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Wetland Walkabout Baseline Fish Community Assessment

Reef Catchments Limited

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Cover Image

Shallow dried out wetland habitat (Top), fyke net in position surveying fish communities at the Tidal Floodgate site (Bottom) and juvenile milkfish (*Chanos chanos*) recorded at the Tidal Floodgate site (Inset).

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1.0 Background

In 2024, Reef Catchments Limited (RCL) engaged Catchment Solutions (CS) to undertake a baseline fish community investigation at 'Wetland Walkabout' in Andergrove, Mackay, Queensland (Figure 1). The survey aimed to gather information regarding the condition of fish communities at sites planned for restoration works. Results from this baseline survey will be used to compare with post-wetland restoration monitoring at the same sites to evaluate the success of the project. Wetland walkabout is a 32 hectare, private nature reserve and forms part of the McCreadys Creek Reserve. It encompasses a range of wetland ecosystems, including freshwater creeks, lagoons, and estuarine environments. The proposed restoration works include the removal of a tidal floodgate to enhance fish passage, water quality, and habitat connectivity between Wetland Walkabout and downstream receiving environments of McCreadys Creek estuary and the Great Barrier Reef (GBR) Marine Park. Other planned wetland restoration works include the construction of deep pool refuge habitat, installation of complex in-stream habitat (e.g. large hardwood logs with root balls), re-instating aquatic connectivity between different habitats within the wetland complex and improving water quality.

The preliminary fish community assessment was conducted between the 10th and 11th of December 2024. The assessment consisted of fish community surveys at two locations using a range of active and passive fish community monitoring techniques, including fyke netting, seine netting, and cast netting. Due to high conductivity levels, electrofishing techniques could not be performed. Water quality parameters and habitat conditions were recorded at these sites and at a range of additional sites where fish communities could not be monitored because the shallow habitats were completely dry. A priority focus of the wetland restoration works includes the re-instatement of deep pool refugia. With a changing climate, the importance of refuge habitat for sustaining freshwater biodiversity, particularly through extended dry times, is crucial.

Wetland Walkabout's aquatic habitats are located at the bottom of an urbanised catchment. This has potentially resulted in the wetlands capturing fine sediment from upper reaches, particularly following landuse change (e.g. urbanisation) and over time reduced water permanence and aquatic ecosystem health. A range of wetland restoration works are planned at the sites to enhance resilience and increase the ability of the wetlands to provide nursery habitats for key fisheries species such as barramundi, mangrove jack, milkfish, prawns, and mud crabs in addition to small-bodied prey species such as empire gudgeon. These species provide important food resources for aquatic fauna such as wetland birds (e.g. Jabiru, greater egret, darter), saltwater crocodile, turtles, and improve water quality flowing to receiving environments such as the GBR.

2.0 Site Details

Wetland habitats at the site are characterised by shallow, temporary pools, man-made wetlands, tidal estuaries, and freshwater creeks. Seasonal rainfall and tidal flows mediate water levels, flows, and salinity levels. The vegetation in the area includes mangroves, reeds, sedges, and melaleuca species. These species stabilise soil, filter water, and provide vital habitat and shade for aquatic

faunal communities. Several mapped Matters of State Environmental Significance exist in the area, including high ecologically significant wetlands, defined watercourse, and regulated vegetation.

