SALMARSH TO MANGROVE)
04/07/12	90	517998.07	6969342.02	60	8	100	–	–	–	30	5	5	1	2	1	0	3	2	0	0	P	1	1	P	THIN STRIP OF POOR 10M WIDE BETWEEN DEAD AND FAIR
04/07/12	91	518014.58	6969311.58	30	1.2	100	–	–	–	70	5	5	1	1	1	0	0	2	0	1	P	1	1	P	753-4
04/07/12	92	518021.47	6969265.42	70	8	100	–	–	–	30	10	10	1	1	1	0	1	2	1	1	P	1	1	F	
04/07/12	93	518045.16	6969246.34	40	8	100	–	–	–	30	20	15	1	1	2	0	2	2	1	1	P	3	1	P	755 NORTH
04/07/12	93	518045.16	6969246.34	80	12	100	–	–	–	20	5	10	1	1	1	0	2	2	1	0	P	1	1	F	756 SOUTH

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs / other	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
04/07/12	94	518111.16	6969231.62	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	THIN STRIP OF POOR (10M) ALONG SOUTHERN BOUNDARY OF DEAD AREA/FAIR TO THE SOUTH
04/07/12	95	518159.34	6969185.17	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	757-8 DEAD SURROUNDED BY FAIR
04/07/12	96	518127.63	6969178.88	85	4	100	–	–	–	2	5	5	1	1	2	0	1	1	1	0	A	1	1	F	
04/07/12	97	518087.30	6969150.91	70	14	85	–	10	5	10	10	10	1	1	2	0	1	1	2	0	A	3	1	F	
04/07/12	98	518069.74	6969121.02	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	S/M	759-62 SAND ACCRETION WITH YOUNG SALTMARSH LOTS OF SEAGRASS WRACK
04/07/12	99	518019.67	6969158.56	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	S/M	762-5 A SEPARATE SAND BERM WITH PASPALUM AND SALT MARSH

Appendix G Survey Data from Whyte Island 2012

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
GPS6																									
02/07/12	1	516422.52	6968676.73	60	2	100	–	–	–	5	1	1	0	1	2	0	1	2	0	0	A	1	2	F	photos 1-2
02/07/12	2	516439.74	6968676.90	35	2	100	–	–	–	5	5	5	1	1	2	0	2	2	0	0	P	1	2	P	Right dead left poor
02/07/12	3	516455.55	6968657.47	65	3.5	100	–	–	–	5	3	3	1	1	2	0	2	1	0	0	P	1	2	F	photos 3-4
02/07/12	4	516435.12	6968629.80	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	MA
02/07/12	5	516469.95	6968650.94	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	6	516460.69	6968702.62	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	7	516460.44	6968702.42	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	8	516467.86	6968675.24	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	9	516527.57	6968656.70	10	0.5	100	–	–	–	50	0	0	1	1	1	0	0	–	0	0	P	2	1	RG	AREA 20X30M
02/07/12	10	516551.05	6968629.79	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	11	516570.33	6968593.05	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	12	516560.13	6968560.82	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	13	516565.83	6968521.14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	14	516581.67	6968503.25	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	15	516598.56	6968528.85	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	16	516616.43	6968540.54	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	photo 22
02/07/12	17	516629.67	6968524.74	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	18	516635.15	6968518.60	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	19	516642.46	6968489.09	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	20	516672.01	6968414.10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	21	516688.26	6968421.65	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	22	516697.23	6968449.47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	23	516761.38	6968447.90	30	0.5	100	–	–	–	50	0	0	1	1	1	0	0	1	0	0	P	2	1	RG	RG 5m to right
02/07/12	24	516803.55	6968412.24	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	RG 5m to right
02/07/12	25	516839.17	6968370.63	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	RG 5m to right
02/07/12	26	516845.46	6968354.11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	RG 5m to right
02/07/12	27	516852.14	6968336.08	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	RG 5m to right
02/07/12	28	516855.11	6968311.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	RG 5m to right
02/07/12	29	516858.53	6968301.88	20	1	100	–	–	–	50	0	0	1	1	1	0	0	2	0	0	P	2	1	RG	
02/07/12	30	516878.58	6968258.36	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	31	516875.31	6968246.15	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	32	516881.68	6968200.15	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	33	516886.11	6968187.54	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	34	516879.12	6968150.28	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
02/07/12	35	516879.44	6968117.64	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	36	516848.55	6968059.53	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	37	516861.55	6967991.08	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	PW
02/07/12	38	516888.15	6967984.63	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	PW
02/07/12	39	516979.70	6967994.49	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	PW
02/07/12	40	517098.17	6967963.76	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	PW
02/07/12	41	517069.34	6967796.12	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	PW
02/07/12	42	517016.36	6967799.86	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	PW
