

# Environmental Impact Monitoring Program (EIMP) - Spring 2012

Lot 1 on RP804106, Trent Road via Ayr

PREPARED FOR

Pacific Reef Fisheries (Australia) Pty Ltd



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## 1 Introduction

### 1.1 Background

This report has been prepared for Pacific Reef Fisheries (Australia) Pty Ltd (PRF) by Gassman Development Perspectives to fulfil the requirements of the Environmental Impact Monitoring Program (EIMP) developed by BTEQ in March, 2005. This monitoring program was developed in part to satisfy ongoing licensing requirements determined by the Department of Environment and Heritage Protection (DEHP, formerly Department of Environment and Resource Management), Great Barrier Reef Marine Park Authority (GBRMPA) and the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC, formerly Department of Environment, Water, Heritage and the Arts).

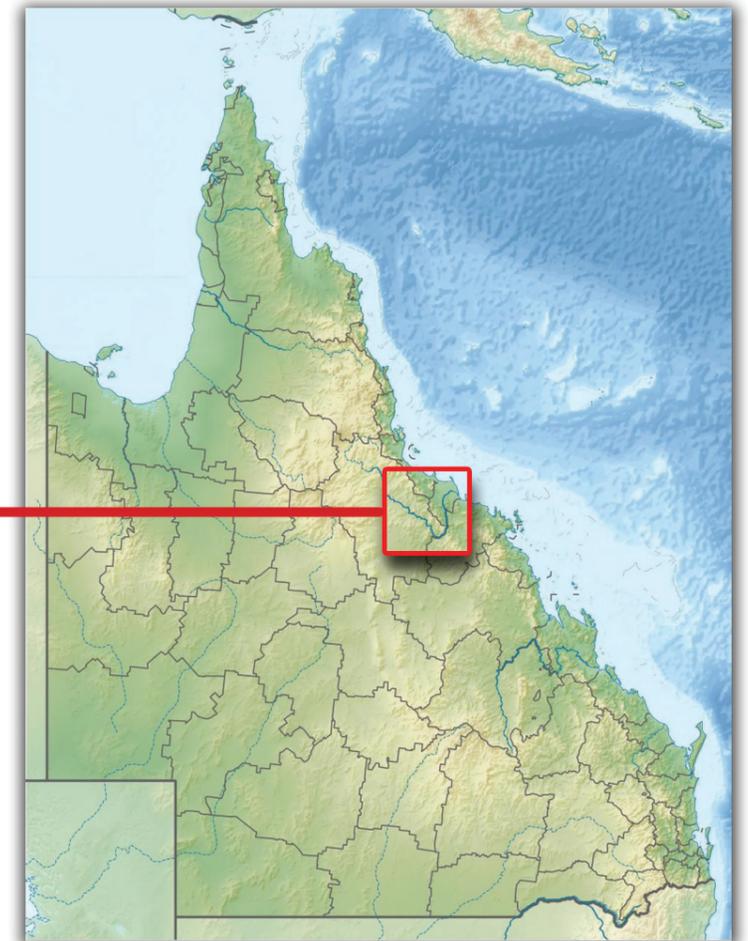
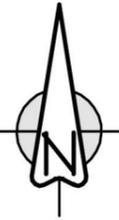
This report outlines the results for this sampling event which continued the three year monitoring program. This monitoring occurred on 11<sup>th</sup> and 12<sup>th</sup> of December, 2012. The purpose of the annual monitoring program is to determine any changes that occur to the receiving environment as a result of adjacent prawn farm activities by comparing various parameters

PRF has the following approvals which allow for the discharge of aquaculture of aquaculture waste to the surrounding environments:

- DEHP – Integrated Authority NR0280
- GBRMPA – Permit no. G01/352.2
- DSEWPC – EPBC 2001/402

### 1.2 Site description

The farm is located on Trent Road, Alva Beach which is 15km east of Ayr, Queensland (Figure 1). The site consists of 75 operational ponds covering 68 hectares for the production of Marine prawns (*Penaeus monodon*). 30 additional ponds covering 30 hectares are currently under construction. The facility also has a hatchery, processing plant, 10.3 hectares of settlement-treatment ponds and 7 hectares of constructed mangrove wetland designed to reduce contaminants in the aquaculture waste prior to release into the receiving environment. Aquaculture waste generated on-site is treated prior to discharge into Little Alva Creek. An aerial image of the site can be found in Figure 2.





