

**14 Giant Kelp –EPBC Act referral
assessment**

January 2015

Internal Memo

Blackmans Bay STP Upgrade – Assessment of effects on Giant Kelp and North West Bay ecosystem, January 2015

Executive Summary

The nearshore area between Flowerpot Point and south of the Blackmans Bay outfall has boulder-reef habitat between 1 m and 8 m depth. This area supports a diverse macroalgae community, including the Giant Kelp, *Macrocystis pyrifera*. A monitoring program has been in place since 2008 and *Macrocystis pyrifera* has been a constant presence between 400 m north and south of the outfall, though the extent of the surface canopy it forms varies. The most recent monitoring survey in December 2014 documented patchy *M. pyrifera* extending along the coastline from Blackmans Bay south to Tinderbox Marine Reserve.

Relatively high nutrient availability (particularly nitrate) is important for the maintenance of giant kelp. When the outfall was upgraded, it was recognized that nutrients from the Blackmans Bay outfall (treatment of sewage produces substantial quantities of nitrate) may benefit Giant Kelp near the outfall. In light of this, the nearshore section of the outfall pipeline includes three adjustable discharge ports to maintain some extra nutrient input for the kelp.

The Giant Kelp at Blackmans Bay has been monitored since 2008. Since installation of the new outfall no change in its extent or condition has been observed, indeed *Macrocystis pyrifera* rapidly colonized the new outfall structure.

“Giant Kelp Forests of South East Australia” were listed as a threatened ecological community under the EPBC Act in 2012. The *Macrocystis pyrifera* community near the Blackman’s Bay outfall does not fulfill all the requirements to be considered a “Giant Kelp Marine Forest”. The upgrade of the Blackmans Bay STP does not entail any recognized threatening process. On this basis, it was decided that the presence of Giant Kelp is not a reason to refer the upgrade project for consideration under the EPBC Act.

Under this proposal the two sewage discharges in North West Bay at Electrona and Margate will be closed. North West Bay is a sheltered embayment that extends to the west of the D’Entrecasteaux Channel, South of Hobart. While much of the shoreline of the bay is undeveloped, the townships of Electrona, Margate, Snug and Howden occupy parts of the shoreline. North West bay has a large range of uses including marine industries, recreational activities, tourism and marine farming (Jordan et al, 2002). Two fish farm leases near the entrance to North West Bay are currently in use (Tinderbox and Shepherds Point). North West bay is used for recreational purposes including sailing, fishing and swimming and it retains a number of natural values (such as seagrass beds) and areas of historical and ecological importance. The proposal will reduce nutrient loads discharged to the head of North West Bay and may lead to localized improvements water quality there.

Giant Kelp 'Marine Forest' at Blackman's Bay

The marine outfall associated with the Blackmans Bay STP discharges 600 m offshore from the shore in 13 m water depth, around 1 km south of Flowerpot Point. The nearshore area between Flowerpot Point and south of the outfall has boulder-reef habitat between 1 m and 8 m depth. This area supports a diverse macroalgae community, including the Giant Kelp, *Macrocystis pyrifera*. This stand of *M. pyrifera* is the last giant kelp 'forest' in the Derwent Estuary (Figure 1).