02/07/12	43	517015.98	6967799.26	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	PW
02/07/12	44	516896.72	6967792.89	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	PW
02/07/12	45	516809.03	6967783.20	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	PW
02/07/12	46	516821.38	6967821.01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	Finger of poor
02/07/12	47	516835.11	6967878.43	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	48	516852.80	6967946.98	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	49	516847.73	6967995.98	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	50	516825.73	6967995.17	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Outer edge of poor finger
02/07/12	51	516813.86	6967979.22	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	52	516793.25	6967951.53	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	53	516765.82	6967884.61	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	54	516741.35	6967883.07	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	55	516718.45	6967867.24	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	56	516724.23	6967817.64	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	57	516741.69	6967808.36	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	58	516774.49	6967790.24	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	59	516804.44	6967796.47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	60	516814.51	6967792.68	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	61	516813.02	6967770.77	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Dead / poor boundary
02/07/12	62	516820.53	6967747.49	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Thick BMA - recent bloom
02/07/12	63	516819.72	6967722.51	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
02/07/12	64	516828.22	6967711.43	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	Patches of stress
02/07/12	65	516827.58	6967687.15	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
02/07/12	66	516846.36	6967656.96	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
02/07/12	67	516832.19	6967628.44	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
02/07/12	68	516815.14	6967607.64	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	High Algae - recent bloom
02/07/12	69	516799.80	6967575.16	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	High Algae

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
02/07/12	70	516780.57	6967567.44	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	High Algae
02/07/12	71	516763.26	6967571.07	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	High Algae
02/07/12	72	516737.44	6967590.06	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	High Algae
02/07/12	73	516706.23	6967591.89	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	High Algae
02/07/12	74	516704.06	6967595.66	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	High Algae
02/07/12	75	516691.87	6967632.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
02/07/12	76	516686.49	6967646.06	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
02/07/12	77	516696.69	6967663.29	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
02/07/12	78	516681.75	6967669.88	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
02/07/12	79	516665.53	6967685.47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/P	
02/07/12	80	516643.19	6967702.31	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	81	516622.07	6967705.14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	Lots of Algae
02/07/12	82	516610.47	6967715.29	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	83	516612.89	6967737.57	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	84	516598.30	6967747.85	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	85	516587.31	6967753.31	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	86	516563.33	6967758.19	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	87	516545.69	6967763.43	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	88	516512.69	6967762.81	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	89	516491.66	6967768.41	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	90	516472.09	6967781.23	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	91	516466.82	6967824.94	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	92	516463.37	6967850.71	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	93	516473.67	6967879.26	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	94	516501.29	6967892.69	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	95	516512.91	6967902.38	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	Fair
02/07/12	96	516501.64	6967910.42	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	97	516469.85	6967918.75	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	98	516462.37	6967931.16	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	99	516462.03	6967938.16	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	100	516453.01	6967962.97	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	101	516449.93	6967974.47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	102	516473.53	6967978.91	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	103	516483.94	6967966.26	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	104	516513.93	6967954.69	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
