MARINE POLLUTION RESEARCH PTY LTD

Marine, Estuarine and Freshwater Ecology, Sediment and Water Quality Dynamics

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Mr. M Bennett
149 Riverview Road
AVALON NSW 2106 **17 November 2016**

DRAFT AQUATIC ECOLOGY ASSESSMENT

PROPOSED JETTY, RAMP, PONTOON & MOORING PEN
149 RIVERVIEW ROAD AVALON

Figure 1 Location of existing boatshed, stub jetty and slipway at 149 Riverview Road Avalon in relation to adjacent marine facilities

1 INTRODUCTION

I was requested by Mr Mark Bennett of Bennett Architects & Associates to prepare a report on possible marine ecological impacts of extending the existing jetty at 149 Riverview Road Avalon and including a ramp, pontoon and mooring pen facility. The proposal is shown in a general arrangement plan (Bennett Architects & Associates Pty Ltd, dated 27 September 2016). A copy of this plan is attached to this report at **Appendix A**. The proposed jetty extension would be 2m long with an additional 2.83m fixed narrow (1.2m) walkway plus a ramp offset to bring the facility parallel to the Division of Waterway (DoW) and to achieve the 2m setback from the DoW. The ramp would connect to a 2.4m by 3.6m pontoon with the overall length of the total extension being 13.9m. The ramp would be made from DPI Fisheries approved mesh material to allow light penetration to the seabed and the pontoon would be manufactured using the same mesh material to facilitate additional light penetration to the seabed. The proposed mooring pen is 4m by 6m.

Figure 1 provides an aerial view showing similar marine facilities around the site. Figure 2 shows the existing facility looking towards shore. Figures 3 and 4 provide views of the jetty from the south and north respectively, showing the preponderance of rock reef outcrops around the Facility.

Figure 2 Existing jetty, slipway and boat shed facility looking to shore. Note sandstone seawalls on shoreline and rocky reefs to the north of the jetty.

Figure 3 View north to the existing facility. There is sandy beach on the south side of the facility and rocky shore and reef extending out into subtidal waters on the north side. Note also the Zostera seagrass bed offshore from the sandy beach and from the existing jetty.

Figure 4 View of proximity of existing facilities at Nos 149 and 147 (south) Riverview Rd.

2 AQUATIC ECOLOGY OF THE SITE

A diver-survey of the site was undertaken on 20 September 2016 to map out the main aquatic ecological features and inspect the seabed for marine vegetation. The seabed over the complete property frontage was surveyed out to the limits of the adjacent facilities. The weather was sunny and calm and waters were clear and suitable for underwater photography and measurements. As there are seagrass beds in the locality a 5m survey staff was laid out end to end along the centre line of the proposed facility to determine the locations of various seagrass beds, and a 0.5m by 0.5m quadrat was used to obtain seagrass (*Posidonia australis*) shoot densities within each of the identified seagrass bands. Underwater photographs were taken of the seabed along the survey staff line and these are included in **Appendix B** to this report.

Figure 5 shows the main aquatic habitats at the site superimposed onto an aerial photograph. Depth contours were taken from the site survey plan and are depths below chart datum (m ISLW) which approximates Lowest Astronomical Tide (LAT. The main habitats are as follows:

- There is a mixed riparian rock and sandy beach either side of the existing boatshed and jetty (Figures 2 to 4) and there is a natural intertidal rock and rubble reef offshore as indicated in Figure 5.
- There is a mixed *Caulerpa* and seagrass distribution from the edge of the existing jetty at around 0m LAT extending 23 m offshore from the edge of the existing jetty (see detailed underwater transect photographs in **Appendix A**).
- The pest algae species *Caulerpa taxifolia* extended through the whole seagrass distribution.
- *Posidonia australis* seagrass occurred from 3m offshore to 19m offshore.
- *Zostera capricorni* seagrass occurred from 0m offshore to 23m offshore.
- *Halophila ovalis* seagrass occurred inshore and generally throughout the other seagrass distribution as a very minor and patchy component.
- The seabed beyond the 23m mark was bare silty sand sediment.
- Jetty support piles and the wetted edges plus undersides of pontoons in the locality (at Nos 147 and 149) supported a diverse cover of algae and encrusting fauna (see Figures A14 to A16 in Appendix B).

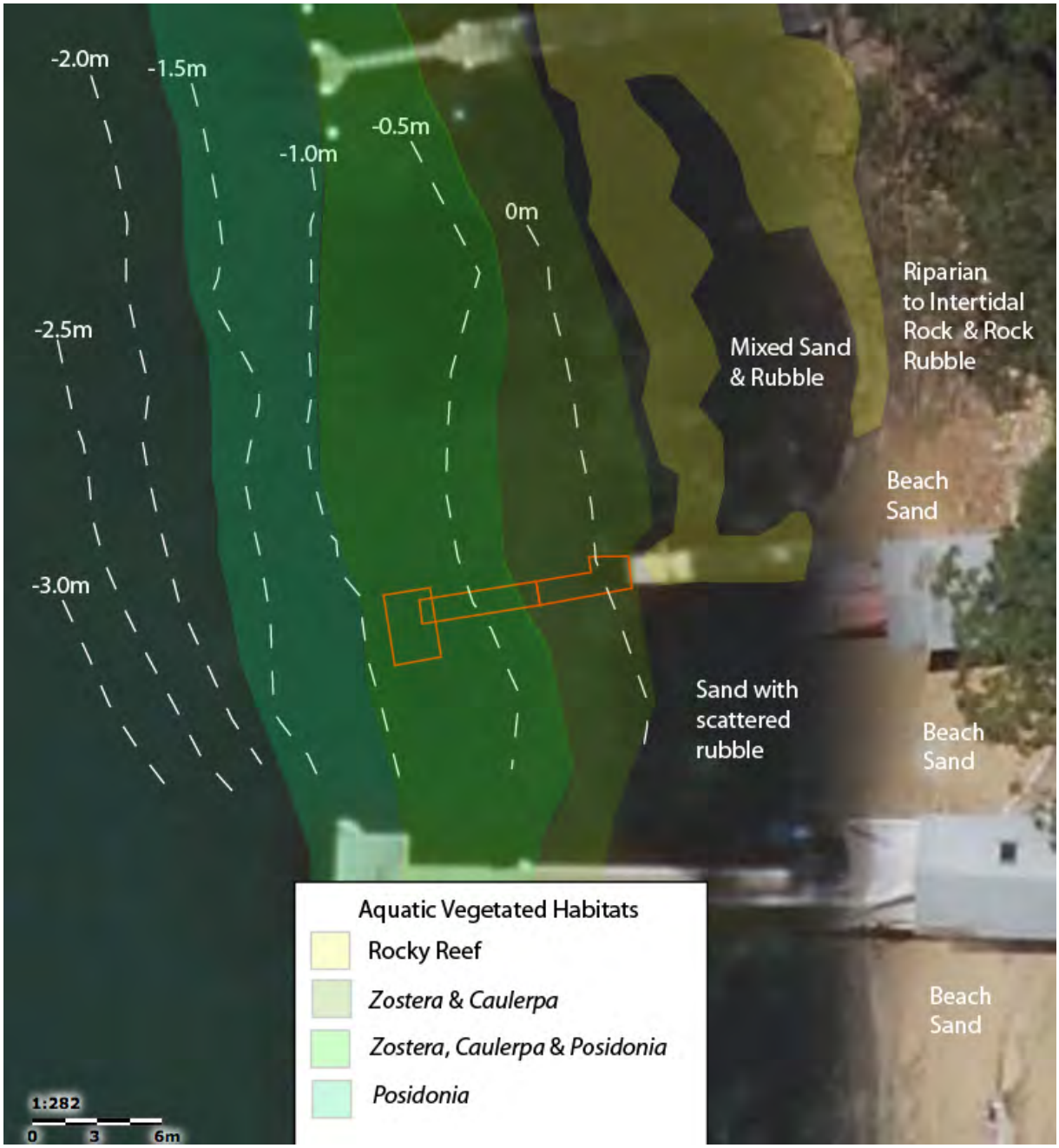


Figure 5 Aquatic Habitats at 149 Riverview Road Avalon, September 2016.

2.1 *Posidonia* distribution and density

The *Posidonia australis* distribution was noted to be relatively even but with low shoot densities. *Posidonia* shoot density was quantified by replicate measuring of shoot densities in 0.25m^2 quadrats along the transect line. Four distances were selected at random in the *Posidonia* bandwidth (from 3m to 19m offshore) and at each selected distance point, *Posidonia* shoot density was measured in five rolling quadrats. Results (as shoots per m2) are shown in **Table 1** below.