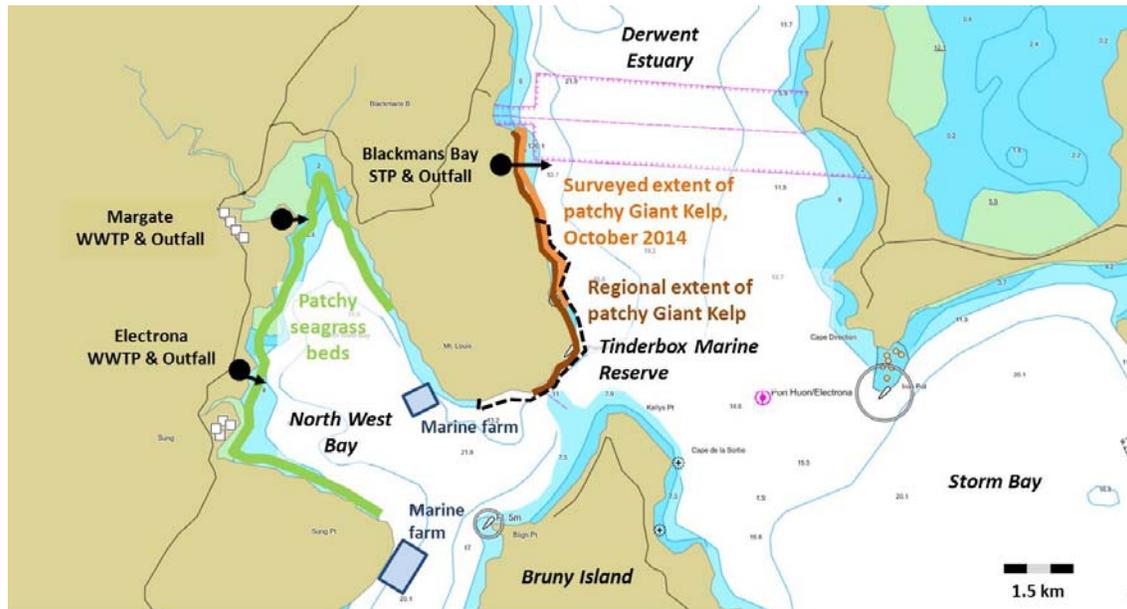


Figure 1 Giant Kelp habitat in the southern Derwent Estuary

Relatively high nutrient availability (particularly nitrate) is important for the maintenance of giant kelp. When the outfall was upgraded, it was recognized that nutrients from the Blackmans Bay outfall (treatment of sewage produces substantial quantities of nitrate) may indeed be the reason Giant Kelp persists near the outfall. In light of this, nearshore section of the outfall pipeline includes three adjustable discharge ports to maintain some extra nutrient input for the kelp (Figure 2).

TasWater, who manage the Blackmans Bay STP, are planning to increase the capacity and upgrade the treatment process at the plant. This will result in a higher volume of wastewater being discharged via the outfall but a lower load of nitrogen (owing to upgraded treatment).



Figure 2 Blackmans Bay STP outfall and nearby giant kelp habitat

In August 2012, Giant Kelp ‘Marine Forests’ in south-east Australia were listed as a threatened ecological community under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Due to the planned changes to the Blackmans Bay outfall discharge (effluent volume and nutrient loads) it is appropriate to consider whether the plant upgrade requires federal environmental approval. Determining whether changes to the discharge require federal environmental approval requires answering two questions:

1. Does the *Macrocystis pyrifera* community near the Blackman’s Bay outfall constitute a protected “Giant Kelp Marine Forest”?
2. If so, will the changes to the Blackmans Bay outfall discharge have a “significant detrimental impact on the ecological community”?

Question 1: Does the *Macrocystis pyrifera* community near the Blackman's Bay outfall constitute a protected "Giant Kelp Marine Forest"?

The defining attributes of Giant Kelp Marine Forests were outlined in Conservation Advice provided to the Minister in August 2012 (s266B, EPBC Act 1999):

The key defining attributes of the ecological community are:

- *Macrocystis pyrifera* plants which form a forest with either a closed or semi-closed surface or sub-surface canopy;
- *Macrocystis pyrifera* plants growing at a depth generally greater than eight metres below sea level;
- A rocky substrate for *Macrocystis pyrifera* plants to attach to;
- A diversity of marine species on the seafloor, in the understory and throughout the water column;
- Cold water with mean sea surface temperature between 5C and 20C;
- Moderate wave exposure; and
- Distribution restricted to waters off the coast of Tasmania particularly in the Bruny, Freycinet and Davey bioregions, but also the Boags and Franklin, Flinders and Otway bioregions....[details of Victorian and South Australian distribution left out].

