

Study of mangrove biomass at Pacific Reef Fisheries Prawn Farm: Alva, Queensland.

Mark Spears, Gassman Development Perspectives. May 2014.

Introduction

Gassman Development Perspectives (GDP) was commissioned by Pacific Reef Fisheries to undertake a broad scale assessment of the approximate total biomass of mangroves present on the Pacific Reef Fisheries Alva prawn farm located at Lot 1, Trent Road, Alva (Figure 1). The purpose of this assessment was to collate baseline data upon which to compare future ongoing monitoring in order to track the approximate mangrove biomass present on the farm.

The mangrove communities present on the land occupied by the farm have been artificially established and form part of the Pacific Reef Fisheries discharge water treatment system. Prior to the construction and operation of the aquaculture facility, the mangrove cover on the subject land was minimal.

Methodology

Four (4) mangrove areas were selected for study across the farm site which were considered to represent a robust cross section of different mangrove communities present on the subject site. The locations of these study areas are represented in Figure 2. At each location, a permanent quadrat was established of an appropriate size considered the surrounding waterways and infrastructure. The dimensions of each quadrat are outlined in Table 1 below.

Table 1 – Size and dimensions of sample quadrats

Quadrat Number	Quadrat Size
1	11x20m = 220m ²
2	8x40m = 320m ²
3	20x20m = 400m ²
4	60x5m = 300m ²



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Brisbane Office
Level 8
97 Creek Street Brisbane Q. 4000
t: (07) 32216732
f: (07) 32217308
e: mail@gassman.com.au

Gold Coast and Logan Office
Access Business Park
76 Business Street Yatala Q. 4207
t: (07) 38073333
f: (07) 32875461
w: www.gassman.com.au