02/07/12	105	516551.66	6967909.28	90	4	100	–	–	–	1	1	1	1	1	1	1	1	1	0	0	A	1	2	F	Finger of fair
02/07/12	106	516553.06	6967908.58	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	107	516595.45	6967903.12	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	108	516612.28	6967893.04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	109	516598.91	6967882.93	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	110	516603.25	6967866.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	111	516656.22	6967900.11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	112	516663.05	6967926.23	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	113	516663.97	6967974.58	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	114	516665.84	6967990.19	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	115	516686.88	6968013.98	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	116	516705.61	6968045.97	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	117	516734.81	6968082.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	118	516731.58	6968107.85	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	119	516718.37	6968114.82	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	120	516718.46	6968133.89	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	121	516710.96	6968163.47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	122	516719.45	6968182.18	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	123	516721.01	6968205.55	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	124	516711.07	6968229.54	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	125	516701.61	6968257.35	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	126	516694.67	6968278.70	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	127	516684.77	6968291.57	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	128	516653.94	6968310.51	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	129	516633.37	6968341.14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	130	516643.42	6968369.11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	131	516634.93	6968390.46	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	132	516606.33	6968408.45	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	133	516594.50	6968418.07	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	134	516569.84	6968424.04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	135	516562.74	6968434.74	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	136	516551.13	6968441.42	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	137	516536.28	6968443.95	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	138	516517.46	6968452.64	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	139	516512.13	6968455.77	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
02/07/12	140	516510.41	6968460.52	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	141	516509.22	6968494.61	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	142	516505.24	6968512.59	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	143	516505.22	6968542.65	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	144	516499.89	6968561.92	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	145	516494.52	6968579.10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	146	516484.00	6968589.50	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/D	edge of fair and dead
02/07/12	147	516787.44	6968464.30	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D pw	
02/07/12	148	516806.70	6968477.46	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P pw	Pore Water
02/07/12	149	516953.60	6968462.62	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G pw	
02/07/12	150	516897.58	6968462.80	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F pw	
GPS 8																									
02/07/12	1	516486.33	6968681.90	60	2.5	100	–	–	–	5	1	1	0	1	2	0	1	2	0	0	P	1	2	F	
02/07/12	2	516424.17	6968676.86	65	3.5	100	–	–	–	5	3	3	1	1	2	0	2	1	0	0	P	1	1	F	RIGHT OF MARK IS DEAD/SALTMARSH
02/07/12	3	516441.73	6968680.02	30	12	100	–	–	–	10	10	10	1	2	2	0	2	2	0	0	P	1	2	P	
02/07/12	4	516455.53	6968656.79	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
02/07/12	5	516435.20	6968630.44	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
02/07/12	6	516468.06	6968651.56	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
02/07/12	7	516463.05	6968703.86	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
02/07/12	8	516471.92	6968673.62	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
02/07/12	9	516485.53	6968647.93	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
02/07/12	10	516528.03	6968657.44	5	0.2	100	–	–	–	50	0	0	1	1	1	0	0	1	0	0	P	2	1	RG	
02/07/12	11	516538.55	6968657.26	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
