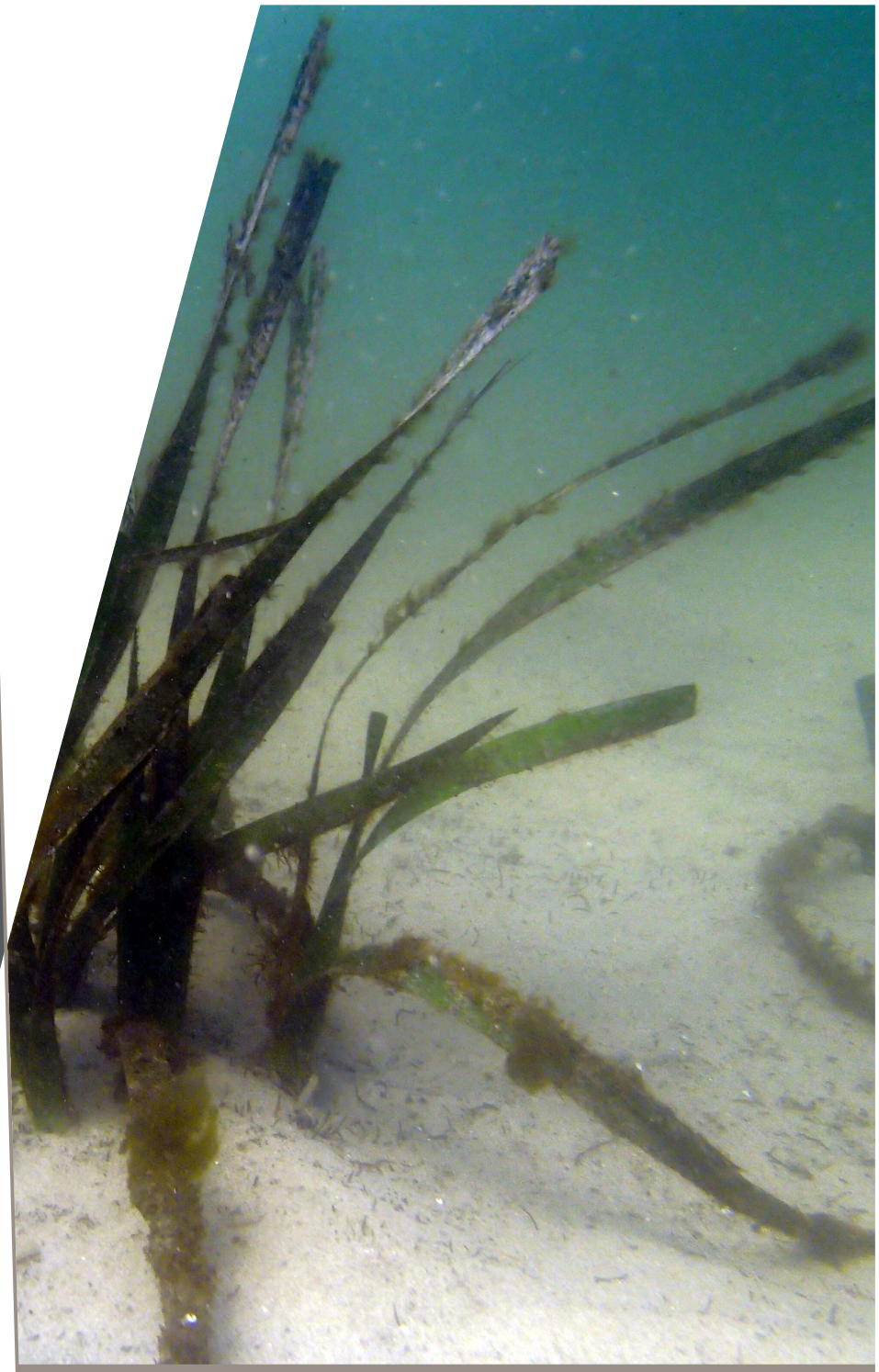
Port Botany Post Construction Environmental Monitoring

Seagrass
Summary Report
October 2013

EL1112046



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1 Introduction

1.1 Background

As part of the Port Botany Expansion Project, Sydney Ports Corporation has rehabilitated Penrhyn Estuary located adjacent to the port expansion. Penrhyn Estuary is a small waterway of approximately 30 ha located to the west of Brotherson Dock. It was created artificially during the reclamation of the Botany foreshore between 1975 and 1978. Since its creation, it has become well known as a key habitat for a diverse group of migratory birds, but it also contains other important estuarine habitats such as seagrass and saltmarsh

The purpose of the rehabilitation works was to enhance the existing intertidal habitat, expand the estuary as a long term habitat for migratory shorebirds and to create a new shallow subtidal area for seagrass. This involves expansion of saltmarsh habitat and increasing the area of intertidal sand and mud flats. The design, methodology and ongoing maintenance for the estuary is outlined within the Penrhyn Estuary Habitat Enhancement Plan (PEHEP) (The Ecology Lab, 2011).