Table 1 *Posidonia* shoot density at 149 Riverview Road Avalon

Distance offshore (m)	Shoots per metre squared in each replicate					Shoots/site	
	Rep1	Rep2	Rep3	Rep4	Rep5	Mean	StDev
16	8	0	16	24	12	12.0	8.9
13	32	24	16	40	36	29.6	9.6
10	28	32	40	48	28	35.2	8.7
5	24	36	16	0	12	17.6	13.4

Results are summarised as follows:

- Overall mean ± standard deviation (sd) *Posidonia* shoot density in the proposed jetty ramp and pontoon area was 23.6 ± 13.4 shoots/m^2.
- Inshore *Posidonia* shoot distribution (measured at 5m offshore) was the most uneven (low ratio mean/standard deviation of 1.3) and overall shoot density (mean ± sd) was low at 18 ± 13 shoots/m^2.
- Mid-shore *Posidonia* shoot distribution (measured at 10 and 13m m offshore) was less uneven (higher mean/sd ratios of 3 to 4). Whilst overall shoot density was up to double the inshore density (at 30 ± 10 shoots/m^2 and 35 ± 9 shoots/m^2), it was still relatively low for comparable *Posidonia* beds such as occur in Careel Bay and Botany Bay, where shoot densities vary between 80 to 250 shoots/m^2.
- Offshore *Posidonia* shoot distribution (measured at 16m offshore) was as uneven as the inshore *Posidonia* distribution (similar ratio mean/ sd of 1.3) and overall shoot density was low at 12 ± 9 shoots/m^2.

The overall *Posidonia* shoot densities measured for this project are generally but not always higher than previous shoot densities measurements made at Nos 139, 143, 147 and 155 Riverview Road between 1999 and 2002. Overall *Posidonia* densities measured offshore of properties with no marine facilities (at the time) at Nos 139, 43 and 147 were 26±6, 15 ±4 and 16 ± 5 shoot/m^2 respectively. Measurements of *Posidonia* shoot densities under a meshed pontoon (at No 143) was 15 ± 4 shoots/m^2 and under a narrow meshed jetty at No 155 was 18 ± 4 shoots /m^2. For the present study there were no *Posidonia* shoots found under the solid pontoon at No 147 and there was some *Zostera* under the footprint of the meshed ramp that matched the *Zostera* cover either side of the ramp.

It is concluded that *Posidonia* distribution on the seabed fronting No 149 Riverview Road is similar to that found along the stretch of Riverview Road from at least No 139 through to No 155 Riverview Road. Whilst overall *Posidonia* density was similar to other density studies in the general locality, it is at the higher end of the distributions, matching densities measured at No 139 Riverview Road in 2002. Notwithstanding, these *Posidonia* densities and the overall patchy natures of the distribution along the Riverview Road frontage of Pittwater still puts the beds into the low density/patchy distribution classification.

With regard to other requirements by DPI Fisheries for evaluation of this proposal the following are relevant:

- There are no mangroves or saltmarsh stands at the subject property or in the locality.
- There are no aquaculture activities, or commercial fishing (hauling or meshing) in the locality (EPA 1992).
- The pest algae species (*Caulerpa taxifolia*) listed under the FMA is common at the site and has been frequently recorded along this section of Riverview Road since the early 2000's.
- Seagrass beds in Pittwater that include *Posidonia australis* are listed as an *Endangered Ecological Community* under the FMA and are listed as a *Threatened Ecological Community* under the EPBC Act. The mixed *Posidonia* segrass bed at No 149 Riverview Road does not meet the criteria for *Posidonia* beds under the EPBC Act criteria.

3 POSSIBLE CONSTRUCTION & OPERATIONAL IMPACTS

The proposed construction works require the placement of at least five support piles for the jetty extension, the installation of the ramp and floating pontoon, installation of two locator piles to keep the pontoon in place and two piles for the mooring pen (see plan attached at **Appendix A**). Potential impacts from these activities are as follows:

- Placement of piles can disturb marine biota under the footprint of the pile and cause localised turbidity.
- The proposed jetty extension plus ramp and pontoon cast shadows that can limit light penetration to seabed marine vegetation.
- Use of a pontoon for mooring of a vessel can cause additional shading if the vessel is left moored at the pontoon for extended times, and there can be a potential for bottom habitat disturbance from propeller wash or damage when vessels arrive or leave the pontoon during low tides.

3.1 Assessment of Construction Impacts

Whilst placement of piles creates turbidity, this is not considered a significant problem as turbidity would be localised to the immediate area around the piling work area, would be confined to bottom waters and would disperse rapidly. Placement of the piles would displace some seagrass. For piles of 400mm diameter, up to 0.126 m^2 seagrass habitat could be impacted per pile. Accordingly, pile placement could destroy some 1.1m^2 mixed *Zostera* and *Posidonia* habitat, and between 27 and 36 *Posidonia* shoots could be lost.

There is a potential risk of damaging inshore rock rubble algae and seagrass beds via the use of anchors, mooring blocks and other apparatus for undertaking the construction works, or via construction related vessel wash and propeller thrust. These risks can be mitigated to insignificance by the implementation of suitable mooring, anchoring and work practices that must be included in the project Construction Environment Management Plan (**CEMP**):

(i) No vessel is to be moored with anchor gear placed in or on the rocky reef or seagrass bed area (0 to 30m offshore).

(ii) Construction vessels are not to be placed directly over rocky reef or

seagrass beds if there is a risk of there being less than 600 mm depth between the underside of the vessel and the sea bottom at any time; allowing for tide and wave action.

(iii) In order to minimise wash and to prevent bottom scouring, towing or pushing vessels must not use excessive power to manoeuvre barges into place in the vicinity of the rocky reef/seagrass beds.

3.2 Operational Impacts

With respect to the possible operational impacts on the aquatic ecology of the locality from the use of the facilities for occasional berthing (pick up and drop off) at the proposed pontoon, the depths around the western and southern sides of the pontoon are all > -1m chart datum (ISLW) and therefore there would always be more than 1m depth beside the pontoon sides for all tide conditions. Provided the pen is only used for short term berthing (pick up and drop off only) and provided vessels have a minimum clearance of 0.5m between the lowest part of the vessel propulsion and the seabed when berthing, there is low risk of disturbance for the seabed and seagrass. The risk can be further mitigated by ensuring vessels are only berthed along the western or southern sides of the pontoon. During very low tides, berthing should be confined to the western side of the pontoon.

The proposed jetty extension plus ramp and pontoon cast shadows that can limit light penetration to seabed marine vegetation:

- The 2m by 2m proposed jetty extension and the 2.8m by 1.2m deck extension are mostly situated over *Caulerpa* pest algae and *Zostera* seagrass habitat and by virtue of the height above the seabed shading are unlikely to impact this habitat to any observable extent.
- Both the 6.6m by 1.2m ramp and the 2.4m by 3.6m pontoon are located over mixed *Posidonia* and *Zostera* seagrass with a shading risk for around 189 and 204 *Posidonia* shoots respectively.

By virtue of the orientation of the facility to available sunlight, and by the use of suitable metal or plastic open weave mesh on the ramp and pontoon to allow light penetration to the seabed, there is likely to be sufficient direct, reflected and refracted sun-light to support seagrass. This conclusion is based on a previous analysis of potential shading impacts undertaken for a proposed jetty ramp and pontoon at the adjacent property south prepared in 2001 (MPR 2001) that was aligned in the same manner as the present proposal for No 149.

For the No 147 proposal shading effects for the proposed jetty ramp and pontoon extension were estimated for 9 AM, 12 Noon and 3 PM on two dates, one in mid summer (22 January) and one mid winter (22 June). These dates provide for the range of shading effects over a full year. Calculation of the amount of time an individual seagrass plant would be shaded by the proposed jetty was made in the following manner:

- The maximum east and west extent of the proposed facility shadow was calculated for the shadows cast by the head of the jetty at 9 AM and 3 PM, to provide a daily range and an average rate of change of shadow over that time period.
- For seagrass under the jetty, the time any individual plant was in shadow was calculated by applying the rate of change, using the 12:00 shadow width.