02/07/12	12	516550.41	6968627.54	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		10M LINE OF SEEDLINGS NEXT TO DEAD
02/07/12	13	516571.42	6968598.57	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG/D	BOUNDARY OF RG AND DEAD
02/07/12	14	516559.40	6968559.88	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG/D	BOUNDARY OF RG AND DEAD
02/07/12	15	516559.57	6968559.21	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG/D	BOUNDARY OF RG AND DEAD
02/07/12	16	516580.91	6968501.32	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG/D	BOUNDARY OF RG AND DEAD
02/07/12	17	516615.98	6968540.26	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG/D	BOUNDARY OF RG AND DEAD
02/07/12	18	516673.79	6968406.41	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG/D	

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
02/07/12	19	516697.35	6968451.47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG/D	
02/07/12	20	516720.52	6968455.76	40	1	100	–	–	–	50	0	0	1	1	1	0	0	0	0	0	P	1	1	RG	
02/07/12	21	516829.05	6968384.48	30	0.5	100	–	–	–	50	0	0	1	1	1	0	0	1	0	1	P	2	1	RG	
02/07/12	22	516852.07	6968325.43	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
02/07/12	23	516859.28	6968301.87	30	1	100	–	–	–	50	0	0	1	1	1	0	0	1	0	1	P	2	1	P	
02/07/12	24	516874.99	6968271.67	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
02/07/12	25	516875.89	6968246.59	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
02/07/12	26	516878.41	6968216.77	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
02/07/12	27	516879.46	6968148.42	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
02/07/12	28	516867.25	6968101.29	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
02/07/12	29	516867.23	6968101.22	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
02/07/12	30	516796.22	6968464.82	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
02/07/12	31	516801.67	6968477.39	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
02/07/12	32	516801.92	6968478.17	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
03/07/12	33	553007.33	6965895.24	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
03/07/12	34	539491.54	6957540.82	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
03/07/12	35	527984.21	6954780.08	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
03/07/12	36	527951.31	6954791.37	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
03/07/12	37	524963.34	6955112.57	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
03/07/12	38	516384.79	6968892.28	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
03/07/12	39	516383.27	6968870.11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
03/07/12	40	516950.46	6967730.52	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD = POOR
03/07/12	41	516944.68	6967748.18	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR
03/07/12	42	516926.82	6967763.90	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR
03/07/12	43	516908.98	6967791.88	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR
03/07/12	44	516918.74	6967804.15	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR
03/07/12	45	516946.09	6967825.41	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR
03/07/12	46	516959.71	6967838.76	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR
03/07/12	47	516966.26	6967865.73	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
03/07/12	48	516966.15	6967886.81	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR
03/07/12	49	516963.30	6967915.27	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR
03/07/12	50	516962.84	6967941.32	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR
03/07/12	51	516976.55	6967945.99	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR
03/07/12	52	516989.72	6967988.04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR
03/07/12	53	516983.55	6968067.56	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR
03/07/12	54	516986.20	6968081.85	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR
03/07/12	55	516984.22	6968100.86	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR
03/07/12	56	516975.44	6968123.45	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR
03/07/12	57	516961.00	6968141.92	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR
03/07/12	58	516961.22	6968142.08	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR
03/07/12	59	516954.37	6968154.20	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR
03/07/12	60	516945.47	6968169.18	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR
03/07/12	61	516957.04	6968183.91	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR
03/07/12	62	516969.00	6968199.91	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR
03/07/12	63	516979.29	6968202.24	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR
03/07/12	64	516990.01	6968207.34	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD = FAIR LANDWARD= POOR
03/07/12	65	517069.57	6968200.58	85	10	95	–	–	5	2	1	1	1	1	2	0	0	0	1	0	A	2	1	G pw	
03/07/12	66	517027.35	6968191.34	90	7	100	–	–	–	3	2	2	1	1	2	0	0	1	1	0	A	0	1	F pw	
03/07/12	67	516929.77	6968159.26	65	3.5	100	–	–	–	3	2	2	2	2	3	0	0	1	1	0	A	1	1	P pw	