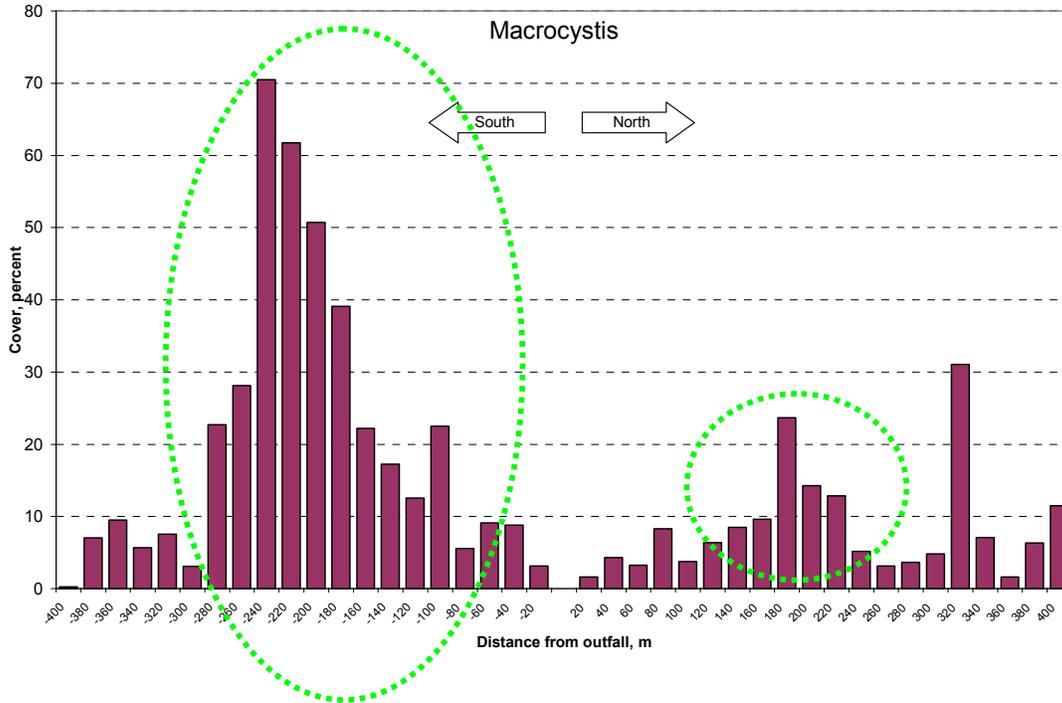
Does *Macrocystis pyrifera* form a forest with either a closed or semi-closed surface or sub-surface canopy?

The simple answer to this question is that *M. pyrifera* 'forms a forest with either a closed or semi-closed surface or subsurface canopy' **from time to time** in the area.

As part of monitoring for the previous shoreline discharge, and upgraded offshore discharge, CEE has undertaken several surveys of the *M. pyrifera* habitat at Blackman's Bay. CEE surveys have documented *M. pyrifera* cover on the seabed. This measure provides a better indication of the persistent density of the forest – as the canopy is subject to large seasonal variations. *M. pyrifera* cover of the seabed is determined by the area covered by the kelp's holdfasts.

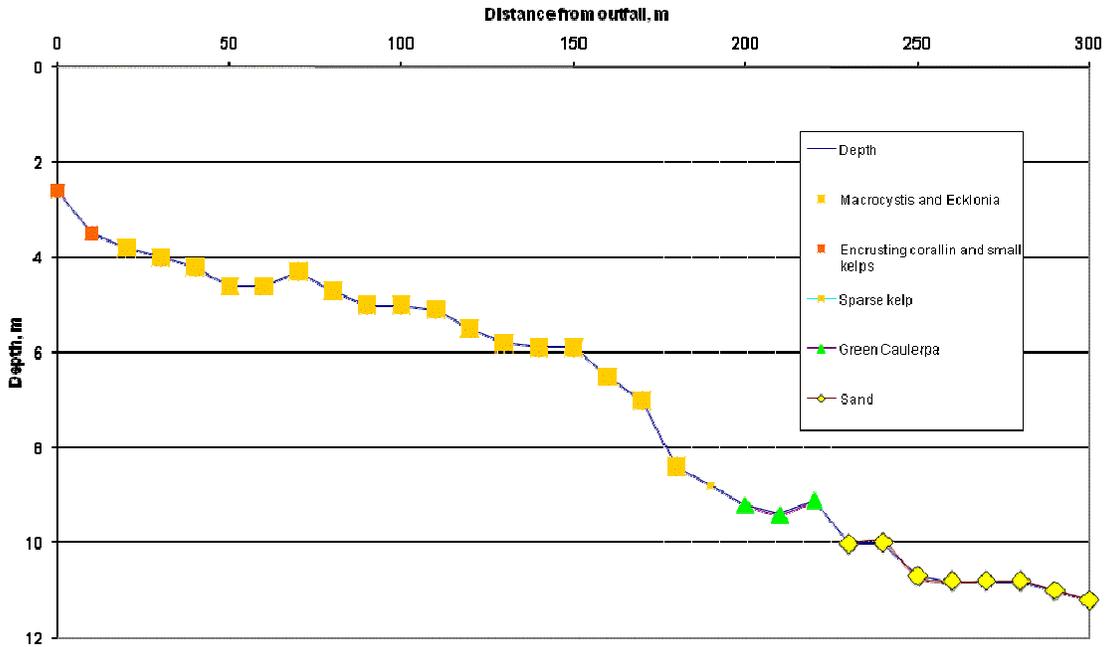
In 2008 transects spanning the 4 m depth contour to the north and south of the outfall, and from the old shoreline discharge to 300 m offshore were examined. *Macrocystis* was present along the 4 m depth contour to at least 400 m north and 400 m south of the outfall (Figure 3). In areas where it covered more than 20% of the seabed, a canopy was formed (indicated by the green ovals). The densest part of the forest in 2008 was between 100 m and 280 m south of the outfall (then a shoreline discharge).