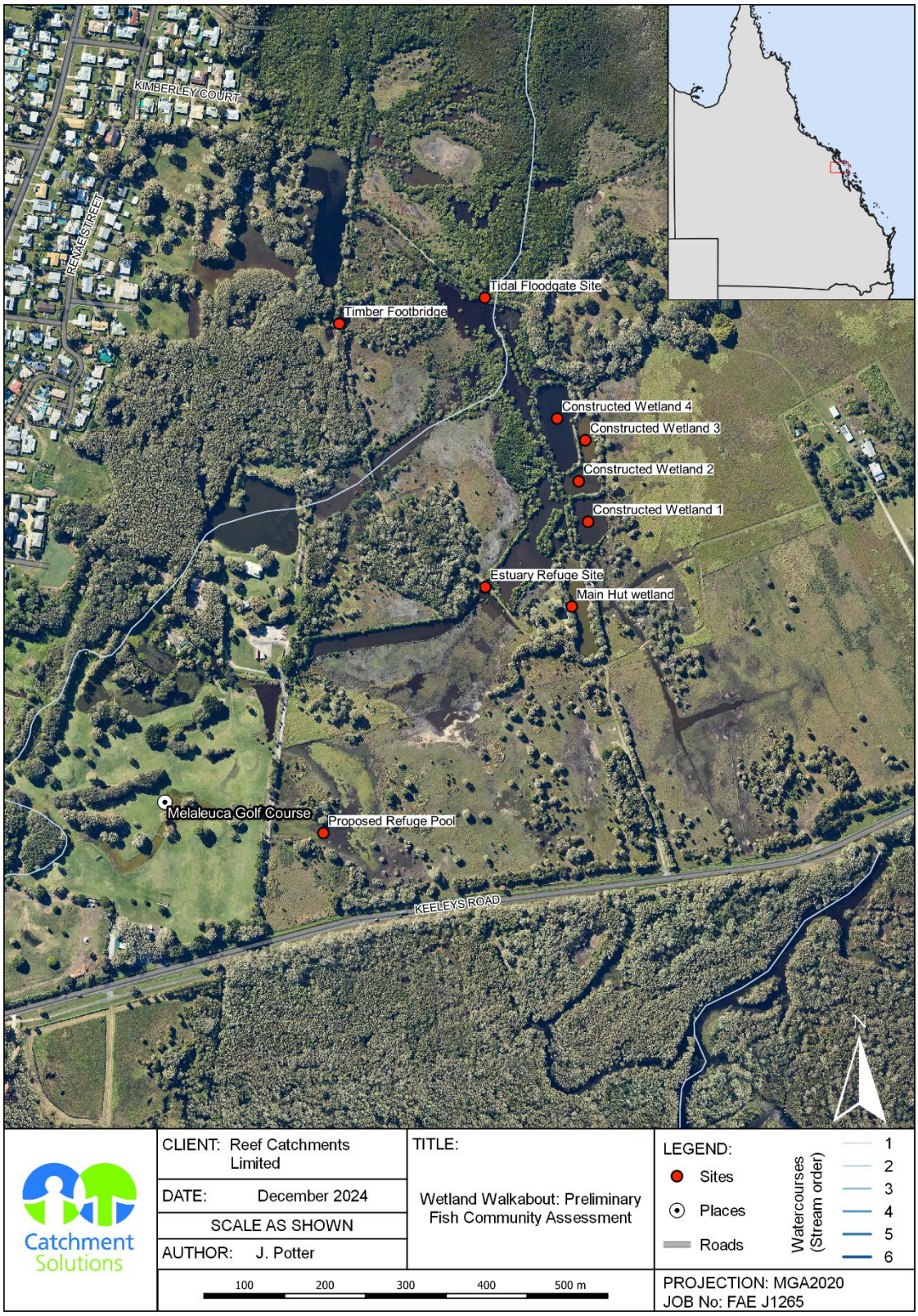

Figure 1. Map showing sampling sites at Wetland Walkabout.

The meteorological conditions during the sampling were typical for the pre-wet season summer periods seen in the Mackay region. Meteorological conditions observed during the sampling period at Mackay Harbour, QLD (Mackay M.O; Station #033119) are listed below:

Date	Temp (°C)		Max wind Gust		Rainfall	Humidity 9am
	Min	Max	Spd (km/h)	Dir	(mm)	(%)
10/12/2024	25.6	32.9	28	N	0	68
11/12/2024	22	30.5	39	SSE	21.8	87

Tidal Floodgate Site

The Tidal Floodgate site is located between a mangrove-dominated estuary (downstream) and a tidal salt pan (upstream) and is bounded by a constructed bund. When the floodgate is opened during high tidal periods, saltwater inundation recharges the salt pan, upper creek channels and constructed wetlands. During the sampling period only one shallow pool (0.2 – 0.3 m deep) remained (Figure 2). This pool was brackish and approximately 30 m (length) x 5 m (width). The pool was void of complex habitat and lacked shade. Turbidity was high.

Figure 2. Showing Tidal Floodgate site.

Timber Footbridge Site

The timber footbridge site is influenced by freshwater inflows emanating from upstream urban areas. The site is connected to the downstream Tidal Floodgate site during the wet season but only had a shallow (0.2 m deep) wetland pool remaining during the sampling period. This pool was approximately 20 m (length) x 10 m (width) (Figure 3). Riparian vegetation was in moderate condition, dominated by mangrove fern, melaleuca, casuarina species and invasive floating aquatic weed; *Salvinia molesta*. In-stream habitat was in poor condition with minimal native macrophytes and complex wood habitat. The substrate was comprised of dead and decomposing organic matter.