As part of the Port Botany Expansion Project, extensive dredging and modifications have altered seagrass habitat in Penrhyn Estuary and along nearby Foreshore Beach in Botany Bay. As part of the PEHEP, beds of the endangered seagrass *Posidonia australis* located within the dredging footprint were removed and transplanted to Quibray Bay, while the more common *Halophila* spp., *Zostera capricorni* and any remaining *P. australis* have continued to be monitored for loss and/or re-establishment. Prior to activities associated with the Port Botany Expansion Project, seagrasses at Foreshore Beach showed a decline in both aerial extent and continuity of cover. Mapping done prior to the Environmental Impact Statement (The Ecology Lab 2003) indicated a continuous bed along the entire length of Foreshore Beach with varying density from sparse to dense cover. Mapping of the same area prior to construction works indicated a decline in width and aerial extent, and decrease in *P. australis* patches (Bio-Analysis 2010).

The aim of the seagrass monitoring program is to determine if seagrass habitat has been affected by port construction and if mitigation efforts and habitat creation have been successful. Key objectives to support this aim are:

> Mapping of the distribution, and measuring ecological characteristics, of seagrass along Foreshore Beach and in the rehabilitated area; and

> Measuring the success of transplanting *P. australis* in Quibray Bay.

1.2 Purpose of this report

This report provides a summary of the data collected during the spring (October – November) 2013 survey as part of the seagrass monitoring works of transplanted *P. australis* in Quibray Bay. The spring 2013 survey at Quibray Bay is the second and final post-construction survey of transplanted seagrasses in Quibray Bay. This Seagrass Monitoring Summary Report provides preliminary discussion and identifies any important observations during field work and inspection of the raw data collected. A more detailed annual report will be submitted in April 2014.

2 Monitoring Methodology

The monitoring methodology for sampling of transplant and experimental sites was followed as outlined in the Monitoring Services Plan (Cardno, 2012). A summary is provided in the following sections.

1.1 Sampling Design

The sampling design includes monitoring of a number of sites at Quibray Bay as follows (**Figure 1**):

> Transplant Planting sites x 2;

> Transplant Control sites x 2; and

> Experimental sites x 3 (each site comprising 5 treatments, see below).

1.2 Field Procedures

At Planting Areas 1 and 2 and the two control sites, nine random 0.25m^2 quadrats were used to sample shoot density for each species. Ten random measurements of leaf length and epiphyte load were taken in each of the 0.25m^2 quadrats.

At each of the three experimental sites shoot density for each species for each experimental treatment was recorded within the three fixed 0.25m^2 quadrats for each of the five treatments (i.e. 15 quadrats per site with 45 quadrats in total). There were five experimental planting treatments at each of the experimental sites.

> Rhizomes;

> Existing *P. australis*;

> Trimmed;

> Entire; and

> Bare.

Epiphyte load was recorded by divers on randomly selected leaves within quadrats containing seagrass using a four-point classification scale:

> L = Low;

> M = Medium;

> H = High; and

> N = None.

The amount of epiphytic growth on the leaves is considered an indicator of seagrass health. Excessive epiphytic growth can reduce the amount of light available for growth and high epiphytic load may be indicative of high nutrient levels within the water column.

2.1 Quality Control Procedures

Prior to fieldwork, all staff were familiarised with sampling techniques and species identifications. All GPS Waypoints and maps were checked against 2012 entries to ensure consistency between surveys. Field data were entered and checked for errors using a two person checklist.