Issue	Date	Description	SJH DRN	MDS CHK
-	05-05-14	ORIGINAL ISSUE		

Project: Trent Road, Alva Beach
Lot 1 on RP804106

Client: Pacific Reef Fisheries

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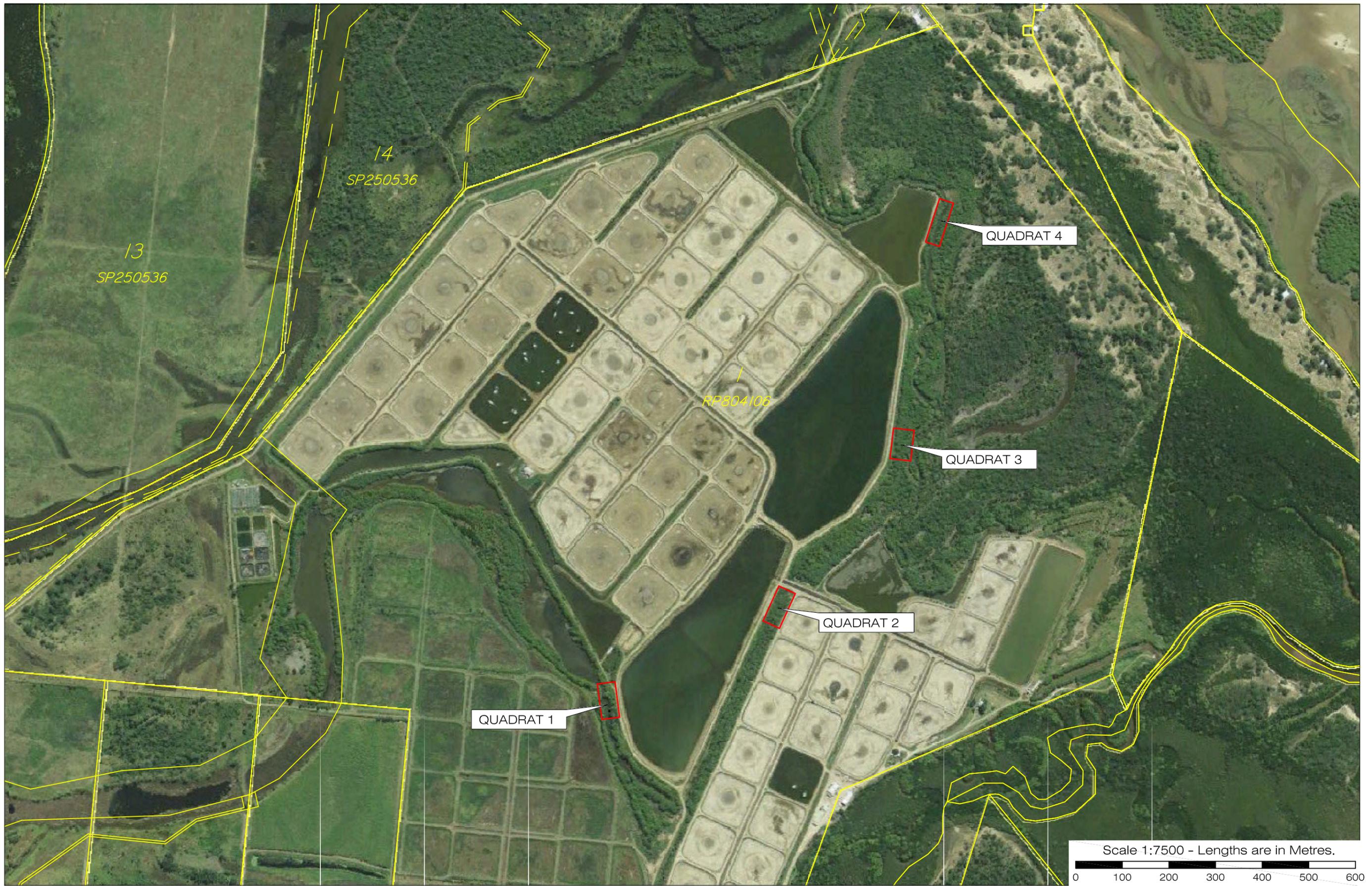
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Drawing Title: Figure 1 Aerial Map

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Scale 1:7500 - Lengths are in Metres.
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Brisbane Office
 Level 8
 97 Creek Street Brisbane Q. 4000
 t: (07) 32216732
 f: (07) 32217308
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 Figure 2
 Location of Study Quadrats

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 FIGURE2

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Each quadrat was marked with wooden pegs and flagged with pink survey tape. A GPS location was taken at each of the quadrats. At each location, all mangroves present were identified to species level and individual trees counted. Counts were divided into trees over 4m in height and trees under 4m in height. The dominant canopy height was also recorded. Photographs taken at each quadrat is included in Appendix 1.

This study was only commissioned at a broad scale and as a result, specific measurements such as diameter at breast height (DBH), individual tree heights and wood biomass were not collected. The basis of estimating the average biomass of individual trees was calculated using data collected by Fromer et al. (1998) whose study investigated aboveground biomass of mangrove genera which were comparable to those present on the Pacific Reef Fisheries property.

The site based survey determined that the majority of trees over 3m in height displayed a DBH of between 13 to 16cm. Trees under 3m in height generally displayed a DBH of between 3 to 5cm. Consequently, the biomass of trees of these sizes as quantified by Fromer et al. (1998) were used as the basis for the estimation of biomass at Pacific Reef Fisheries.

Results

The results of each of the four quadrats sampled are included below in Table 2. Stem counts for each quadrat were undertaken for trees over and under 3m in height, and the density calculated on a per hectare basis.