Shadow calculations are summarised in Table 2 below. Note that the 2.5 m shadow range in mid summer is centred on the jetty and no other seagrass in the vicinity are impacted. In contrast the mid winter shadow is cast to the south of the jetty (from about 1 m south of the jetty at 9 AM to 17 m south of the jetty at 3 PM) and therefore no seagrass shoot under the jetty is shaded. That is, the amount of time any one seagrass plant under the footprint of the jetty would be shaded during the year would vary from 0 minutes in mid winter to 2.5 hours in mid summer.

Table 2 Original Shading Calculations for a similarly aligned jetty ramp and pontoon facility at No 147 Riverview Road

Sun Date	Shadow Range	Rate of Change of Shadow	Noon Shadow	Time in Shade
Jan-22	3.1 m	0.52 m/hr	1.3 m	2.5 hours
Jun-22	15.8 m	2.63 m /hr	1.7 m	39 min

By applying a mesh material to the ramp, this shading could be reduced to insignificance. Maximum sunlight penetration through the mesh material occurs around mid-day, coinciding with the maximum shading effect from a solid structure. Thus, maximum benefit is derived from a mesh structure when it is needed most. Further, as the water surface is seldom still (via both wind waves and vessel wakes), there would be refraction effects for much of the time, providing additional light to the seagrass plants. That is, it is concluded that there would be a low risk of impact on seagrass beds or plants from shading from the proposed jetty and ramp extension.

As the pontoon will require floatation it cannot be manufactured entirely of light penetrating mesh and by virtue of the increased width of the pontoon it will cast an overall greater shadow than the ramp. Also, due to the pontoon floating in the water, the overall diurnal and

seasonal range of the shadow over adjacent waters is much reduced so the potential shading impact is reduced to the footprint of the pontoon alone. This also means that there would be overall more ability for light reflection and refraction to provide sunlight to the shaded seagraass over the year. Accordingly there remains a medium risk for at least some *Posidonia* loss to shading from the proposed pontoon. However, the combination of natural sunlight penetration around the pontoon edges plus additional sunlight penetration via pontoon mesh decking would considerably lessen the risk of *Posidonia* shoot loss - as demonstrated for the mesh pontoon at No 143 Riverview Road (and as discussed in Section 2.1 above).

The provision of a berthing area includes the risk that vessels will be moored for longer periods than the proposed drop off and pick up restriction, and if vessels are moored for long periods in the mooring pen there is a greater risk of *Posidonia* loss to shading from the vessel hull. This risk can be mitigated to a low risk by provision of a condition of consent that stipulates that the mooring pen can only be used for pick up and drop off and cannot be used for storing a vessel.

4 REFERENCES

EPA (1992)

Coastal resource atlas for oil spills in Broken Bay, Pittwater and the Hawkesbury River. NSW EPA. March 1992.

MPR (2001)

Marine Ecology Survey – Proposed Jetty Extension 147 Riverview Road Clareville. Report prepared for Estuary Constructions, August 2001.

Fisheries NSW (2013)

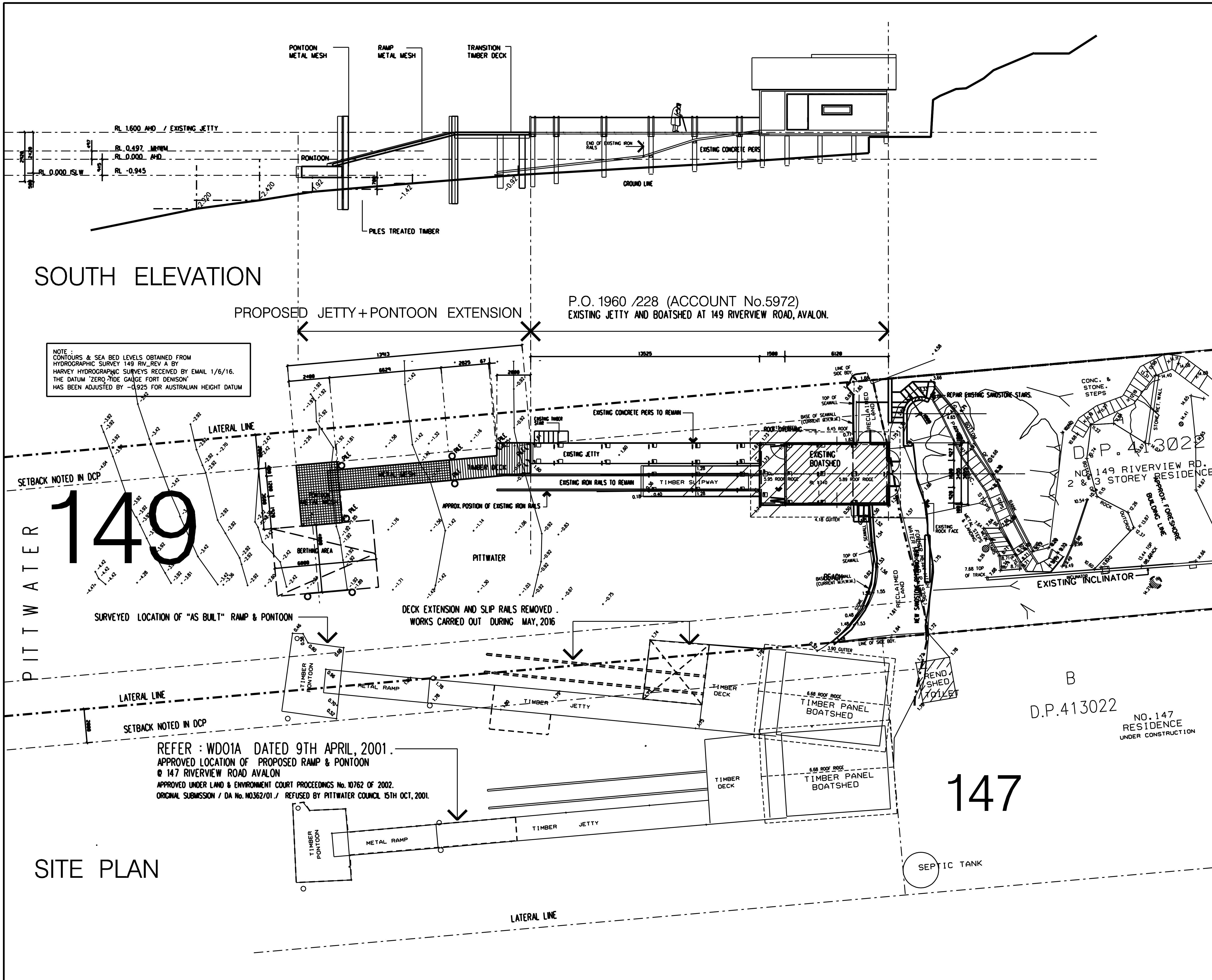
Policy and Guidelines for Fish Habitat Conservation and Management (2013 update), NSW Department of Primary Industries, June 2013.

West R J, Thorogood C, Walford T, Williams R J (1985)

An estuarine inventory for New South wales. Fisheries Bulletin No 2. Dept of Agriculture, NSW Sydney 165 pp.

APPENDIX A

PLAN OF PROPOSAL


PONTOON METAL MESH
RAMP METAL MESH
TRANSITION TIMBER DECK
RL 1.600 AHD / EXISTING JETTY
RL 0.497 MHWM
RL 0.000 AHD
RL -0.945
RL 0.000 ISLW
PONTOON
END OF EXISTING IRON RAILS
EXISTING CONCRETE PIERS
GROUND LINE
PILES TREATED TIMBER
SOUTH ELEVATION
PROPOSED JETTY + PONTOON EXTENSION
P.O. 1960 /228 (ACCOUNT No.5972)
EXISTING JETTY AND BOATSHED AT 149 RIVERVIEW ROAD, AVALON.
NOTE :
CONTOURS & SEA BED LEVELS OBTAINED FROM
HYDROGRAPHIC SURVEY 149 RIV_REV A BY
HARVEY HYDROGRAPHIC SURVEYS RECEIVED BY EMAIL 1/6/16.
THE DATUM 'ZERO TIDE GAUGE FORT DENISON'
HAS BEEN ADJUSTED BY -0.925 FOR AUSTRALIAN HEIGHT DATUM
LATERAL LINE
SETBACK NOTED IN DCP
149
PITTWATER
EXISTING CONCRETE PIERS TO REMAIN
EXISTING JETTY
EXISTING IRON RAILS TO REMAIN
TIMBER SLIPWAY
EXISTING BOATSHED
APPROX. POSITION OF EXISTING IRON RAILS
BERTHING AREA
PITTWATER
REPAIR EXISTING SANDSTONE STAIRS.
CONC. & STONE. STEPS
D.P. 413022
NO. 149 RIVERVIEW RD.
2 & 3 STOREY RESIDENCE
APPROX FORESHORE BUILDING LINE
EXISTING INCLINATOR
RECLAIMED LAND
SURVEYED LOCATION OF "AS BUILT" RAMP & PONTOON
DECK EXTENSION AND SLIP RAILS REMOVED .
WORKS CARRIED OUT DURING MAY, 2016
TIMBER PONTOON
METAL RAMP
TIMBER JETTY
TIMBER DECK
TIMBER PANEL BOATSHED
LINE OF SIDE BDY.
B
D.P.413022
NO. 147 RESIDENCE
UNDER CONSTRUCTION
REFER : WD01A DATED 9TH APRIL, 2001.
APPROVED LOCATION OF PROPOSED RAMP & PONTOON
@ 147 RIVERVIEW ROAD AVALON
APPROVED UNDER LAND & ENVIRONMENT COURT PROCEEDINGS No. 10762 OF 2002.
ORIGINAL SUBMISSION / DA No. N0362/01./ REFUSED BY PITTWATER COUNCIL 15TH OCT, 2001.
147
SEPTIC TANK
SITE PLAN
LATERAL LINE