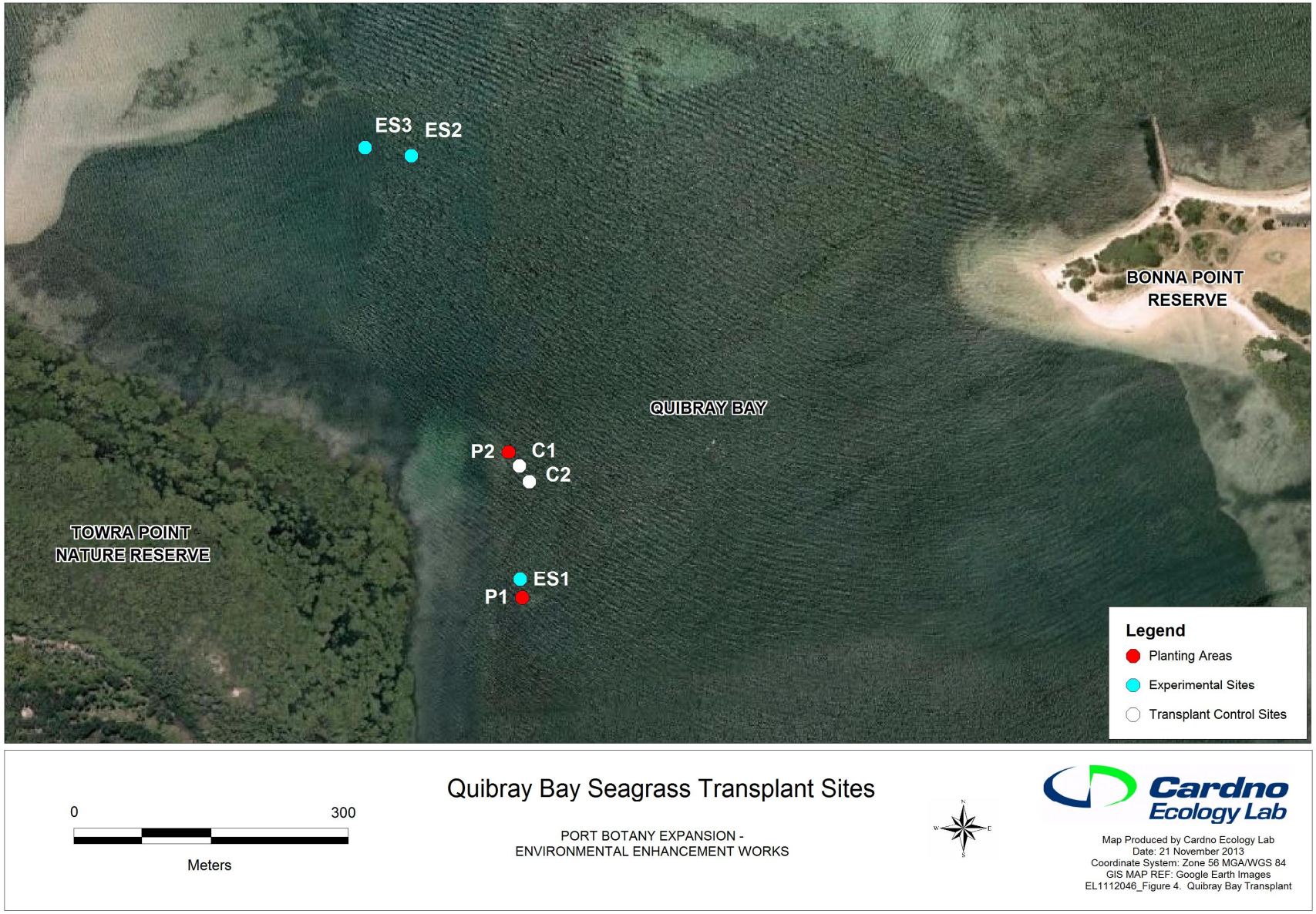

Figure 1 Quibray Bay seagrass experimental and transplant sites

3 Monitoring Works

During the field work no HSE incidents or near misses were recorded for the seagrass monitoring works, while no non-compliance reports (NCR) required issuing for corrective actions.

Surveys were conducted between 22 October and 14 November 2013. All surveying of seagrass habitat and rehabilitated seagrass in Quibray Bay for 2013 has been completed, with exception of a six fixed quadrats which could not be located due to sediment burial of markers (**Table 1**).

Table 1 Non-sampled fixed quadrates at Experimental Sites in Quibray Bay

Site	Quadrate	Treatment
ES1	113	Entire
ES2	213	Entire
ES2	233	Rhizomes
ES2	243	Existing *P.australis*
ES3	331	Rhizomes
ES3	343	Existing *P.australis*

Some minor delays in sampling occurred in late October and early November due to inclement weather e.g. strong north westerly winds and heavy rainfall. As a result of these delays sampling was completed in mid-November 2013.