**Figure 2** – Aerial photograph of the Pacific Reef Fisheries Prawn Farm

### 1.3 Objectives of the monitoring program

The purpose of this monitoring program is to detect any measurable environmental effects on the receiving waters of Little Alva Creek by regularly monitoring sites on both Little Alva Creek and nearby reference sites along Alva Creek. Observed intra-site differences in the following parameters will determine any measurable impacts that aquaculture waste discharge is having upon Little Alva Creek:

- Mangrove health including species composition, canopy cover, canopy height, density of mature trees and density of saplings;
- Abundance and spatial extent of epiphytic algae;
- Abundance and diversity of benthic macro-invertebrates; and
- Total organic carbon and grain-size distribution of benthic sediments

## 2 Methodology

### 2.1 Sampling locations

Eight (8) locations have been selected for sampling. They are identified as follows:

- A Discharge point into Little Alva Creek
- B 500m downstream in Little Alva Creek
- C 250m north of mouth of Little Alva Creek
- D Location in Alva Creek corresponding with G
- E Location in Alva Creek corresponding with B
- F 250m north of mouth of Alva Creek
- G 250m upstream of discharge point in Little Alva Creek
- H Location in Alva Creek corresponding with A

Figure 3 shows the locations of all sampling sites.

All sites were accessible on this monitoring occasion.

### 2.2 Mangrove health monitoring

Mangrove health was monitored at sites A, B, D, E, G and H. At each site, permanent 400m<sup>2</sup> (20m x 20m) quadrats were established at the water extent of the mangrove edge and extended back into the mangrove stands. At each location the following parameters were measured:

- Species composition;
- Canopy cover;
- Canopy height;
- Density of mature trees (over 3m);
- Density of saplings and small trees (under 3m).

Additionally, three permanent photographic reference points were established at each monitoring location. At each location, three quadrats (0.25m<sup>2</sup>) were used to record the abundance and spatial extent of any epiphytic macroalgae present. Changes in these parameters over time may reflect changing impacts on the waterways.



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# EIMP Sampling Locations | Alva Beach Pacific Reef Fisheries

date: 23-07-10  
scale:  
design: MS/SJH  
plan: 4541 E 00 01

### 2.3 Sediment sampling methods

At locations B, C, E and F sediments were sampled for the following parameters:

- Total organic carbon;
- Grainsize distribution;
- Species composition and abundance of benthic macroinvertebrates.

Three samples were taken and analysed for each parameter at each site. Averages were calculated from the three samples and this average value used for analysis. All results from each sample of macroinvertebrates collected are presented.

### 3 Results and Discussion

#### 3.1 Mangrove health

The results of the mangrove quadrats for the four sites monitored are summarised in **Table 1**. Consistent with last monitoring occasion, a total of six (6) species of mangroves were detected across the four sites. Trees and saplings under 3m in height outnumbered mature trees at all sites. Site H again had the highest density of mature trees (0.5/m<sup>2</sup>) whereas the other sites were comparable in density. Site B had a substantially lower density of saplings in comparison with the other sites (0.04), however this was again slightly higher than last occasion. No substantial changes were observed visually across all sites in comparison to last monitoring occasion.

Similar to last monitoring occasion, epiphytic algae were not observed to be growing on the substrate of any of the monitored sites. Photographs of the quadrats are found in **Appendix 1**.