No.	DATE	AMENDMENT
B	25.11.16	DA ISSUE TO COUNCIL
A	27.09.16	GEN. ISSUE

NOTES

1. FIGURED DIMENSIONS TO BE TAKEN IN PREFERENCE TO SCALED READINGS.
2. ALL DIMENSIONS TO BE CHECKED AND VERIFIED ON SITE BEFORE COMMENCING FABRICATION.
3. ALL CONSTRUCTION TO COMPLY WITH THE BUILDING CODE OF AUSTRALIA, RELEVANT SAA STANDARDS AND LOCAL AUTHORITY REQUIREMENTS.
4. THIS DRAWING IS COPYRIGHT AND THE PROPERTY OF BENNETT ARCHITECTS & ASSOCIATES PTY. LTD. AND MUST NOT BE RETAINED, COPIED OR USED WITHOUT THE CONSENT OF THE AUTHOR.

TRUE NORTH

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DRAWING TITLE
PROPOSED JETTY + PONTOON + BERTHING AREA

PROJECT
PROPOSED ALTERATIONS AT:
LOT A – D.P. 413022
149 RIVERVIEW ROAD, CLAREVILLE

FOR:
MR M.R. BENNETT

JOB No.	0576	DWG No.
SCALE	1:100	CC103 B
DATE	SEP 2016	
DRAWN	MRB	
CHECKED	MRB	

APPENDIX B

UNDERWATER PHOTOGRAPHS

OF

SEABED TRANSECTS

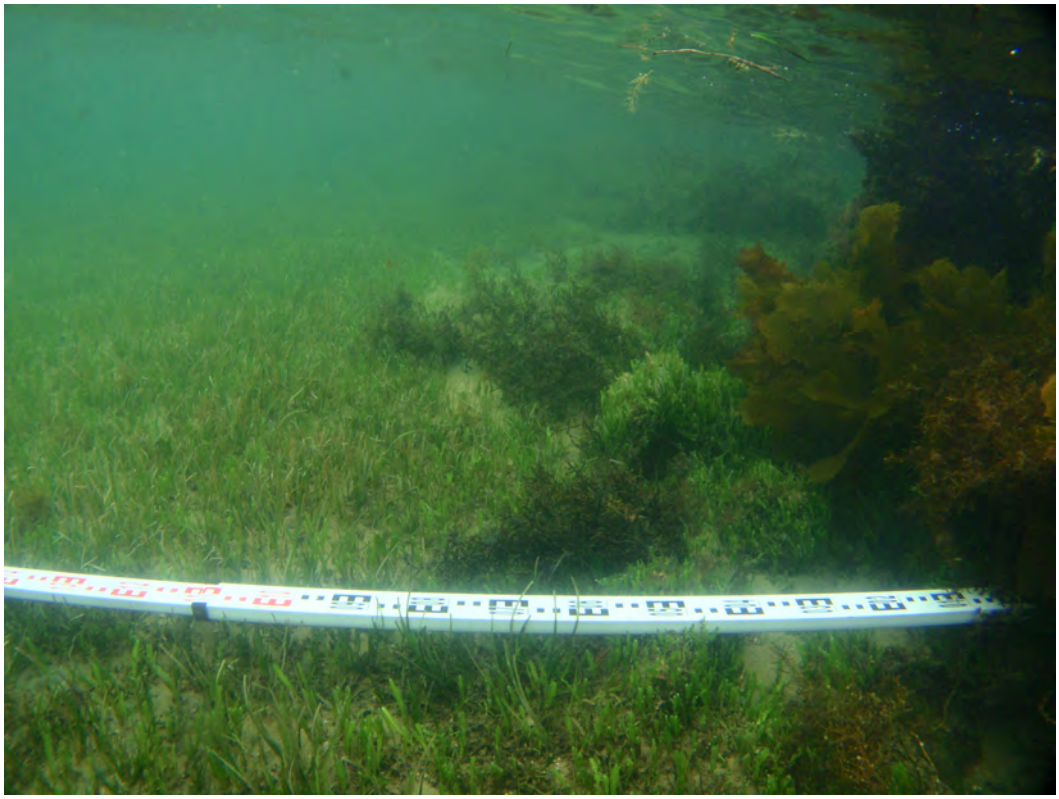

Figure A1: 0 to 1.5m looking north. Outer jetty pile on the right. *Caulerpa* dominant with scattered, low density but even *Zostera* cover and very low density of *Halophila* ; distribution CZ(H).

Figure A2: 0.5 to 5m offshore looking west. CZ(H) in the foreground to 3m and mixed *Caulerpa* and *Zostera* with low density Posidonia to 5m (ZCP) see also Figures A3 through to .

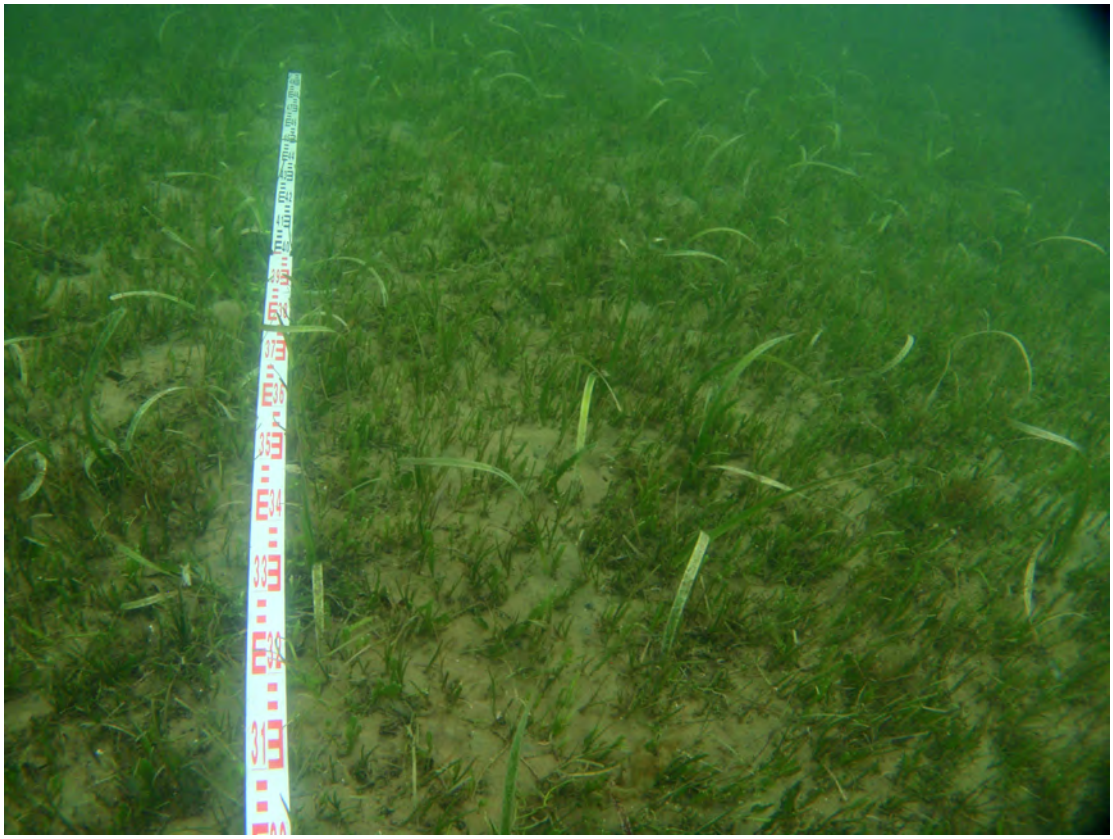

Figure A3: 3 m to 5m, ZCP as per Figure A2.

