

August 2023

# WEST CULBURRA MIXED USE DEVELOPMENT

CONDITION 17f AQUATIC ECOLOGY MONITORING ADDENDUM  
ARISING FROM FIRST SIX MONTHLY BASELINE AQUATIC  
ECOLOGY REPORT



Frontis. Sampling the intertidal saltmarsh zone at site SWB2-I

**ADDENDUM PREPARED FOR SEALARK PTY LTD**

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## 1. INTRODUCTION

State Significant Development Application SSD3846 concept proposal for a staged, residential and commercial development located on the northern side of Culburra Road between the Crookhaven River Estuary and Lake Wollumboola was approved with conditions, including the undertaking of an 18-month water quality and aquatic ecology baseline monitoring program to be submitted to the Department of Planning and Environment.

Marine Pollution Research Pty Ltd (MPR) was commissioned by the proponent Sealark Pty Ltd to prepare the baseline aquatic ecology monitoring methodology report for the Approved Conditions of Consent (CoCs) C17 and C18 in 2022. Noting that the Aquatic Ecology monitoring program would not include the Condition C18d oyster lease water quality sampling which was to be undertaken by Martens & Associates Pty Ltd, who were commissioned to undertake all relevant water quality monitoring as described in the companion Water Quality Methodology Report (Martens & Associates 2022). Final Aquatic Ecology (MPR 2022) and Water Quality Methodology reports were reviewed and endorsed by the Environmental Representative (ER) on 16 November 2022 and the 18 month monitoring program commenced on 1st December 2022.

Conditions of Consent 17(f) requires that *during the baseline period a progress report must be prepared when the final methodology for the baseline has been determined and approved by the independent expert, and then at 6-monthly intervals until the end of the baseline period.*

MPR prepared and submitted the Condition 17(f) first six monthly Aquatic Ecology baseline report in July 2023 (MPR 2023). As this report included some clarification and elaboration of the approved methodology, the Environmental Representative (ER) suggested that the methodology clarifications and elaborations be brought together as an addendum to the approved Aquatic Ecology Methodology Report.

## 2 AQUATIC ECOLOGY METHODS - CLARIFICATIONS & ELABORATIONS

As per the Approved Methodology Report, the sampling program is made up of four main components; Estuarine Intertidal Habitat Monitoring, Subtidal Seagrass Monitoring, Crookhaven Estuary Aquaculture Oyster Monitoring and Lake Wollumboola Freshwater Biota Monitoring. Methodology clarifications and elaborations for each of these components are provided in Sections 2.1 to 2.4 below.

### 2.1 Estuarine Intertidal Habitat Monitoring

Figure 2 for Approved Aquatic Ecology Monitoring Report indicated the overall Site Locations but did not define the sub-site locations as provided in Table 1 for that report. **Figure 1** below shows the adopted site sub-site locations. As it became clear during initial sampling that all Swale sub-sites were not actual surface swales and were in some cases shallow sub-surface discharges, so to avoid confusion the sub-sites were redesignated as ***In-line sites (I)*** for sites most likely to drain sub-catchments and **Ridge sites (R)** for the sub-sites located on the boundary between sub-catchments.

Whilst the overall methodology for the Intertidal Estuarine Habitat surveys remains as approved, the following additional detail arising from the actual first six-monthly sampling program are provided to supplement the approved methodology:

- The two 2m ladder transects separated by a 2m space configuration is retained and set up as per the approved methods but the configuration is now described as four fixed line intercept transects set 2m apart providing the overall fixed 6m wide plot for placement of random quadrats. This adjustment allowed for a more representative landscape mapping of the sub-site intertidal zones without increasing potential trampling impact. These plots still retain variable offshore lengths determined by local sub-site tidal zoning.

The distinctions between two monthly and before/during and after sampling requirements for all the intertidal monitoring parameters were not all provided in the Approved methodology and these are now clarified as follows:

- The Intertidal Point Intercept Habitat Transect and Plot Quadrat Sampling requirements are undertaken two monthly, meaning that all transects and quadrats will be sampled nine times (*9 by 2 month terms*) over the 18 month period, with each sampling occurring within each designated two-monthly term).

- The Intertidal Transect Height Profile, Plot Shade/Drip Line measurements and Landscape Mosaic assessments were scheduled to be undertaken at the beginning and end of the 18-month program and this has now been regularised and expanded to be undertaken three times (*3 by 6 month terms*) over the 18 month period.

The methodology for *line point intercept measurements* is clarified as follows:

- For each line transect the start to stop points of vegetation assemblages are recorded based on main species present and then all plants noted within this assemblage are listed.
- For this process a master species list has been constructed with two letter plant codes to facilitate monitoring and data presentation. The present working Species and Code Key is provided as **Table C1** in **Appendix C** and this table will continue to expand and be refined as new species are encountered and others are confirmed.
- Refinement of the species list will also include specific distinction between local indigenous plants and weed species.

The methodology for *landscape mosaic descriptions* is clarified as follows:

- For each of the 6m wide landscape plots initial definition of the main plant assemblages within the plot are determined by dominant zone species and/or dominant abiotic factors such as bare sediment.
- Once the assemblages are determined and described, the cross-over points for each of the four fixed transects for each of the assemblages are plotted directly onto squared graph paper and a six-meter survey staff is then deployed across the four shore-normal transects (i.e., laid shore parallel) to enable measurements to 'join the dots' on the graph paper for the assemblage limits between the fixed transect measurements.
- The sketches are later digitised to produce the landscape mosaics for each sub-site plot. Each landscape plot is accompanied by a drone photo of each subsite plot plus site photographs looking up and down the plot areas.