Figure 3. Showing Timber Footbridge site

3.0 Methodology

Fyke Netting

A single fyke net was employed at each site consisting of a single 5m wall configuration, with 600mm hoops and 4 mm mesh. The cod end of each fyke net was raised and held above the water surface by a star picket. A small surface float was placed inside the fyke net to ensure any air breathing animals did not drown if they were inadvertently trapped in the net. At both sites, a single fyke net was set perpendicular to the shore to direct and capture fish into the funnel-shaped opening. The net was anchored to the ground with a star picket. The fyke net was set in the day and left overnight, before being checked and emptied the following day.

Figure 4. Showing fyke net sampling at the Timber Footbridge site

Seine Netting

One seine shot was conducted at each site using a 4m long seine with a 2m drop and 4 mm mesh. Each shot encompassed the entire reach of each pool in order to fully represent fish community compositions present and control for microhabitat use preferences within each site. Two people were required to use the seine net effectively. After entering the water, a person would hold each end of the net and extend it to 1.5 m across the width of the stream. The net was then dragged upstream with a weighted bottom chain maintaining the contact between the bottom of the net and the substrate. Towards the end of the drag, the ends of the net were drawn together before being lifted out of the water.

Seine netting results have been standardised by 'seine shot'. This is termed Catch Per Unit Effort (CPUE) and equates to the number of fish captured per seine shot. Due to the limited amount of open water habitat available at each site during the monitoring period, only one seine shot could be performed at each site. It is anticipated that additional open water habitat will be available following wetland restoration works, resulting in a higher number of seine shots at each site. Seine netting was performed before setting the fyke nets.

Cast Netting

Cast netting was performed by a proficient 'cast netter' following the use of the seine net. The cast net used has a diameter of 7-foot, with a 3/4-inch mesh size. This is suitable for capturing a range of fish sizes while minimising the chances for fish to escape. Sampling was conducted by selecting 10 random locations within the pools at each site to ensure representative coverage. At each location, the net was thrown and retrieved once. If a cast resulted in a misthrow (e.g., improper spread or obstruction), the sample was excluded, and an additional random location was selected for a rethrow. After completing 10 adequate throws within the pool, the fish collected were processed together, with species, size, and abundance recorded.

Fish Processing

Captured fish were placed into an aerated tub which had water obtained from the sampled pools. All fish captured were identified to species level, counted, and measured to the nearest millimetre (fork length of forked-tail species, total length for all other species). After processing, all native fish were released at the point of capture.

Pest fish captured during sampling events were euthanised as per Biosecurity Queensland legislation and ANZCCART procedures and disposed of in an appropriate manner.

Water quality Parameters

Before commencing fish community sampling, physico-chemical water quality and velocity measurements were taken both upstream and downstream of the barrier. Parameters were measured at 0.3 m below the water surface. Readings were allowed to stabilise before parameters were recorded. The parameters recorded were as follows:

- pH
- Dissolved Oxygen (mg/L & % saturation)
- Electrical Conductivity (µs/cm)

- Temperature (°C)
- Depth (m)

4.0 Results

4.1 Fish Community Monitoring

No fish species were captured or observed using all three netting methods at the Timber Footbridge site (Table 1). Four species were recorded at the Tidal Floodgate site with juvenile Milkfish (*Chanos chanos*) being the most abundant species (n=12) representing 75% of the catch.

Table 1. Showing fish species recorded at both sampling sites, including migration classification.

MIGRATION CLASSIFICATION	SCIENTIFIC NAME	COMMON NAME	SAMPLING SITES	
			Timber Footbridge	Tidal Floodgate
DIADROMOUS	*Lates calcarifer*	Barramundi		1
	Scatophagus argus	Spotted scat		1
	Chanos chanos	Milkfish		12
MARINE	*Gobiidae sp.*	Unknown goby sp.		2

A total of 16 individual fish (Table 2), were recorded at the Tidal Floodgate site across the four fish species. Three of the captured species were classified as diadromous and in the juvenile stages of their lifecycle, while one species, Unknown goby species (*Gobiidae sp*.) is classified as marine and was a mature adult at 35 mm fork length (FL). A single juvenile barramundi (*Lates calcarifer*) was the largest fish species recorded, measuring 230 mm FL (Figure 5).