**Table 1 – Mangrove observations for permanent quadrats**

Quadrat	Species Present	Density of trees >3m (per m <sup>2</sup> )	Density of trees <3m (per m <sup>2</sup> )	Epiphytic algae % cover and abundance	GPS coordinates
A	<i>Ceriops australis</i> ; <i>Avicennia marina</i> ; <i>Rhizophora stylosa</i>	0.04	0.75	0	-19.469, 147.486
B	<i>Avicennia marina</i> ; <i>Rhizophora stylosa</i>	0.02	0.05	0	-19.4654, 147.49
D	<i>Avicennia marina</i> ; <i>Rhizophora stylosa</i> ; <i>Ceriops australis</i>	0.4	1.2	0	-19.4655, 147.473
E	<i>Avicennia marina</i> ; <i>Rhizophora stylosa</i> ; <i>Aegialitis annulata</i>	0.03	0.75	0	-19.4632, 147.487
G	<i>Avicennia marina</i> ; <i>Rhizophora stylosa</i>	0.8	0.75	0	-19.4703, 147.4837

H	<i>Rhizophora stylosa</i> ; <i>Avicennia marina</i> ; <i>Aegalis annulata</i> ; <i>Osbornia octodonta</i>	0.05	0.5	0	-19.4644, 147.4802
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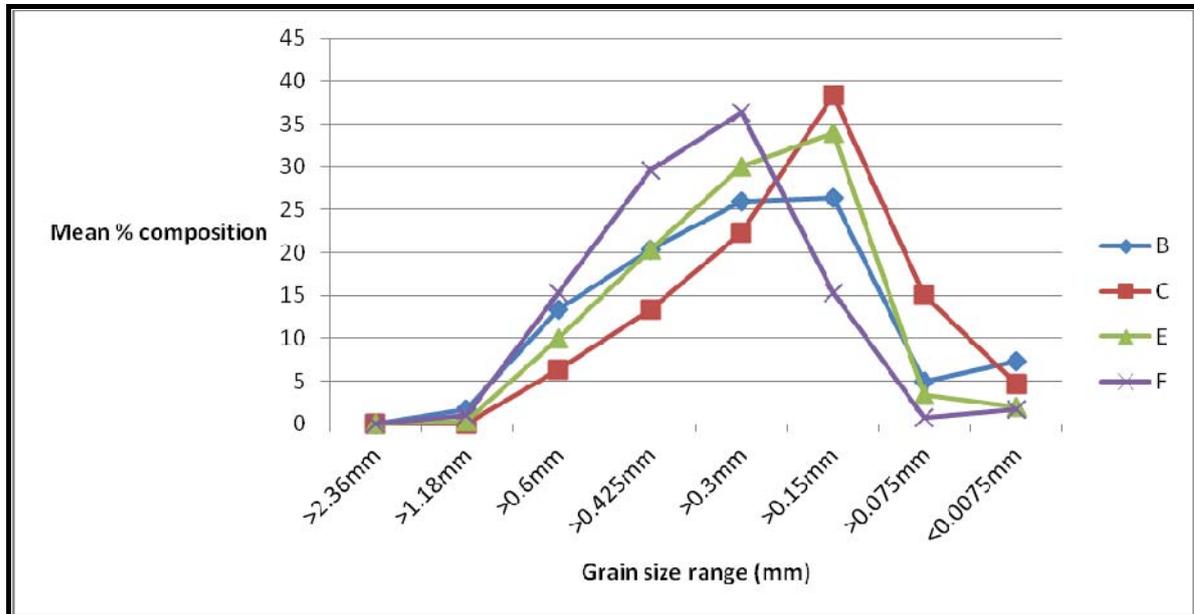
### 3.2 Sediment biogeochemistry