Figure 3 *Macrocystis pyrifera* distribution along the 4 m depth contour - 2008



The survey of the transect perpendicular to shore spanned the depths 2.5 to 11.5 m (Figure 4). Boulder reef was present from 2.5 m depth to around 9 m depth. Boulders became sparse 200 m from the outfall (at 8 m depth) and the seabed was entirely sand beyond 240 m from the outfall (10.5 m depth). *Macrocystis* was present from around 30 m from the old outfall out to around 200 m from the old outfall. The densest area of *Macrocystis*, and the area in which it formed a forest, was between 90 m and 150 m offshore the old shoreline discharge (5 m to 6 m depth). Beyond this plants were only sparsely distributed (as boulder substrate became sparser), and other macroalgae, such as *Caulerpa* and red algae species were dominant.

Figure 4 *Macrocystis pyrifera* distribution from shoreline discharge to offshore - 2008



Satellite images provide a record of the dynamics of the Giant Kelp forest at Blackman’s Bay (Google Earth). The table below describes whether or not a surface canopy was apparent, and its extent, immediately offshore from the Blackmans Bay STP.

Table 1 Visibility and extent of *M. pyrifera* surface canopy, 2005-2014

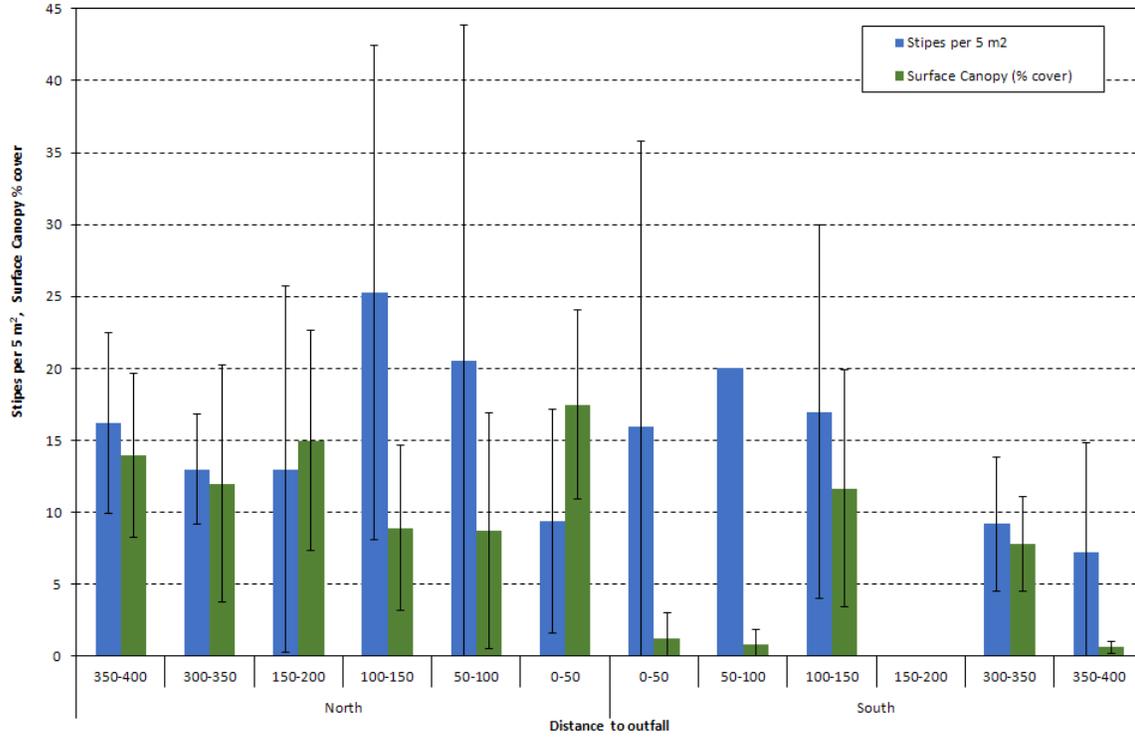
Date of imagery	Surface Canopy	Extent
April 2005	Present	250 m N-S, 200 m E-W
November 2005	Present	250 m N-S, separate small patch to the south
May 2011	Present	Up to 500 m N-S, patches further north and south
October 2011	Present	Up to 500 m N-S, patches further north and south
September 2012	Present	Unclear
November 2012	Present	Unclear
February 2013	Present	Around 200 m N-S, 200 m E-W
April 2013	Not visible	
August 2013	Present	Around 200 m N-S, 200 m E-W
October 2013	Present	Unclear
February 2014	Not visible	
July 2014	Not visible	