Table 2 – Results of quadrat data

Quadrat	Area of quadrat surveyed	Species Present	Canopy height	Number trees over 3m	Density of trees over 3m	Number of trees under 3m	Density of trees under 3m
1	220m ²	<i>Avicennia marina</i>	5m	54	2450/ha	15	682/ha

Quadrat	Area of quadrat surveyed	Species Present	Canopy height	Number trees over 3m	Density of trees over 3m	Number of trees under 3m	Density of trees under 3m
2	320m ²	<i>Avicennia marina</i> , <i>Exocoeria agallocha</i>	6m-8m	40	1250/ha	71	2219/ha
3	400m ²	<i>Avicennia marina</i> , <i>Aegilitis annulata</i>	7m	62	1550/ha	16	400/ha
4	300m ²	<i>Avicennia marina</i> , <i>Rhizophora stylosa</i> , <i>Ceriops sp.</i> , <i>Aegilitis annulata</i>	6m	83	2767/ha	204	6800/ha
Average					2004/ha		2525/ha

According to Fromer et al. (1998), the aboveground biomass weight of mangroves in their study for *Avicennia* mangroves which measured 13cm in DBH was 71.8kg and 15.5cm was 87.6kg. An average figure of these two biomass weights was calculated to be 79.7kg. As the majority of mangroves over 3m in height ranged between these DBH values, this average weight reported by Fromer et al. (1998) is used as the basis for calculating mangrove biomass at Pacific Reef Fisheries.

Also according to Fromer et al. (1998), the aboveground biomass weight of *Avicennia* mangroves in their study which measured 3.5cm and 4.5cm DBH weighed 2.8kg and 5.7kg respectively. The average weight between these two values of 4.25kg has been utilised as the value for trees under 3m in height.

Consequently, the average mangrove biomass per hectare was calculated using these values and the average stem count for trees over and under 3m in height across all four (4) quadrat sites. The results are outlined in Table 3 below.

Table 3 – Calculation of total biomass of mangroves per hectare

	Average weight of tree	Stems per hectare	Total biomass per hectare
Trees over 3m	79.7kg	2004	159.72 t/ha
Trees under 3m	4.25kg	2525	10.73 t/ha
			170.45 t/ha

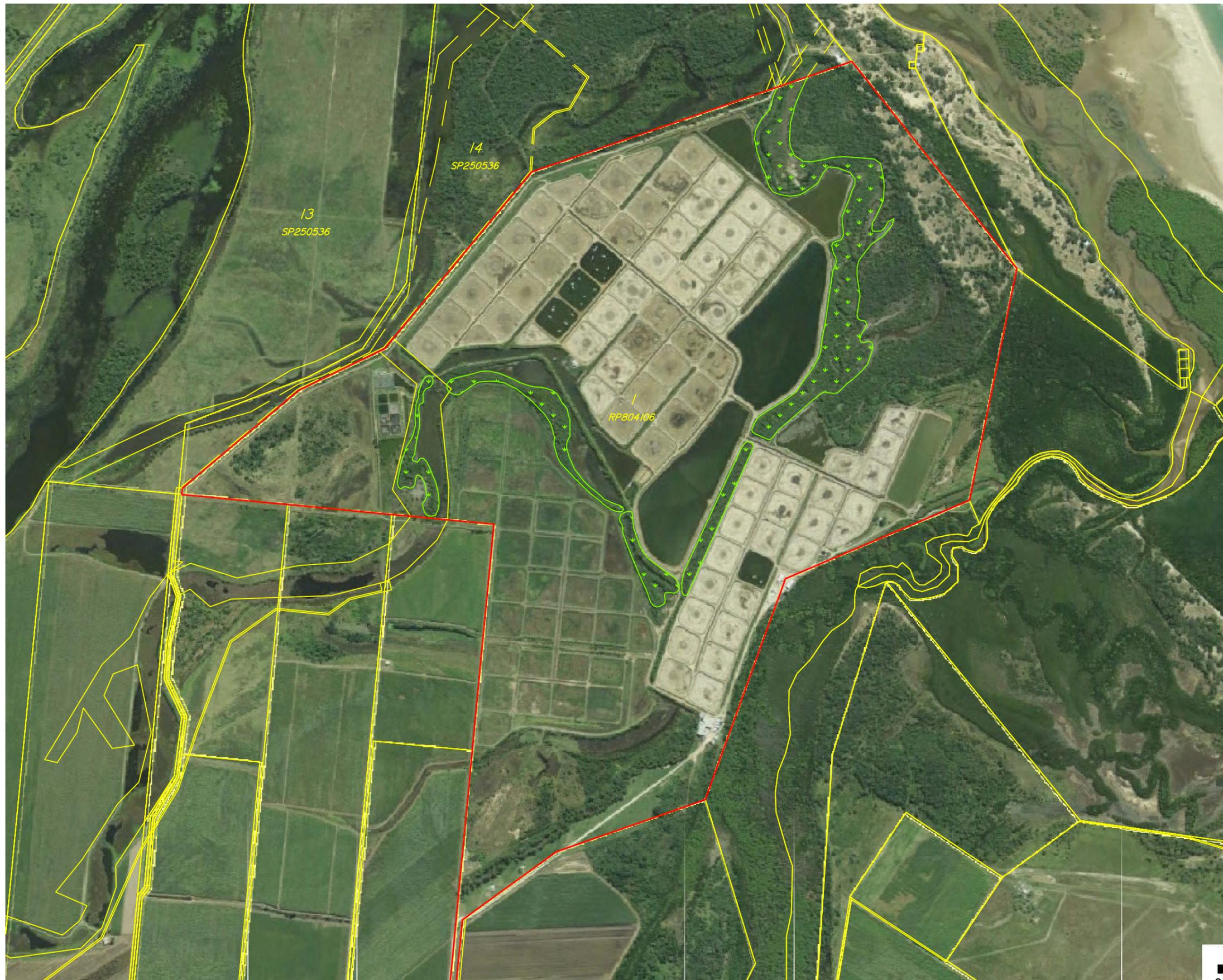
This biomass of 170.45 t/ha is comparable to the findings of Fromer et al. (1998) who reported two (2) stands of mature coastal mangroves in French Guiana as containing 180 t/ha and 315 t/ha respectively.