03/07/12	68	516998.06	6968120.65	70	12	100	–	–	–	5	3	3	1	1	1	0	2	2	1	0	A	2	2	F pw	
03/07/12	69	517000.80	6968130.51																						

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments	
03/07/12	70	517009.30	6968154.62	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	71	516973.77	6968172.97	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	72	516968.17	6968196.32	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	73	517011.84	6968221.25	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	74	517018.22	6968234.42	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	75	516996.02	6968250.51	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	76	516966.41	6968251.73	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	77	516949.14	6968273.71	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	78	516939.58	6968300.76	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	79	516937.83	6968323.47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	80	516921.01	6968346.15	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	81	516902.30	6968365.94	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	82	516900.55	6968383.23	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	83	516902.44	6968404.39	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	84	516896.87	6968429.93	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	85	516913.81	6968434.31	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	86	516918.98	6968443.11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	87	516922.63	6968447.66	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	88	516945.28	6968468.28	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	89	516942.31	6968502.61	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	90	516942.61	6968501.67	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	91	516917.00	6968542.88	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	92	516895.67	6968573.01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	93	516858.89	6968591.17	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	94	516847.35	6968601.76	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
03/07/12	95	516603.79	6968689.33	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD= LANDWARD= POOR	FAIR
03/07/12	96	516595.16	6968706.67	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD= LANDWARD= POOR	FAIR
03/07/12	97	516571.43	6968731.30	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD= LANDWARD= POOR	FAIR
03/07/12	98	516548.84	6968748.68	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD= LANDWARD= POOR	FAIR
03/07/12	99	516534.77	6968759.79	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD= LANDWARD= POOR	FAIR

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments	
03/07/12	100	516521.90	6968776.10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD= LANDWARD= POOR	FAIR
03/07/12	101	516522.40	6968793.41	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD= LANDWARD= POOR	FAIR
03/07/12	102	516508.68	6968819.59	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD= LANDWARD= POOR	FAIR
03/07/12	103	516494.24	6968832.94	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD= LANDWARD= POOR	FAIR
03/07/12	104	516465.98	6968841.95	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD= LANDWARD= POOR	FAIR
03/07/12	105	516447.43	6968844.47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD= LANDWARD= POOR	FAIR
03/07/12	106	516435.74	6968851.95	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F/P	SEAWARD= LANDWARD= POOR	FAIR
GPS 10																										
02/07/12	1	516488.60	6968682.31	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
02/07/12	2	516423.33	6968674.52	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
02/07/12	3	516440.59	6968681.29	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
02/07/12	4	516456.64	6968655.86	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
02/07/12	5	516433.84	6968629.48	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
02/07/12	6	516472.04	6968652.70	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
02/07/12	7	516461.36	6968703.42	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
02/07/12	8	516486.17	6968645.82	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
02/07/12	9	516527.44	6968655.29	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
02/07/12	10	516549.80	6968628.38	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
02/07/12	11	516581.88	6968502.37	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
02/07/12	12	516615.49	6968538.07	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
02/07/12	13	516673.13	6968408.88	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
02/07/12	14	516698.32	6968448.48	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
02/07/12	15	516723.03	6968459.85	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
02/07/12	16	516763.33	6968446.18	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
02/07/12	17	516831.37	6968384.75	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