The table shows that over the past 10 years or so, a surface canopy of *M. pyrifera* has been a persistent feature of the area off the Blackmans Bay STP. The canopy has varied in its extent, but has been most persistently present immediately offshore from the STP. From time to time, the surface canopy has disappeared, most likely due to natural seasonal variations in giant kelp growth. Kelps grow most from spring through to summer, and usually die back in late summer. Autumn and Winter storms can remove both intact and senescent fronds.

A survey conducted in August 2012 quantified the distribution of *Macrocystis pyrifera* along the same transect alignments used in 2008 (CEE, 2013, Ecological Risk Assessment for the Blackmans Bay outfall). The survey found giant kelp was present along the transects in a similar distribution to the 2008 survey, including on inshore section of the new outfall structure, although abundance was slightly lower than 2008.

A further survey was conducted on 30 October 2014, a time when *Macrocystis* abundance is often high following winter and spring growth. Transects were surveyed either side of the outfall (200 m north and 200 m south) and at reference sites to (300-400 m north and 300-400 m south). All transects were layed at depths between 6 and 7 m. The number of *M. pyrifera* stipes (stems) and the percent cover of the canopy was estimated along sections of each transect. Figure 5 shows the results of the survey. As in 2008 the densest area of *M. pyrifera* is seen to the north of the outfall, particularly between 50-150 m north, and near Flower Pot Point between 300-400 m north of the outfall. To the south *M. pyrifera* is more patchy, but was present in all areas surveyed except 150-200 m south of the outfall. It is important to note that *M. pyrifera* is most abundant in the areas to 200 m either side of the outfall.

Figure 5 *Macrocystis pyrifera* abundance – October 2014



Do *Macrocystis pyrifera* plants grow at depths generally greater than 8 m?

The discussion above shows that at Blackmans Bay the majority of *M. pyrifera*, and all the 'canopy forming' kelp, grows between approximately 3 and 6 m depth. Plants become sparse at 7 m depth and a lack of rocky substrate means they are absent beyond this depth.

Therefore, the answer to this question is no, the plants do not grow at a depth generally greater than 8 m below sea level.

Is there a rocky substrate for *Macrocystis pyrifera* plants to attach to?

At Blackmans Bay, there is rocky substrate consisting of boulders between the shoreline and approximately 7-8 m depth.

Is there a diversity of marine species on the seafloor, in the understory and throughout the water column?

Surveys by CEE have noted the other marine species on the seafloor and in the water column beneath the *M. pyrifera* forest at Blackmans Bay. The 2008 survey noted a diverse benthic macroalgae assemblage beneath the *M. pyrifera* canopy including kelp and other brown algae (*Ecklonia radiata*, *Carpoglossum confluens*, *Acrocarpia paniculata*), green algae (*Ulva* sp., *Caulerpa trifaria* and other *Caulerpa* spp.), and red algae (encrusting coralline algae, encrusting *Feldmania* sp., *Gloiosaccion brownii*, *Plocamium* spp. *Phacelocarpus* sp., *Ballia* sp).