This average biomass for mangroves found on the Pacific Reef Fisheries farm was then multiplied by the number of hectares of mangroves present on the subject site.

A total of 23.37 hectares of mangroves were found to be occurring on the Pacific Reef Fisheries farm site (Figure 3). A total of 3983.42 tonnes of mangrove biomass was estimated to be occurring on the Pacific Reef Fisheries farm site (Table 4).

Table 4 – Total biomass of mangroves for Pacific Reef Fisheries Farm

Total biomass per hectare	Total hectares of mangroves	Total biomass for entire farm
170.45 t/ha	23.37 ha	3983.42 tonnes



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Area of Mangroves
23.37Ha Total

Scale 1:12,500 – Lengths are in Metres



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Client:	Pacific Reef Fisheries

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Conclusion

This study has estimated the approximate biomass of mangroves present on the Pacific Reef Fisheries site. This information is important to monitor changes in mangrove biomass over time which may in turn impact upon the rates of uptake of nitrogen, phosphorous and other elements over time.

In consideration of the minimal mangrove biomass previously present on the subject land prior to the construction and operation of the aquaculture farming activities, the establishment and maintenance of approximately 3983.42 tonnes of mangrove biomass is considered to be a substantial improvement in the environmental condition of the marine habitat surrounding this locality.

It is recommended that monitoring of mangrove biomass utilising the permanent quadrats established on this initial baseline monitoring occasion occur every two (2) years to ensure the ongoing health and viability of mangroves is maintained within the farm site.

References

Fromer et al. (1998). Structure, above-ground biomass and dynamics of mangrove ecosystems: new data from French Guiana. *Oecologia* 115: 39-53.

Appendix 1 – Photographs of Mangrove Quadrats

Quadrat 1 – 4 photos





Quadrat 2 – 4 photos





Quadrat 3 – 4 photos



Quadrat 4 – 4 photos