02/07/12	18	516851.21	6968336.08	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
02/07/12	19	516854.39	6968313.32	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
02/07/12	20	516879.80	6968150.43	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
02/07/12	21	516858.68	6968008.36	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
02/07/12	22	516853.02	6967992.47	90	1.5	100	–	–	–	5	2	2	1	1	1	0	0	1	0	0	P	3	1	P/D	RIGHT=DEAD SEAWARD=POOR
02/07/12	23	516871.99	6967866.57	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	LANDWARD & SEAWARD =POOR
02/07/12	24	516869.80	6967805.95	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		PHOTO 1-2
02/07/12	25	516701.54	6967543.60	80	4	100	–	–	–	5	3	3	1	2	2	0	1	2	0	0	P	3	1	F	PHOTO 3-4
02/07/12	26	516610.46	6967523.82	80	9	100	–	–	–	4	1	2	1	1	2	0	1	1	3	0	P	4	1	G	PHOTO 5-6
02/07/12	27	516524.81	6967496.41	20	12	100	–	–	–	5	1	1	1	1	1	0	1	1	0	0	P	1	2	G	PHOTO 7
02/07/12	28	516688.61	6967346.28	90	15	95	–	–	5	5	4	3	1	2	2	0	1	1	3	0	P	4	1	F	PHOTO 8
02/07/12	29	516852.94	6967309.07	30	20	100	–	–	–	5	1	1	1	1	2	0	1	1	1	0	P	0	2	G	PHOTO 10 - EPI ALGAE
02/07/12	30	517021.56	6967419.15	35	15	90	–	–	10	5	2	2	1	2	2	0	1	1	3	0	P	1	1	F/G	PHOTO 11 - LITTER
02/07/12	31	517093.51	6967412.12	20	20	100	–	–	–	0	2	2	1	1	1	0	1	0	4	0	P	1	3	G pw	PHOTO 14-15
02/07/12	32	517029.84	6967437.86	50	15	100	–	–	–	10	5	4	1	2	2	0	1	1	3	0	P	3	2	F pw	PHOTO 17 LITTER
02/07/12	33	516961.18	6967497.93	80	10	100	–	–	–	5	2	3	2	2	2	0	2	2	1	0	P	2	1	P pw	PHOTO 19
02/07/12	34	516888.55	6967532.06	0	0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0	P	1	0	D pw	PHOTO 20
03/07/12	35	516601.88	6968837.29	80	12	95	–	5	–	2	1	1	1	1	1	0	1	0	3	0	P	2	2	G/F	SEAWARD =GOOD LANDWARD=FAIR
03/07/12	36	516624.18	6968834.82	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	37	516637.32	6968837.62	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	38	516660.39	6968832.95	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	39	516674.92	6968828.51	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	40	516693.54	6968824.35	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	41	516709.38	6968832.58	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	42	516721.78	6968823.64	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	43	516730.08	6968810.66	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	PHOTO 21
03/07/12	44	516743.25	6968798.55	60	14	100	–	–	–	3	2	2	2	2	2	0	2	0	3	0	P	1	1	F	SEAWARD = FAIR LANDWARD = FAIR
03/07/12	45	516756.65	6968782.21	70	2.5	95	–	–	5	2	1	1	1	1	1	0	0	0	4	0	A	3	2	RG	PHOTO 22
03/07/12	46	516755.36	6968786.59	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	RG TO WPT 56
03/07/12	47	516744.75	6968784.15	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	48	516739.30	6968782.73	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	49	516720.00	6968784.90	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	50	516716.59	6968779.38	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	51	516724.97	6968766.19	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	52	516723.54	6968743.60	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	53	516720.19	6968742.06	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	

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03/07/12	54	516726.70	6968732.90	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	55	516734.59	6968723.89	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
03/07/12	56	516743.22	6968719.23	80	8	90		5	5	1	1	1	1	1	1	0	0	0	4	0	A	3	2	G/F	SEAWARD = GOOD LANDWARD=FAIR
03/07/12	57	516749.20	6968707.82	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	58	516762.60	6968680.42	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	59	516778.53	6968663.12	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	60	516774.15	6968634.39	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	61	516777.78	6968613.62	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	62	516785.20	6968579.15	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	63	516791.53	6968556.20	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	64	516820.43	6968545.21	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	65	516832.40	6968523.62	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	66	516885.75	6968517.54	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	67	516895.31	6968513.08	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	68	516895.43	6968511.60	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	69	516906.50	6968504.38	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	PHOTO 23 ADVENTITIOUS ROOTS
03/07/12	70	516918.97	6968486.05	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	71	516964.06	6968446.16	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	72	516968.97	6968425.64	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	PHOTO 25 LANDWARD FAIR
03/07/12	73	516965.87	6968419.62	90	12	95	–	5	–	2	1	1	0	0	1	0	1	0	3	0	A	4	1	G/F	PHOTO 26 SEAWARD GOOD