The giant kelp canopy and diverse macroalgae understory provides habitat for a wide range of invertebrates, though these are generally not visible beneath the dense algae cover.

Fish regularly observed under and around the area of kelp forest include the ubiquitous Blue Throat Wrasse (*Notolabrus tetricus*), Senator Wrasse (*Pictilabrus laticlavus*), Hulafish (*Trachinops caudimaculatus*), Leatherjackets (including *Acanthaluteres vittiger*), and Bastard Trumpeter (*Latridopsis forsteri*).

The October 2014 survey again documented a diverse range of seaweed, invertebrate and fish species within and adjacent to areas of *M. pyrifera* (Table 2).

Table 2 Species observed in October 2014

Brown Algae	Green Algae	Invertebrates
<i>Halopteris glutinosa</i>	<i>Bryopsis gemellipara</i>	<i>Plagusia chabrus</i> (Red bait crab)
<i>Acrocarpia paniculata</i>	<i>Ulva sp.</i>	<i>Jasus edwardsii</i> (Spiny rock-lobster)
<i>Ecklonia radiata</i>	<i>Caulerpa longifolia</i>	<i>Turbo undulates</i> (Turban shell)
<i>Carpoglossum confluens</i>	<i>C. simpliciuscula</i>	<i>Haliotis rubra</i> (Black-lip abalone)
<i>Undaria pinnatifida</i>	<i>C. trifaria</i>	<i>Heliocidaris erythrogramma</i> (sea-urchin)
<i>Zonaria spp.</i>	<i>Chaetomorpha coliformis</i>	<i>Patiriella calcar</i> (Seastar)
<i>Perithalia caudata</i>		<i>Holothurians</i> (Sea-cucumber)
<i>Macrocystis pyrifera</i>		Fish
<i>Sargassum spp.</i>		<i>Aracana ornate</i> (Ornate cowfish)
Red Algae		<i>Latridopsis forsteri</i> (Bastard trumpeter)
<i>Plocamium sp.</i>		<i>Notolabrus tetricus</i> (Blue throat wrasse)
<i>Corallina officinalis</i>		<i>Cephaloscyllium laticeps</i> (Draughtboard shark)
<i>Delisea sp.</i>		<i>Urolophus cruciatus</i> (Banded stingaree)
Encrusting coralline		<i>Trachinops caudimaculatus</i> (Hulafish)
Unknown sp. (felt-like)		<i>Pictilabrus laticlavus</i> (Senator Wrasse)
? <i>Hemineura frondosa</i>		<i>Dotalabrus aurantiacus</i> (Castelnau's Wrasse)
<i>cf. Thuretia sp</i>		

There is a diversity of marine species on the seafloor, understory and throughout the water column.

Is there cold water with mean sea surface temperature between 5°C and 20°C?

Records of sea surface temperatures at a site offshore from Blackmans Bay (Site C in State of the Derwent Estuary report 2009, Figure 6.4) show that temperatures in the area range between 9°C and 19.5°C. This area is therefore suitable for growth of *M. pyrifera*. Incidentally, bottom temperatures for the same site range between 10°C and just over 17°C.

Does the site have moderate wave exposure?

Ocean swells sometimes penetrate up the Derwent Estuary as far as Blackmans Bay, surfing is popular at Blackmans Bay beach to the north of the site. The site is otherwise sheltered.

Is the site in the right region?

Blackmans Bay is within the Bruny bioregion – which forms part of the south-eastern Australian range for *M. pyrifera*.

Summary

While the *M. pyrifera* forest offshore from the Blackmans Bay STP meets most of the criteria for it to constitute a 'Giant Kelp Marine Forest', its shallow depth means it cannot properly be considered part of the threatened ecological community. The forest is restricted to waters less than 8 m deep (due to restricted habitat availability and light availability).

Question 2: Will the changes to the Blackmans Bay wastewater discharge have a detrimental impact on the *M. pyrifera* forest at Blackmans Bay?

To answer this question it is important to place the current proposal in context. There has been a sewage discharge associated with the Blackmans Bay STP for decades. Prior to 2010 sewage was discharged just below low tide mark at the shoreline. This discharge performed poorly with regard to effluent dilution, caused some alteration to marine ecological communities near the shoreline and posed a risk to bathing water quality. However, it was recognized that nutrients from the discharge were likely a factor in the persistence of *Macrocystis pyrifera* near the outfall. The previous discharge did not appear to have any deleterious impact on the giant kelp.