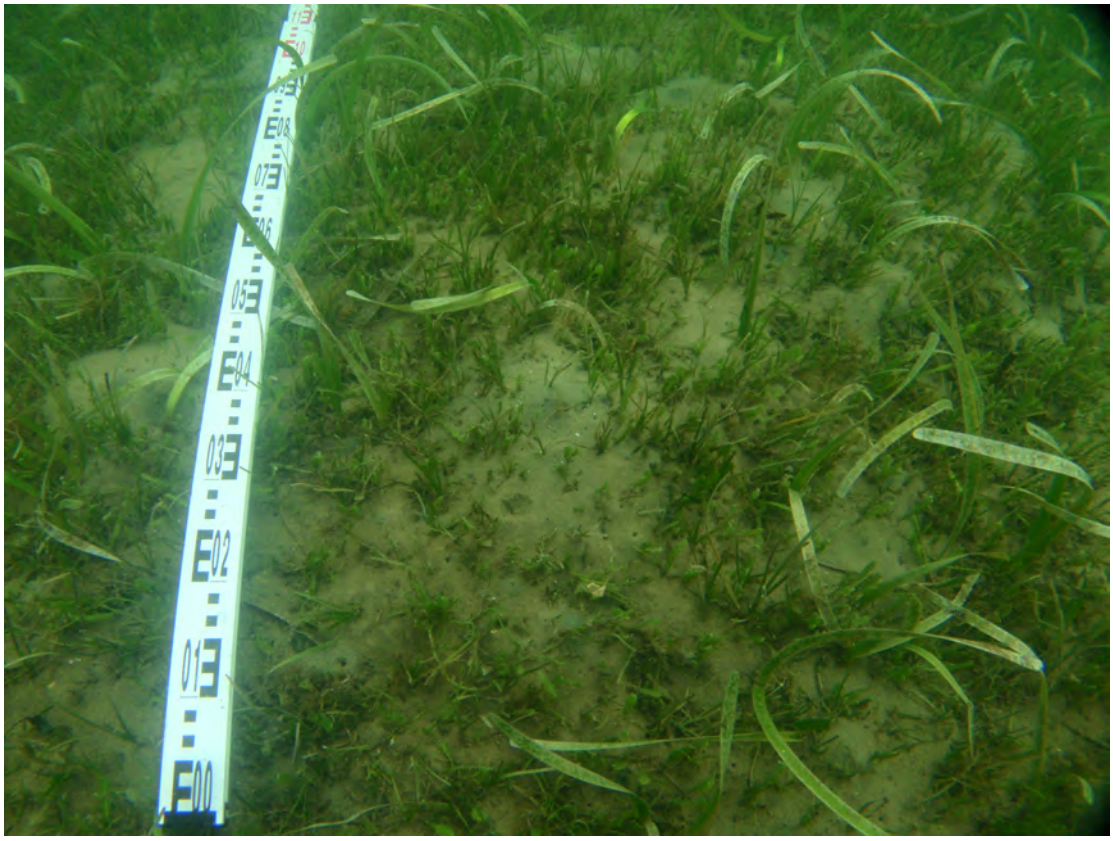

Figure A4: 5m to 6m looking west, ZCP as per Figure A3.

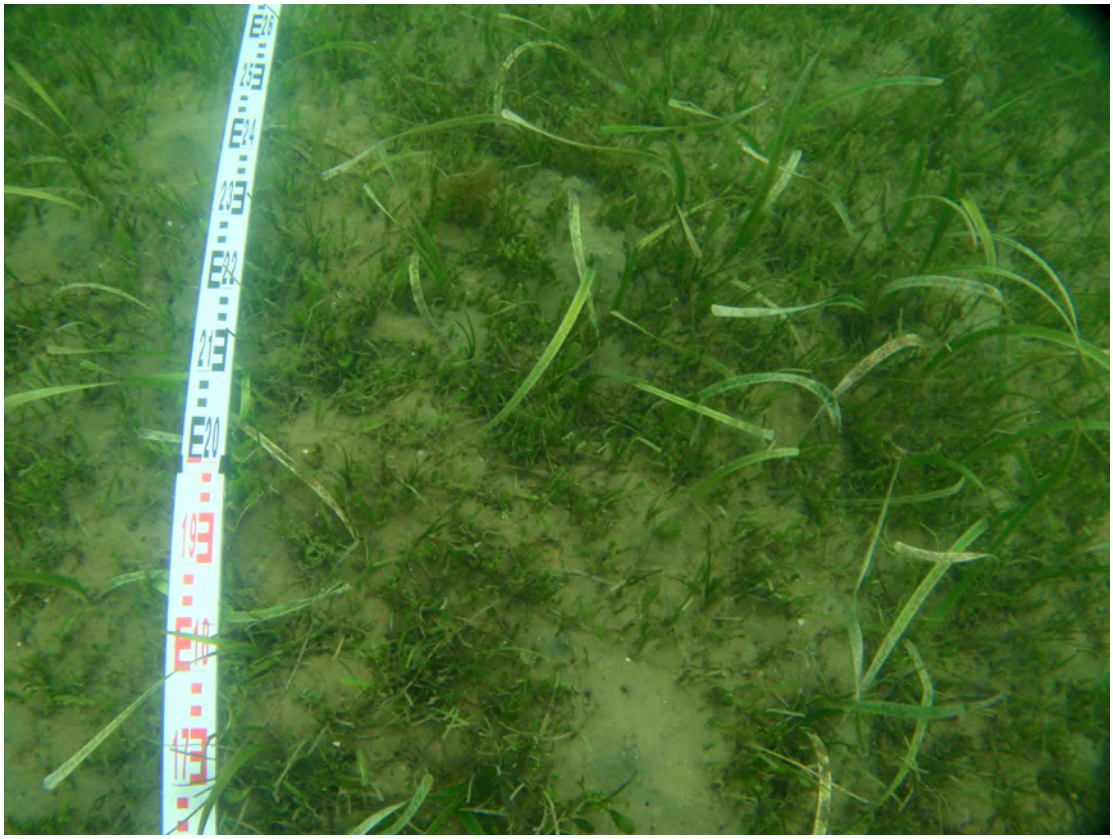

Figure A5: 6 to 7m looking west, ZCP as per Fig A4.