#### 3.2.1 Particle size distribution

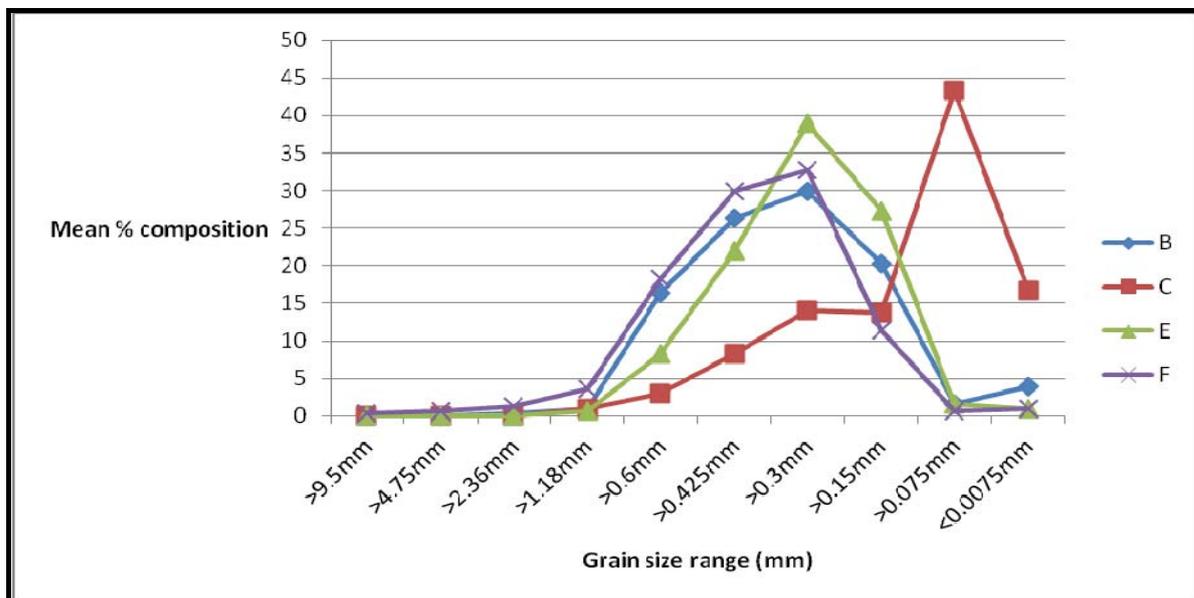
The results of the particle size distribution (PSD) analysis are presented in Figure 4 and Table 2. The four sampled sites continue to appear to be relatively uniform in the distribution of particle sizes, indicating that the prawn farm has not impacted Little Alva Creek in terms of PSD. Sites B, and E appeared to show a correlated distribution of particle size. Site F had a greater concentration of coarser grained sediments with two thirds of the sample represented by particles falling in the 0.425mm and 0.3mm category.

Similar to last monitoring occasion, site C contained a substantially greater proportion of finer sediments. As site C is the site furthest from the entrances of Little Alva and Alva Creek, it is likely that the finer sediments which remained entrained in the water column were deposited further out to sea as water velocities subside. It is clear from the similarities between the comparison sites that the prawn farm is not causing any impacts on the PSD in the receiving waters because sites E and F do not differ significantly from sites B and C. Although site C contains proportionally greater sediments than last monitoring occasion, it is congruous with the observation of site C containing a slightly larger proportion of finer sediments last monitoring occasion. It is considered that geomorphology is a greater contributor to the finer sediments than anthropogenic influences. However, monitoring of any further anomalous patterns should be undertaken to ensure that this difference does not form a pattern potentially attributable to prawn farming operations.

A minimum of eight (8) samples per site would be required to analyse the data statistically, however visual trends observed from charts such as Figure 4 are considered to be sufficiently indicative of changing trends over time. Figure 5 contains the comparison plot from the autumn sampling occasion.



**Figure 4** – Particle size distribution chart for sites B, C, E and F



**Figure 5** – Comparative Particle size distribution chart for sites B, C, E and F from Spring 2010 sampling

**Table 2 –Particle Size Analysis of Sediments from sites B, E and F**

Size parameter	Sampling site											
	B1	B2	B3	C1	C2	C3	E1	E2	E3	F1	F2	F3
%												
<2.36 >1.18mm Coarse sand	0	0	0	0	0	0	0	0	0	0	0	0
<1.18 >0.6mm Coarse sand	0	3	2	0	0	0	0	1	0	2	0	1
<0.6 >0.425mm Medium sand	5	17	18	2	13	4	13	16	1	16	15	15
<0.425 >0.3mm Medium sand	13	22	26	7	25	8	25	30	6	32	29	28
<0.3 >0.15mm Fine sand	22	29	27	23	29	15	29	38	23	36	37	36
<0.15 >0.075mm Fine sand	36	24	19	58	26	31	26	14	62	12	16	18
<0.075mm Silt and clay	11	2	2	7	4	34	4	0	6	0	1	1