Table 2: Tidal Floodgate site

Migration Classification	Species	Common Name	Size Range (mm)			Total Individuals
			Min.	Median	Max.	
Diadromous	*Scatophagus argus*	Spotted scat	24	24	24	1
	Chanos chanos	Milkfish	24	38	43	12
	Lates calcarifer	Barramundi	230	230	230	1
	Gobiidae sp.	Unknown goby species	31	33	35	2
	Total Size Range and Abundance		**24**	**37**	**230**	**16**
	Species Richness			**4**		

Water Quality

Water quality parameters recorded at each potential restoration site were poor, showing low oxygen readings. The pH reading at the Timber Footbridge site was extremely low (2.86) (Table 3).

Table 3: Water Quality parameter at Fish Community Assessment sites.

Site Name	Sample Date/Time	Depth	Temp. (C°)	DO (mg/L)	DO (%sat)	EC (µs/cm)	pH
Tidal Floodgate site	10/12/2024 11:30	0.2	28.4	0.82	13.6	70597	5.99
Timber Footbridge Site	10/12/2024 11:00	0.15	29.1	3.55	47.7	10079	2.86

Figure 5. Juvenile barramundi recorded at the Tidal Floodgate site during the pre-restoration works survey

Existing Wetland Investigation

Water quality readings were collected from a range of sites across Wetland Walkabout to provide further insights, aid future investigations and identify potential restoration sites. Main Hut Dam and Constructed Wetlands at Wetland Walkabout were mostly suitable for supporting local fish species. The Neighbouring Wetland and Tidal Upper Stream were also suitable, however the Tidal Upper Stream appeared turbid and shallow (Table 4).

Table 4: Water quality parameters of other waterbodies at Wetland Walkabout.

Site Name	Sample Date/Time	Temp. (C°)	DO (mg/L)	DO (%sat)	EC (µs/cm)	pH
Main Hut Dam	10/12/2024 10:15	32.3	1.14	17.3	33164	7.40
Constructed Wetland 3	10/12/2024 10:35	31.4	2.20	32.4	27875	7.37
Constructed Wetland 4	10/12/2024 10:25	32.3	2.22	35.2	47205	6.88
Neighbouring Wetland	10/12/2024 10:45	31.1	3.23	44.4	6403	6.91
Tidal Upper Stream	10/12/2024 11:15	29.3	2.25	34.3	46396	6.08

5.0 Discussion & Conclusion

Monitoring results revealed the wetlands fish community assemblages to be in poor condition, with low species diversity and abundance. No fish were recorded at the Timber Footbridge site. pH readings at this site were extremely low (2.86), and water depth very shallow (0.3 m deep). The lack of fish at this site is likely due to insufficient water depth and lack of permanent refugia. It is possible that the pooled water at this site during the study was from localised rainfall and not from stream flows. These stream flows provide connectivity with downstream permanent wetlands, allowing fish the opportunity to migrate upstream into new habitats. Additionally, the shallow nature (0.3 m) of this site, combined with high evaporation rates experienced in the tropics, may have resulted in this wetland habitat completely drying out (prior to rainfall filling it up, but not enough to re-connect with permanent downstream habitats), and any fish that accessed this habitat during the previous wet season perishing. Priority wetland restoration works at this site include construction of deep pool refugia to increase survival rates.

Monitoring results at the Tidal Floodgate site showed fish community assemblages to be in poor condition, with low species diversity and abundance. Three of the four fish (Figure 6) recorded at this site, barramundi (*L. calcarifer*), milkfish (*C. chanos*), and spotted scat (*S.argus*) are diadromous species. Fish species belonging to the diadromous migration classification typically spawn in saltwater habitats before migrating upstream into lowland freshwater nursery areas such as Wetland Walkabout. They utilise brackish and lower freshwater wetlands as juveniles to feed, grow and evade predators before migrating downstream to saltwater habitats to spawn as adults. Facilitating unimpeded connectivity and maintaining good quality nursery habitats with complex in-stream logs, intact riparian corridors, shade and good water quality increases their chances of survival and completing their life-cycle.

Figure 6. Fish recorded during the survey; juvenile milkfish (left), unknown goby species (right).

It's recommended that wetland restoration works prioritise the construction of deep pool refugia and the addition of in-stream habitat such as logs with root balls. These restoration works will improve water quality and provide opportunities for fish to persist throughout the dry season. Adding in-stream habitats like logs with root balls helps improve food resources by providing areas for algae, small invertebrates, and fish. These structures also offer shelter for fish, helping them

avoid predators, which increases their chances of survival. Boosting juvenile survival rates improves the chances of fish reaching maturity, spawning and increasing fish populations.