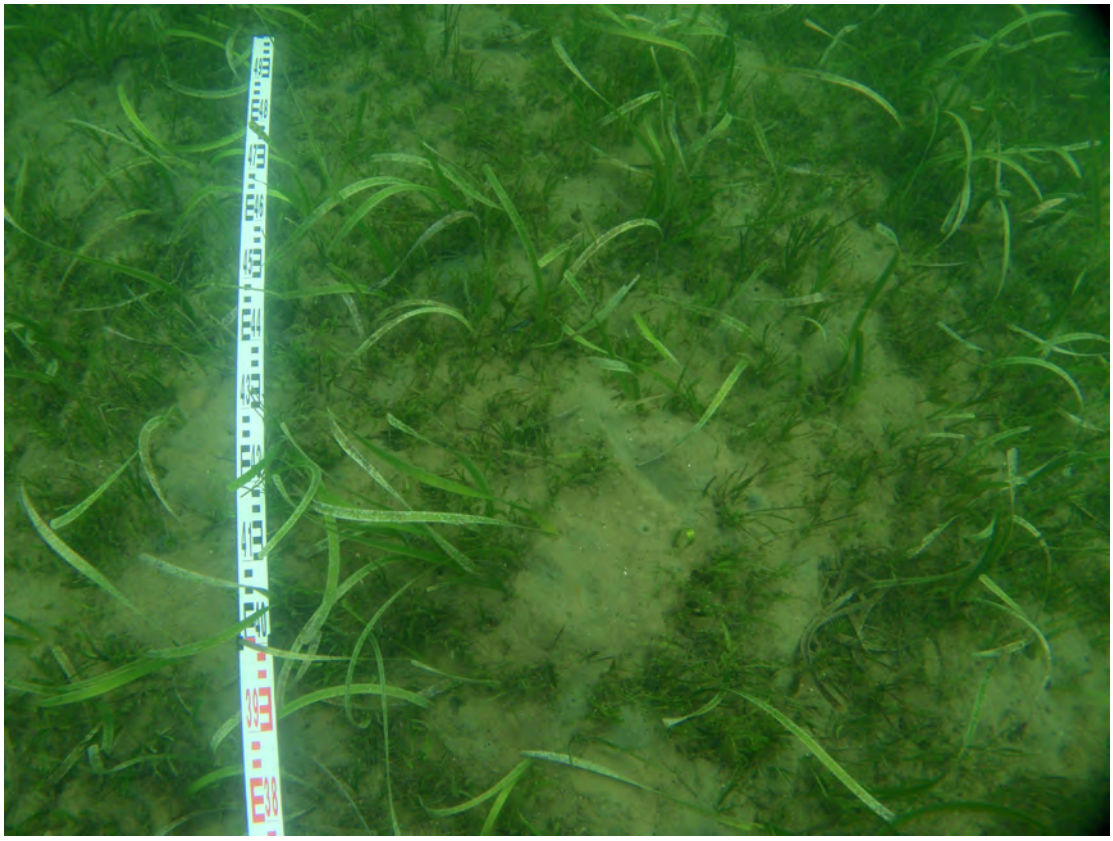

Figure A6: 8.7m to 10m looking west, less *Caulerpa* and less *Zostera* with same *Posidonia* density as previous transects. Distribution CZP.

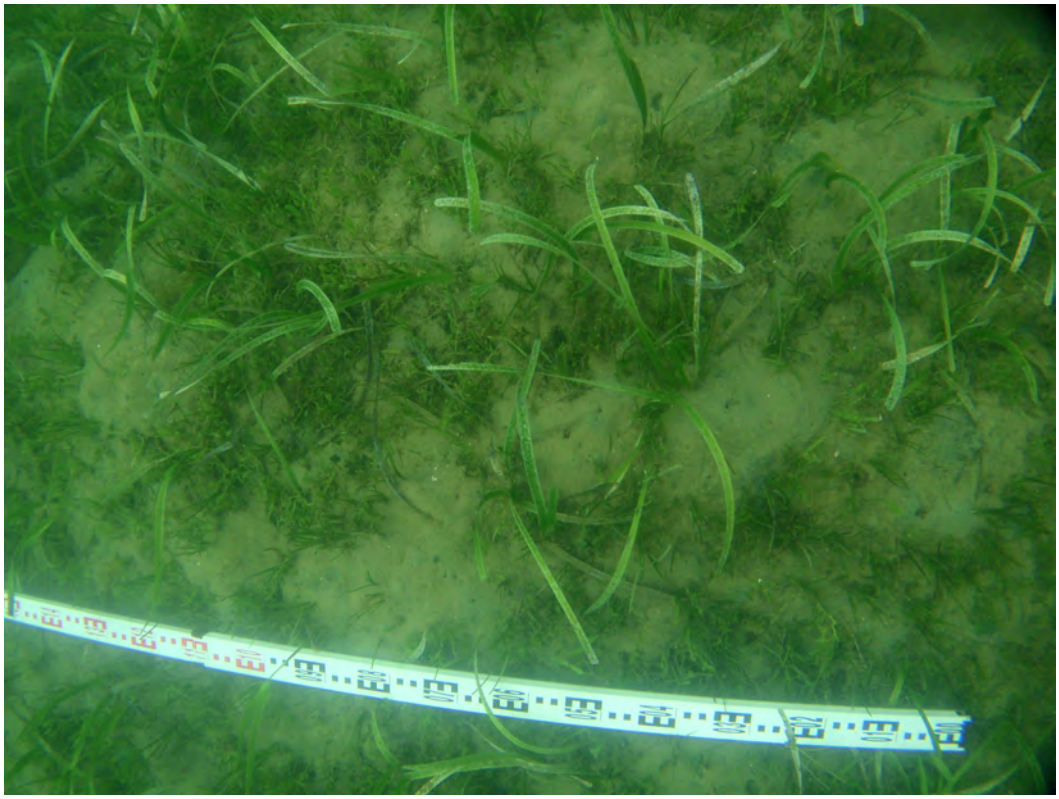

Figure A7: 10 to 11.5m looking north. Same distribution as Figure A6 with less *Zostera. Distribution* PC(Z). Proposed pontoon is situated around 10m to 12.4m along this transect line.

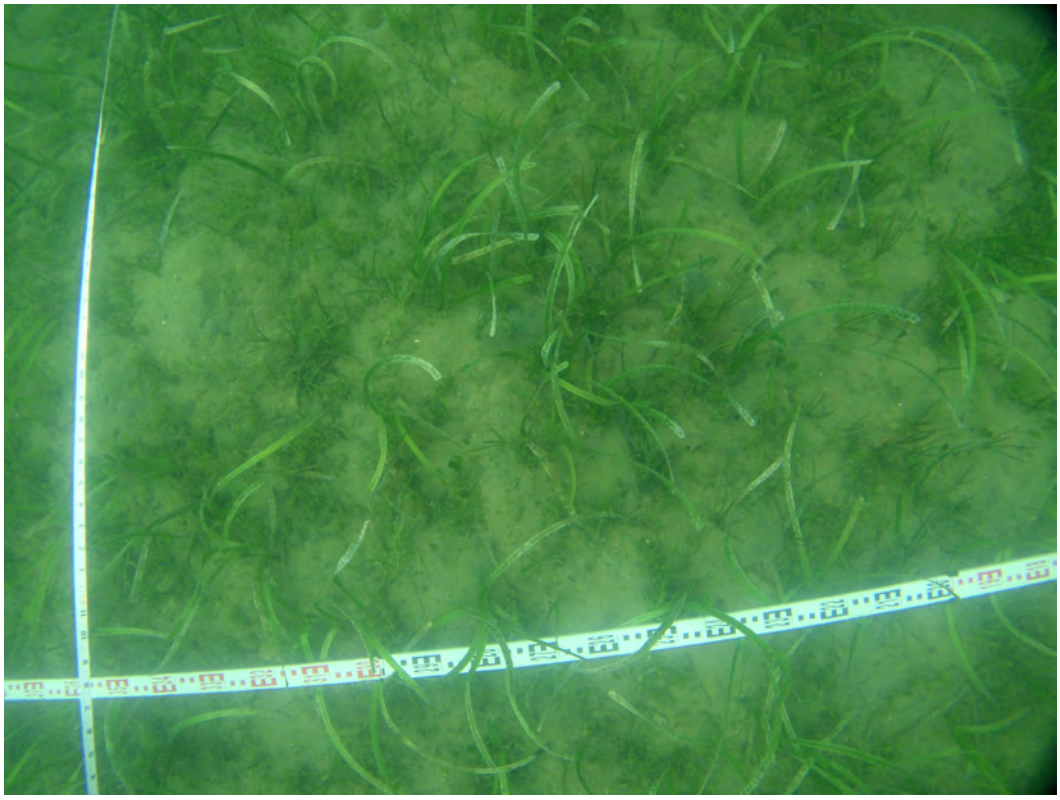

Figure A8: 11.8 to 13.6m looking north. Tape is located at 13.5m offshore, which is around 1m offshore from the outside edge of the proposed pontoon. There is no more Zostera seagrass; distribution PC.