**Figure 1** Final Adopted Intertidal Habitat Site Locations

Methodology for *intertidal plot quadrat density* is clarified as follows:

- Whilst the transect point-intercept analysis monitors progression or receding vegetation or assemblages over time, density change within these riparian, saltmarsh and inshore mangrove assemblages and zones is assessed via three haphazardly placed quadrats within each zoned area within the plot mosaic (i.e., riparian edge, saltmarsh, saltmarsh-to upper mangrove and upper mangrove zoned habitats):
- The quadrat is 1m x 1m square with a 5x5 grid (i.e., 25 squares). Density is recorded via the following density scale:
  - In quadrats with only one individual, a density value of 0.1 is recorded.
  - Quadrats with species < 30% coverage (< 8 squares) is density value One.
  - Cover between 30 and 60% (9 to 16 squares) is density value Two.
  - Density value Three for coverage greater than 60% (17 or more squares).
  - Crab holes, mangroves seedlings, saplings and adults are individually counted within each quadrat.
  - Mangrove pneumatophore cover is determined by a count of occupied grid squares with values recorded as 0 to 25.

With regard to post wet weather sampling of intertidal habitats the overall trigger for addition sampling is clarified as follows:

- Following any days or continuous days where there is more than 20mm rainfall recorded. a representative number of intertidal site riparian slopes are inspected against the previous site mosaic and height profile data for evidence of erosion or deposition.
- If there is erosion/deposition noted this will trigger a full check of all sites for erosion/deposition which will be documented/described as field notes for the next scheduled transect height and mosaic study.
- Assessment for possible erosion/deposition will also be facilitated by up and down slope transect photography undertaken for each bimonthly intertidal sampling event. Note that this refinement was made in March 2023 so that there are missing photographs for some transects in the first and second bi-monthly terms.

## 2.2 Estuarine Seagrass Monitoring

The Approved Aquatic Ecology Monitoring Report Figure 2 showed the original proposed monitoring site locations as they related to the then proposed oyster monitoring sites. As the oyster monitoring sites were subsequently adjusted in consultation with Crookhaven Oyster farmers, there were some minor adjustments to the seagrass monitoring sites and **Figure 2** below shows the final adopted seagrass monitoring site locations in relation to the final agreed oyster monitoring sites.

Whilst there are no changes to the Approved Seagrass monitoring program, the practical implementation of the program has included the following additional set up and analysis details which are provided here to supplement the Approved methods:

- Seagrass blades are replicated by using polypropylene ribbon, which is 5mm wide, <1mm thick and is cut to 30cm lengths. Four of these 30cm “seagrass blades” are then bundled together and cable tied to a piece of dowel, mimicking a single *Zostera* shoot.
- To calculate the epiphytic sediment and algae weights all 16 artificial seagrass leaves from each replicate are scraped clean using a razor blade with the total wet epibiota and sediment washed into a pre-weighed dry foil dish.
- The wet weight of each foil dish was recorded, and foil dishes were then placed in a laboratory oven at 70 °C for 24 hours.
- Once oven dried the dishes are weighed again.
- The oven dried samples in the foil dishes are then placed into a scientific muffle furnace at 500 °C for 2 hours, burning off all organic matter. The final ash weight of samples is then measured.
- The algae to inorganic epiphyte biomass proportions are calculated as follows:
  - Total organic weight (algae) = Dry weight – Ash weight.
  - Total Sediment weight = Ash weight.
  - These sediment and organic weights were then expressed as gm/cm<sup>2</sup> seagrass surface.



**Figure 2** Final Adjusted Lease Oyster Deployment Locations (blue dots) as recommended by Oyster Farmers. Red dots show corresponding Seagrass ASU sites.



### 2.3 Crookhaven Estuary Aquaculture Oyster Monitoring

Section 2.4 of the Aquatic Ecology Methodology Report provides an overall description of the oyster monitoring program and Figure 2 for that report indicated the Site Locations as they related to the then proposed oyster monitoring sites. Following commencement and as per Condition C18 (e), the oyster monitoring component of the project was presented to Crookhaven/Shoalhaven oyster industry representatives who made a number of recommendations to alter the oyster monitoring program including retention of 12 sites rather than the 10 sites recommended, adjusting the actual site locations in situ and duplicating the recommended Sydney Rock Oyster Monitoring program to include Pacific Oysters. Figure 2 (above) shows the final adopted site locations as recommended and as established in direct partnership with the oyster farmers,

### 2.4 Lake Wollumboola Freshwater Biota Monitoring

Section 2.3 of the Approved Aquatic Ecology Methodology Report provides the rationale and methodology for the adopted Freshwater Biota monitoring program from six sites in three creeks, and, for clarity, the final adopted sampling sites are shown in **Figure 3** below.

As preliminary analysis of Season 1 and 2 ASU macroinvertebrate community results indicated high variation among site replicate samples, with few colonising taxa dominated by bloodworms (sub-families Chironominae and Tanypodinae), the following refinements have been adopted for the existing approved macroinvertebrate sampling program:

- Seasonal deployment time for ASUs has increased from two months per season to three months per season to allow for increased colonisation by stream macroinvertebrates.
- Undertake additional quantitative macroinvertebrate sweep netting of available detritus habitats at each site, comprising three 20 second timed replicate samples per site, to complement and inform the ASU sampling program.

The Electrofishing Methodology did not specify the actual monitoring rate, which is provided here as follows:

- Electrofishing fishing effort comprises three replicated 3-minute shots at each site for each survey period.



**Figure 3** Final adopted Freshwater Monitoring Site Location