In 2010 a new outfall was installed 600 m offshore in 13 m water depth, incorporating a multiport diffuser to achieve effluent dilutions in excess of 100:1 and to remove the risk posed to bathing water quality. The new outfall included three ports within the existing *M. pyrifera* forest to maintain a supply of nutrients into the kelp bed. While flow from the ports is adjustable, since commissioning the ports have been operating at full capacity. A dye-study conducted to evaluate performance of the outfall in 2010 showed the ports providing a steady flow of nutrient-rich effluent into the kelp bed (Figure 6).

Observations and satellite images (Table 1) show that the kelp bed has remained intact since installation of the new outfall, though there have been seasonal and interannual variations in its density. It was most recently visible in aerial images in October 2013, three years after commissioning of the new outfall. A survey in October 2014 found substantial abundance of giant kelp to both the north and south of the outfall. Since commissioning of the offshore outfall in 2010, large numbers of giant kelp plants have colonized the outfall pipeline between around 1 m and 6 m depth.

Figure 6 Fluoresceine dye dispersing through the *Macrocystis pyrifera* canopy - 2010



Implications of the project for Giant Kelp

The upgrade to the Blackmans Bay STP will involve an increase to volumes treated at the plant (wastewater currently treated at Margate and Electrona will be diverted to Blackmans Bay). The treatment plant upgrade will significantly improve nutrient removal. As a result the nutrient loads released to the Derwent Estuary, and into the giant kelp forest, will be less than half the present loads.

The current arrangement does not appear to be having any deleterious impacts on the giant kelp bed. Increased nutrient availability due to the sewage discharge is an accepted factor in *Macrocystis* persistence at the site.

Increases to the flow of effluent from the outfall will not be detrimental to the *Macrocystis*. The current outfall diffuser achieves a high dilution whereby salinity or nutrient changes caused by the outfall cannot be detected beyond 15 m from the diffuser. Increased flow may mean this area of reduced salinity extends to 20 m from the diffuser – still several hundred metres offshore from the *Macrocystis* forest. The

ports that discharge into the *Macrocystis* forest may cause some localized salinity reduction, but no detrimental impacts have been documented at current flow rates.

Warming seawater temperatures and decreased nutrient availability associated with warming ocean temperatures and reduced frequency of ingress of sub-Antarctic waters onto the south east Australian coast are seen as the key threats to persistence of Giant Kelp Marine Forests. These threats are regional by their nature. Intrusion of cold water from the ocean into the Derwent Estuary is an important driver of ecosystem productivity in the region – intrusion of oceanic waters is the major source of nitrogen for the lower Derwent Estuary (State of the Derwent Estuary - 2009).

While point source pollution (such as wastewater) is also recognized as a threat, sewage effluent is also recognized as containing nutrients that can sustain kelp forests. The main threat from wastewater discharge is reduction of light availability through introduction of suspended solids. This threat is not considered relevant to the Blackmans Bay situation: Giant Kelp in the region is limited by habitat availability to water less than 8 m deep and the effluent is low in suspended solids. Ambient water quality may also be important – there may not be sufficient water clarity for algae like Giant Kelp beyond 8 m depth. Nevertheless, it is important that suspended solids loads are maintained at their currently low levels.

The discussion above shows that the proposed changes to the volume of wastewater discharged at Blackmans Bay will not have a detrimental impact on *M. pyrifera*.

A reduction in nutrient load is unlikely to be detrimental to *M. pyrifera* as their main nutrient source is intrusion of oceanic waters. Nevertheless the supply of nutrients into the kelp forest may be managed by adjusting flow from the ‘fertiliser’ ports.

Conclusion

Based on the analysis in this report, the *Macrocystis pyrifera* community near the Blackman’s Bay outfall does not constitute a protected “*Giant Kelp Marine Forest*”.

Nitrogen discharges are to decrease, but the outfall includes three ports that can be adjusted as desired to manage the nutrient input to the kelp forest at Blackmans Bay. Thus it is concluded that the proposed upgrade of the Blackmans Bay STP will not have a “*significant detrimental impact on the ecological community*”? On this basis, it was decided that the string kelp is not a reason to refer the upgrade project for consideration under the EPBC Act.