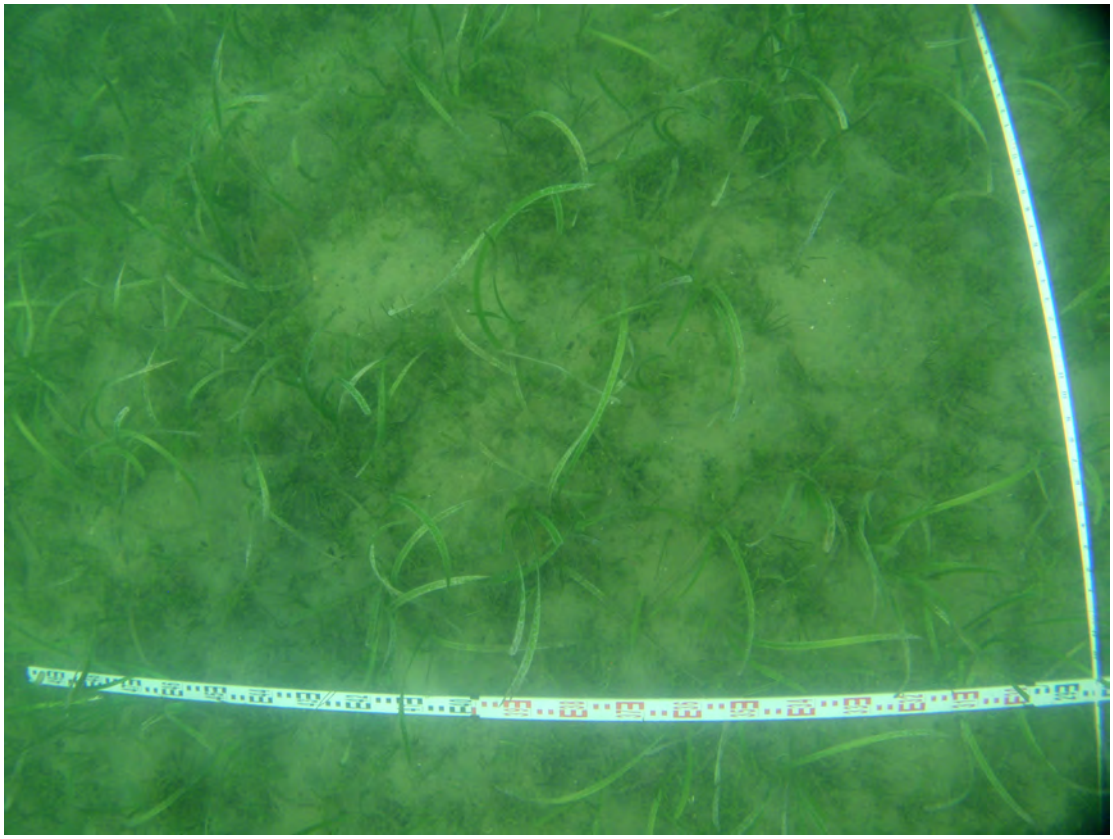

Figure A9: 13.8m to 15m offshore (looking north). *Posidonia* with scattered *Caulerpa*, distribution P(C).

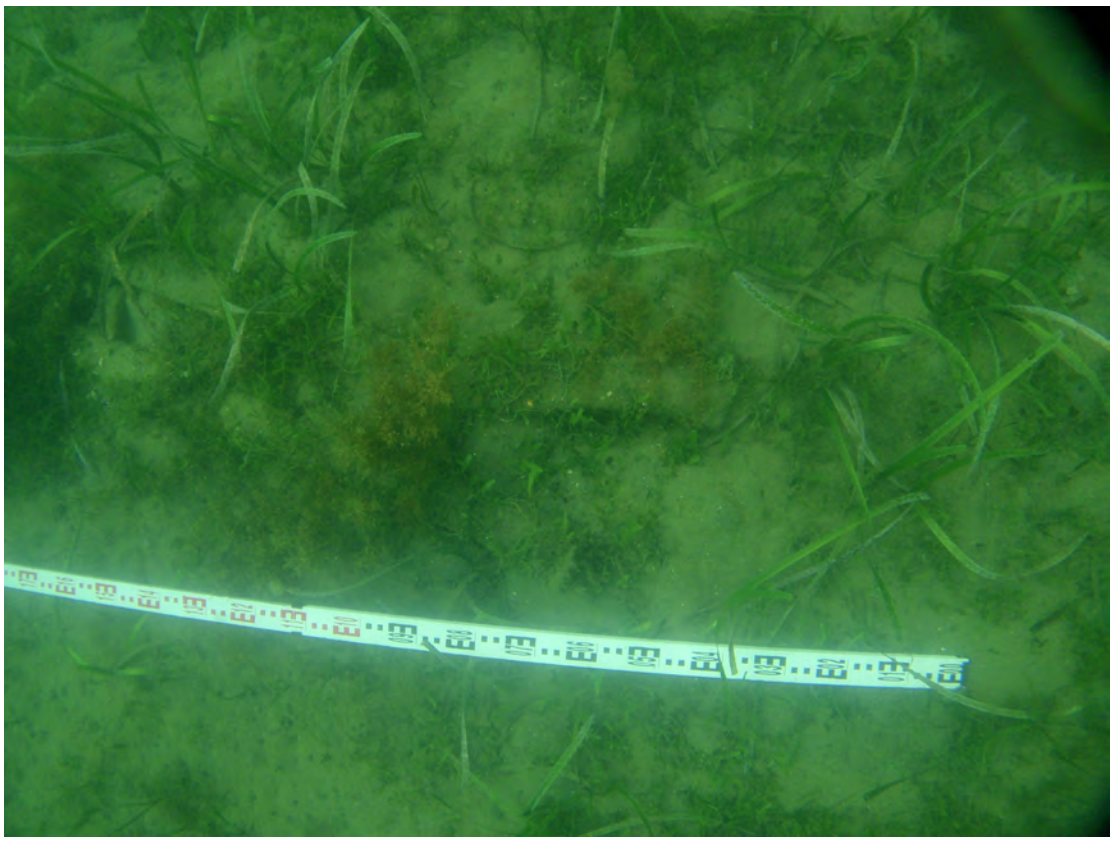

Figure A10: 15m to 16.7m offshore (looking north). *Posidonia* with scattered *Caulerpa*, distribution P(C). Note piece of masonry with brown algae cover.

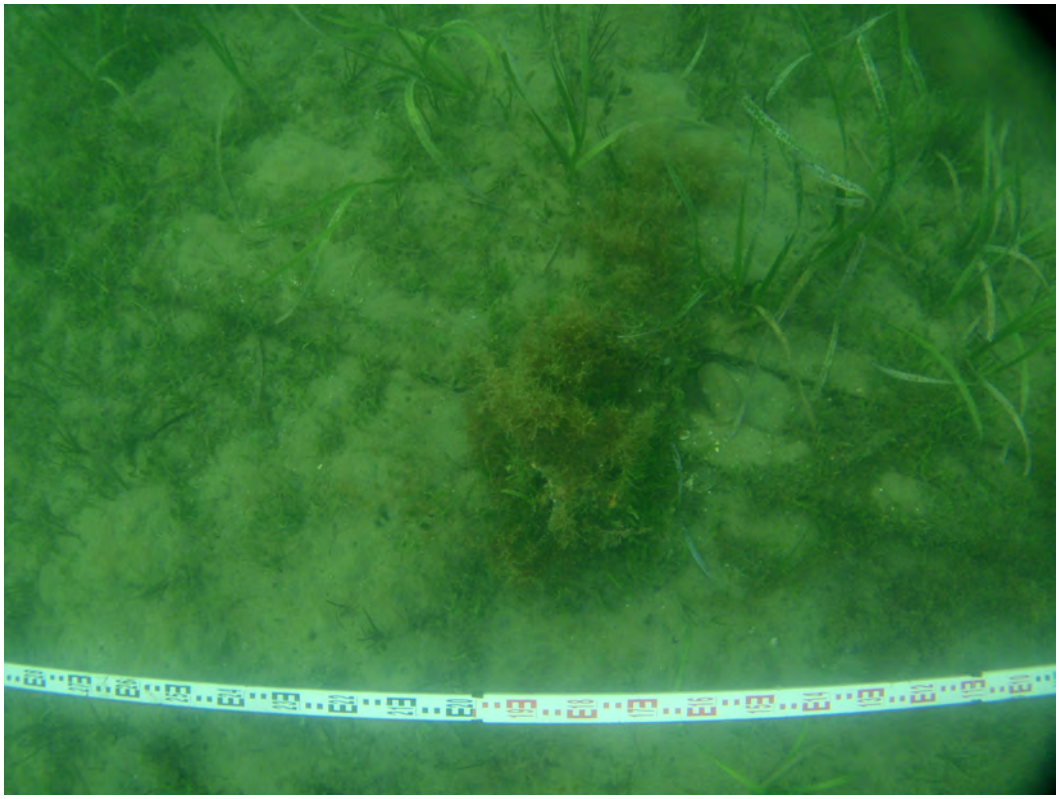

Figure A11: 17m to 18.8m offshore (looking north). Lower *Posidonia* density with scattered *Caulerpa* and some Zostera distribution P(C)(Z). Note planks on seabed with *Sargassum* algae.