### 3.2.2 Total Organic Carbon

Total Organic Carbon (TOC) is an indicator of organic matter preserved within sediment. Organic matter has a high propensity to be retained in finer grained sediments. In **Table 3** it is represented as a percentage of the total weight of sediment collected. On this occasion, site B exhibited the highest proportion of TOC in the sediment which is in contrast to last monitoring occasion when site C was highest. This is higher than last monitoring occasion and more closely reflects the results

observed in Spring, 2010. Apart from an anomalously high result at site E1, the remainder of the sites continue to exhibit relatively low amounts of TOC contained within the sediment.

**Table 3 – Total Organic Carbon**

Site	Total Organic Carbon (%)
B1	0.33
B2	0.25
B3	0.1
C1	0.13
C2	0.07
C3	0.05
E1	0.36
E2	0.02
E3	0.02
F1	<0.02
F2	0.03
F3	<0.02

### 3.2.3 Benthic macroinvertebrate assemblages

Communities of benthic macroinvertebrates are a robust indicator of the relative health of an aquatic ecosystem. As they often have narrow environmental tolerances, even minor anthropogenic changes to a receiving environment are reflected in changes to macroinvertebrate communities.

The results of the macroinvertebrate species composition for sites B, C, E and F can be found in **Table 4**. Changes in the diversity and abundance of benthic macroinvertebrates over time are considered to be a reliable indicator of changing environmental conditions which may be attributable to discharge from the prawn farm.

**Table 5** provides a comparison in diversity between the previous autumn sampling and this occasion. Diversity has noticeably increased between monitoring events across all sites, indicating that the prawn farm is unlikely to be having negative effects on the receiving waters of Alva Creek.

**Table 4 – Macroinvertebrates detected at sites B, C, E and F**

Phylum	Class/order	Family	B1	B2	B3	C1	C2	C3	E1	E2	E3	F1	F2	F3	total
Animalia	Brachiopoda	Lingulidae	0	0	0	1	1	0	0	0	0	0	0	0	2
Arthropoda/ Crustacea	Amphipoda	Corophiidae	0	0	0	0	0	0	0	1	0	0	0	0	1
Arthropoda/ Crustacea	Amphipoda	Urohaustoriidae	0	0	0	0	0	0	0	0	0	5	0	7	12
Arthropoda/ Crustacea	Brachyura	Hymenosomatidae	0	0	0	0	2	0	0	0	0	0	0	0	2
Arthropoda/ Crustacea	Brachyura	Ocypodidae	7	0	0	0	0	0	0	0	0	0	0	0	7
Arthropoda/ Crustacea	Brachyura	Portunidae	0	0	0	0	1	0	0	1	0	0	0	0	2
Arthropoda/ Crustacea	Caridea	Alphidae	0	0	0	0	0	0	1	0	0	0	0	0	1
Arthropoda/ Crustacea	Isopoda	Corallanidae	0	0	0	0	0	0	0	0	0	0	1	0	1
Arthropoda/ Crustacea	Tanaidacea	Kalliapseudidae	3	0	6	0	0	0	0	0	1	0	0	0	10
Arthropoda/ Crustacea	Tanaidacea	Pseudozeuxoidae	0	0	0	0	1	0	0	0	0	0	0	0	1
Mollusca	Bivalvia	Corbulidae	0	1	2	1	4	3	0	0	0	0	1	0	12
Mollusca	Bivalvia	Donacidae	0	0	0	0	0	0	0	0	0	0	6	2	8
Mollusca	Gastropoda	Nassaridae	0	0	0	0	0	1	1	0	0	0	0	0	2
Mollusca	Gastropoda	Volutidae	2	0	0	0	5	0	0	0	0	0	0	0	7