To ensure accuracy between divers in counts of shoot density and measurements of leaf length, surveys count checks were performed by a second diver to ensure consistency among divers for at least one quadrat per diver as part of the quality assurance procedures.

4 Preliminary Findings

Prior to construction activities *P. australis* from Foreshore Beach was transplanted in Quibray Bay as part of the PEHEP (The Ecology Lab, 2011). Transplanting sites were small bare batches within established *P. australis* beds. Transplanting occurred at both the transplant and experimental sites.

In Planting Areas 1 and 2, *P. australis* was recorded with a mean shoot density of 10.89 and 12.78 shoots per 0.25m^2, respectively and mean leaf length of 48.57 cm and 46.01 cm, respectively (**Table 2**). *Zostera capricorni* and *Halophila* spp. were recorded with mean shoot densities of 442.22 and 139.44 shoots per 0.25m^2, respectively in Planting Area 2, with mean leaf lengths (<4 cm) (**Table 2**). 'Medium' epiphytic growth was observed on the majority (59.2 -60.3%) of *P. australis* leaves. In contrast, the majority (>73%) of *Z. capricorni* and *Halophila* spp. leaves had 'low' epiphytic growth (**Table 3**).

In the Experimental Transplant Sites, mean shoot densities up to 19.5 shoots per 0.25m^2 and mean leaf lengths up to 61.8 cm were recorded for transplanted *P. australis* (**Table 2**). Preliminary data indicate that the 'trimmed' seagrass transplant treatment appears the most successful in terms of shoot density, with the exception of Experimental Site 3, where the 'whole' treatment appears most successful (**Table 2**). 'Medium' epiphytic growth was observed on the majority (53.3 -100%) of *P. australis* leaves at Experimental Sites 1 and 2 (**Table 3**). In contrast, the majority (>77.8%) of *Z. capricorni* and *Halophila* spp. leaves had 'low' epiphytic growth with the exception of Halophila spp. within the 'rhizome' treatment group at Experimental Site 2 (**Table 3**).

At Control Sites 1 and 2, *P. australis* was recorded with a mean shoot density of 23.67 and 30.11 shoots per 0.25m^2, respectively and mean leaf length of 44.56 cm and 54.41 cm, respectively (**Table 2**). 'High' epiphytic growth was observed on the majority (67.8%) of *P. australis* leaves at Control Site 1. In contrast, the majority (57.8%) of epiphytic growth at Control Site 2 was 'low' (**Table 3**). No *Z. capricorni* or *Halophila* spp. were observed at the Control Sites (**Table 3**).

In general, transplanting *P. australis* appears to have been successful, albeit, patchy in parts. At most sites *P. australis* has colonised in part previously bare patches.

Table 2 Summary of quadrat data (0.25 m^2) for experimental and transplant sites at Quibray Bay