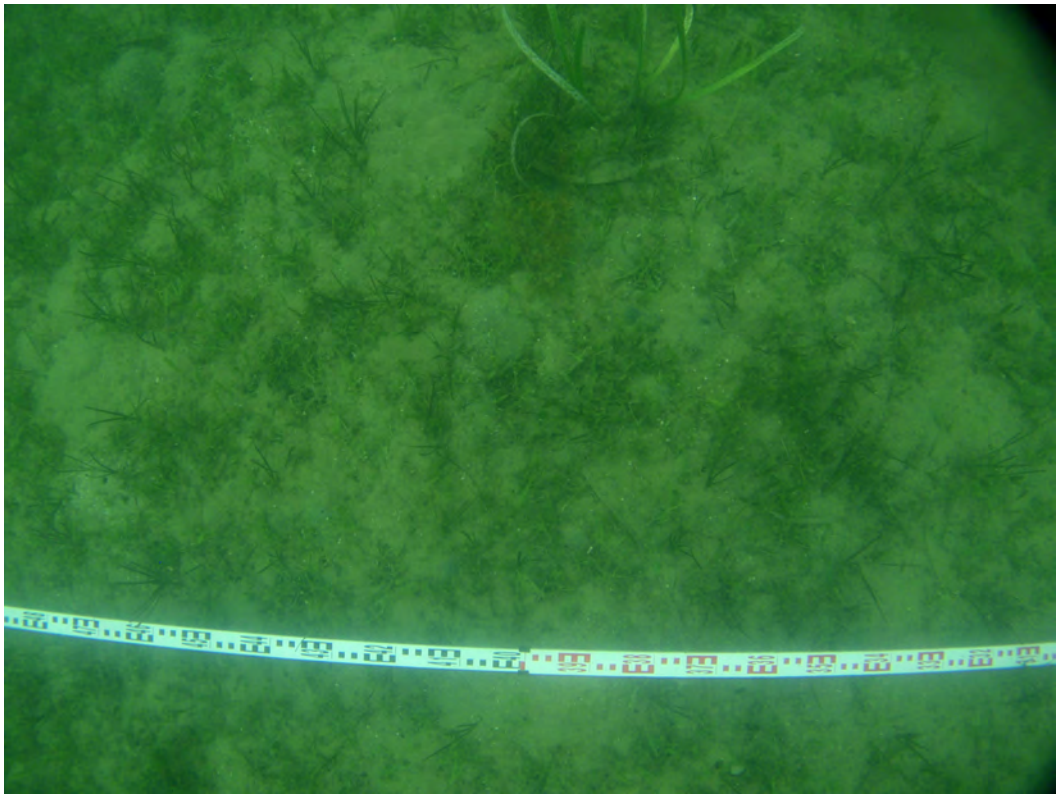

Figure A12: 18m to 19.4m offshore (looking north). Very low *Posidonia*, *Caulerpa* and *Zostera* distribution (C)(P)(Z).

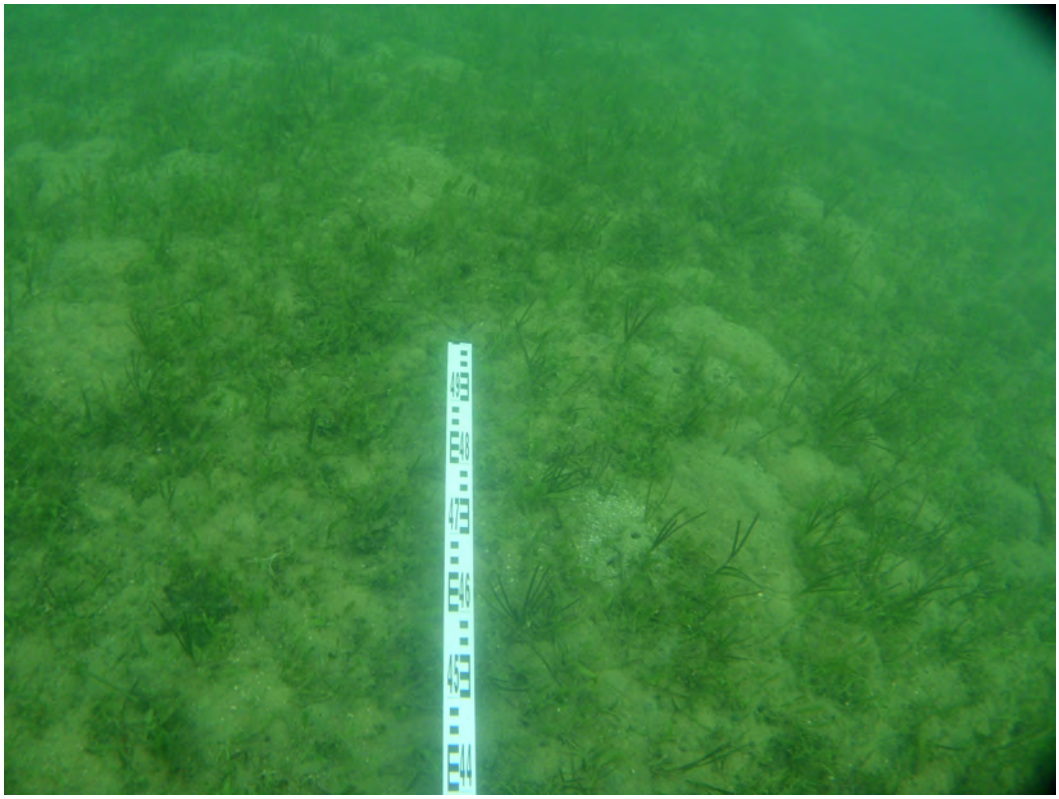

Figure A13: From 19.4m looking west beyond the 20m mark. There was no more *Posidonia* after 19m offshore and the low density *Zostera* extended some 3m to 4 m further offshore. The seabed was bare sediment in waters beyond that point.

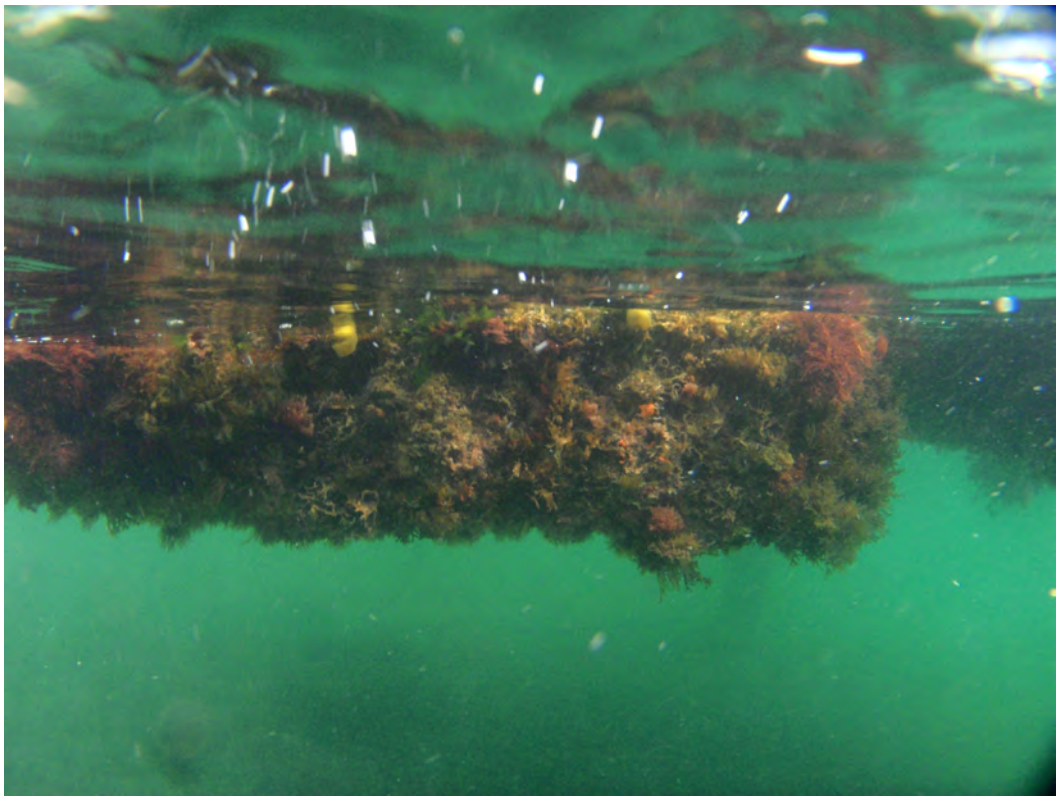

Figure A14: Mixed algae and encrusting fauna growing on side of pontoon (No 147 Riverview Road).

Figure A15: Mixed brown and red algae and green *Caulerpa* growth on outer jetty pile at No 149 Riverview Road.

Figure A16. Similar attached algae, *Caulerpa* and encrusting fauna growth on outer pontoon locator pile for jetty at No 147