**Table 5 – Comparison of diversity in taxa between sampling occasions**

Spring 2011 sampling	Spring 2012 sampling
B = 4 taxa collected	B = 4 taxa collected
C = 2 taxa collected	C = 7 taxa collected
E = 1 taxon collected	E = 5 taxa collected
F = 0 taxa collected	F = 4 taxa collected

#### 4 Conclusion

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On this sampling occasion, all sites were accessible and were sampled. For all parameters including mangrove densities, particle size distribution, total organic carbon, no substantial variances were observed between sampling occasions. In contrast to last sampling occasion, TOC was higher at site B than the other sites, and for all other sites TOC were comparable to last occasion. Comparisons between all sample sites did not detect significant differences between the two sampling occasions and no environmental impacts were detected that could be attributed to activities relating to prawn production. Macroinvertebrate assemblages were more diverse and numerous in comparison to last monitoring occasion. The next sampling event will be in November, 2013.

## Appendix 1 – Photoplates

### Quadrat A – three photos





Quadrat B – two photos





Quadrat D – four photos





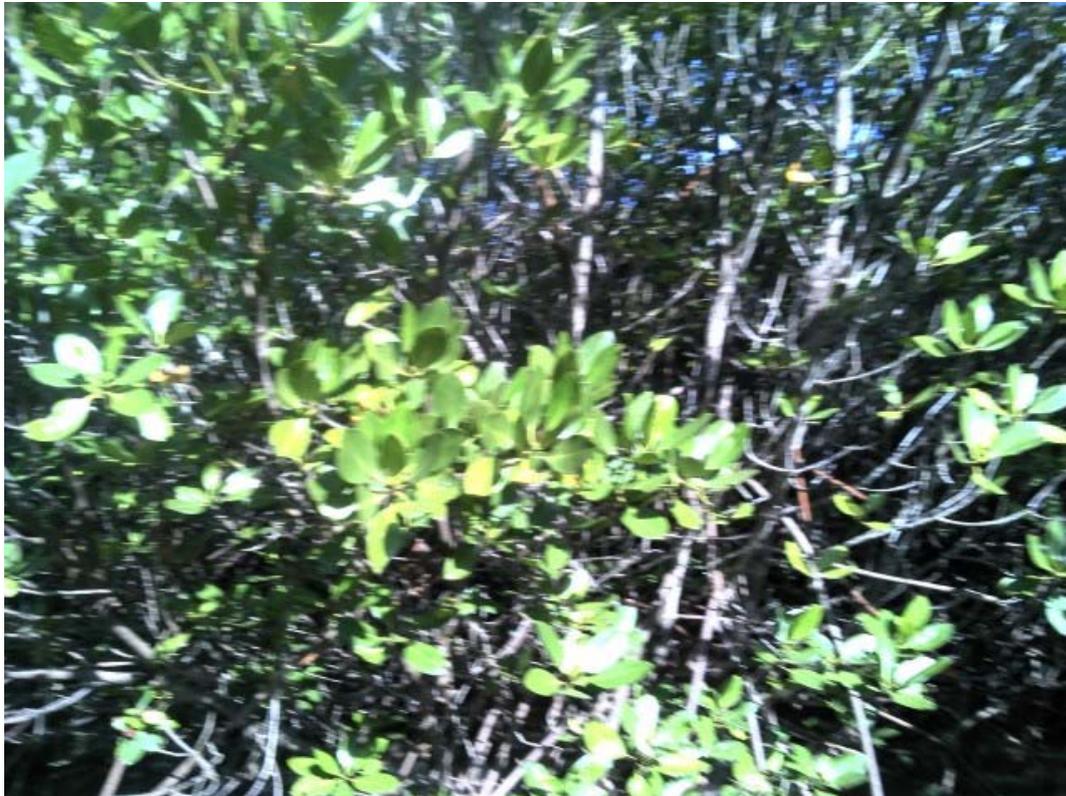


Quadrat E – two photos





Quadrat G – two photos



Quadrat H – four photos