Location	Site	Treatment	Mean (± SE) Shoot Density/ 0.25m²			Mean (± SE) Leaf Length (cm)		
			Posidonia australis	*Zostera capricorni*	*Halophila* spp.	*Posidonia australis*	*Zostera capricorni*	*Halophila* spp.
Quibray Bay (Experimental Sites)	ES1	Whole	12.33 (±4.33)	12.00 (±12.00)	0.00 (±0.00)	61.80 (±4.63)	0.00 (±0.00)	4.25 (±0.47)
		Trimmed	19.00 (±4.51)	0.00 (±0.00)	0.00 (±0.00)	51.07 (±3.58)	0.00 (±0.00)	0.00 (±0.00)
		Rhizome	6.67 (±0.67)	0.00 (±0.00)	7.33 (±7.33)	44.50 (±2.66)	0.00 (±0.00)	3.80 (±0.24)
		Seagrass	17.00 (±2.65)	0.00 (±0.00)	0.00 (±0.00)	61.27 (±3.50)	0.00 (±0.00)	0.00 (±0.00)
		Bare	12.33 (±4.33)	12.00 (±12.00)	0.00 (±0.00)	41.70 (±2.51)	2.50 (±0.25)	0.00 (±0.00)
	ES2	Whole	7.50 (±7.50)	20.50 (±20.50)	31.00 (±31.00)	37.20 (±2.71)	24.8 (±10.63)	3.50 (±0.30)
		Trimmed	10.33 (±3.84)	2.33 (±2.33)	18.33 (±9.17)	50.33 (±3.34)	3.30 (±0.27)	5.55 (±0.51)
		Rhizome	9.00 (±2.00)	14.50 (±8.50)	14.00 (±6.00)	52.25 (±4.01)	3.00 (±0.48)	3.61 (±0.49)
		Seagrass	11.50 (±3.50)	0.00 (±0.00)	0.00 (±0.00)	53.70 (±3.11)	0.00 (±0.00)	0.00 (±0.00)
		Bare	10.00 (±0.00)	11.33 (±5.78)	19.33 (±7.33)	47.93 (±3.27)	2.60 (±0.25)	3.57 (±0.25)
	ES3	Whole	19.50 (±6.50)	7.50 (±7.50)	0.50 (±0.50)	43.93 (±3.09)	11.30 (±0.62)	0.00 (±0.00)
		Trimmed	17.33 (±9.76)	20.67 (±25.31)	21.67 (±15.94)	42.10 (±3.45)	7.23 (±1.06)	5.90 (±0.59)
		Rhizome	18.00 (±0.00)	41.00 (±0.00)	0.00 (±0.00)	51.40 (±3.50)	11.70 (±0.99)	0.00 (±0.00)
		Seagrass	15.00 (±7.00)	0.00 (±0.00)	0.00 (±0.00)	53.50 (±5.38)	0.00 (±0.00)	0.00 (±0.00)
		Bare	8.50 (±4.50)	96.50 (±15.50)	44.5 (±44.5)	44.25 (±3.69)	9.15 (±0.48)	7.20 (±0.61)
Quibray Bay (Transplant Sites)	P1	Transplant	10.89 (±2.51)	0.00 (±0.00)	26.22 (±17.65)	48.57 (±1.40)	0.00 (±0.00)	4.57 (±0.32)
	P2	Transplant	12.78 (±2.70)	442.22 (±182.47)	139.44 (±47.17)	46.01 (±1.24)	3.58 (±0.24)	3.31 (±0.14)
	C1	Control	23.67 (±1.72)	0.00 (±0.00)	0.00 (±0.00)	44.56 (±0.99)	0.00 (±0.00)	0.00 (±0.00)
	C2	Control	30.11 (±1.85)	0.00 (±0.00)	0.00 (±0.00)	54.41 (±0.56)	0.00 (±0.00)	0.00 (±0.00)

Table 3 Epiphyte cover on seagrass at Quibray Bay Experimental and Transplant Sites

Location	Site	Treatment	*Posidonia australis* %			*Zostera capricorni* %			*Halophila* spp. %		
			High	Medium	Low	High	Medium	Low	High	Medium	Low
Quibray Bay (Experimental Sites)	ES1	Whole	0	100	0	0	0	0	0	0	100
		Trimmed	7.4	70.4	22.2	0	0	0	0	0	0
		Rhizome	6.7	70.0	23.3	0	0	0	0	0	100
		Seagrass (control)	3.3	76.7	20.0	0	0	0	0	0	0
		Bare (control)	0	55.2	44.8	0	0	0	0	0	0
	ES2	Whole	0	90.0	10.0	0	0	100	0	0	100
		Trimmed	3.3	53.3	43.3	0	0	0.0	0	22.2	77.8
		Rhizome	0	81.3	18.8	0	0	100	11.1	50.0	38.9
		Seagrass (control)	0	80.0	20.0	0	0	0	0	0	0
		Bare (control)	0	60.7	39.3	0	0	100	0	21.4	78.6
	ES3	Whole	3.3	56.7	40.0	0	0	100	0	0	0
		Trimmed	5.3	42.1	52.6	6.7	3.3	90.0	0	14.3	85.7
		Rhizome	30.0	30.0	40.0	0	0	100	0	0	0
		Seagrass (control)	10.0	80.0	10.0	0	0	0	0	0	0
		Bare (control)	10.5	10.5	78.9	0	0	100	0	0	100
Quibray Bay (Transplant Sites)	P1	Transplant	20.6	60.3	19.0	0	0	0	10.8	16.2	73.0
	P2	Transplant	7.9	59.2	32.9	0	0	100	5.1	10.3	84.6
	C1	Control 1	67.8	32.2	0.0	0	0	0	0	0	0
	C2	Control 2	0	42.2	57.8	0	0	0	0	0	0

5 References

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