03/07/12	74	516984.24	6968381.64	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	75	516992.76	6968361.23	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	76	516970.27	6968329.22	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	77	516977.41	6968303.67	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	78	517006.03	6968268.39	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	79	517019.68	6968230.07	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	80	517027.13	6968212.86	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	81	517027.61	6968186.19	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	82	517026.48	6968168.01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	83	517020.74	6968153.47	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	84	517002.95	6968127.31	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	85	516993.16	6968120.34	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	

Date	Waypoint	Easting	Northing	% Cover	Height	AM	AC	Ct	Rs	% Dead Trees	% Live Trees	% Dead Branches	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Roots	Pneum. Deform	Epi. Algae	Float Algae	BMA (P/A)	Seeding Density	Macro Fauna	Health	Comments
03/07/12	86	516999.49	6968105.01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G/F	
03/07/12	87	517007.40	6968094.27	60	1.5	100	–	–	–	8	0	0	0	0	0	0	0	3	0	0	A	2	1	RG	PHOTO 27
03/07/12	88	517016.09	6968084.16	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
03/07/12	89	517026.55	6968083.96	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
03/07/12	90	517041.76	6968069.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
03/07/12	91	517041.47	6968049.31	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
03/07/12	92	517038.03	6968030.08	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
03/07/12	93	517008.52	6967999.23	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
03/07/12	94	517009.84	6967971.39	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
03/07/12	95	517001.14	6967950.16	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
03/07/12	96	516988.87	6967923.12	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
03/07/12	97	516994.39	6967885.19	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
03/07/12	98	516997.27	6967865.92	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
03/07/12	99	517011.69	6967851.46	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
03/07/12	100	517037.21	6967828.71	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
03/07/12	101	517036.17	6967795.39	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
03/07/12	102	517030.24	6967779.81	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	
03/07/12	103	517007.66	6967764.39	5	0.5	100	–	–	–	95	0	0	1	0	0	0	0	2	1	0	A	1	0	D	PHOTO 30 SEAGRASS WRACK
03/07/12	104	516965.24	6967743.31	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
03/07/12	105	516862.61	6968097.35	5	0.5	100	–	–	–	80	0	0	1	0	1	0	0	1	1	3	P	1	1	D pw	PHOTO 31
03/07/12	106	516910.50	6968050.64	95	2.5	100	–	–	–	5	2	1	1	2	2	0	2	2	1	0	A	2	1	P pw	
03/07/12	107	516982.66	6967974.39	75	3.5	100	–	–	–	5	2	2	2	2	2	0	2	1	0	0	A	1	1	F pw	PHOTO 32
03/07/12	108	517060.61	6967936.46	60	15	100	–	–	–	1	1	0	1	1	1	0	1	1	3	0	P	1	2	G pw	PHOTO 33
03/07/12	109	516854.08	6968635.25	90	15	100	–	–	–	2	2	5	1	0	1	0	1	0	4	0	P	2	1	G/RG pw	PHOTO 34
03/07/12	110	516814.05	6968612.10	85	13	100	–	–	–	2	1	3	2	1	2	0	1	2	3	0	P	3	1	F pw	PHOTO 35-36
03/07/12	111	516647.57	6968588.51	90	2.5	100	–	–	–	1	1	1	2	2	2	0	2	2	0	0	A	1	1	P pw	PHOTO 37
03/07/12	112	516571.37	6968600.00	2	0.5	100	–	–	–	98	–	–	2	2	3	–	–	–	–	0	P	1	1	D pw	PHOTO 38
GPS 14																									
02/07/12	1	516489.90	6968682.56	60	2.5	100	–	–	–	5	1	1	0	1	2	0	1	2	0	0	P	1	2	F	
02/07/12	2	516424.00	6968678.67	70	4	100	–	–	–	5	3	3	1	1	2	0	2	1	0	0	P	1	1	F	
02/07/12	3	516441.21	6968681.41	60	2.5	100	–	–	–	5	5	5	1	1	2	0	1	1	0	0	P	1	1	P	
02/07/12	4	516457.07	6968655.25	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	
02/07/12	5	516456.98	6968655.25	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	

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02/07/12	6	516435.26	6968630.09	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
02/07/12	7	516472.47	6968651.88	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
02/07/12	8	516462.16	6968704.38	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
02/07/12	9	516485.47	6968645.57	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
02/07/12	10	516529.23	6968658.20	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D	
02/07/12	11	516550.16	6968625.84	10	0.5	100	–	–	–	50	0	0	1	1	1	0	0	1	0	0	P	2	1	RG	
02/07/12	12	516569.68	6968594.45	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
02/07/12	13	516558.01	6968559.18	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
02/07/12	14	516565.73	6968516.93	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
02/07/12	15	516582.84	6968498.16	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	RG	
02/07/12	16	516616.76	6968540.63	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	BOUNDARY OF DEAD AND REGROWTH
02/07/12	17	516671.95	6968407.21	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	D/RG	