



Annual Environmental Review Report 2020/2021

Environmental Licence No. 10180/1

East of Yellow Bluff

Marine Farming Lease no. 281

August 2021

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As part of the conditions of the environmental licence, an Annual Environmental Review Report must be submitted to the Director of the EPA each calendar year. The report must cover a 12-month period up to and including April of each year. The licence came into effect in May 2019, the first stocking of finfish occurred in July 2019, and official monitoring subsequently began in August 2019. This is the Second Annual Environmental Review Report for Environmental Licence 10180/1.

The Annual Environmental Review Report summarises environmental parameters monitored between May 2020 and April 2021. The report includes a summary of water quality performance, benthic surveys, water quality measurements, water currents (hydrodynamics), reef and seagrass monitoring, modeling – dispersion water quality, & sediment dispersion, video surveys, and benthic surveys (Table 1).

All fieldwork for this report (other than the video sediment survey) was undertaken by the Institute of Marine & Antarctic Studies (IMAS) and Aquenal. All requirements for frequency and timing of sampling events were met with respect to EL 10180/1.

This report iteratively steps through each of the requirements outlined in the Environmental Licence 108/1 (replicated in Table 1). Information requirements are detailed in this report with short summaries of each being provided to illustrate the main findings. Detailed results can be found in full detail in the Storm Bay Annual Broadscale Environmental Monitoring Program Report 2020/21 (BEMP 2020); and the MF281 Water Quality Performance Report 2020/21 (WQPR). The type of information for each requirement was generally unique and compiled concurrently by the Institute for Marine and Antarctic Studies (IMAS), Aquenal, and Huon Aquaculture staff (video sediment survey only).

Table 1: Information requirements of the Annual Environmental Review Report.

Adapted from Attachment 2 and 3 to Environmental Licence 10180/1

Type of information	Information Requirements	Frequency/Timing	Notes
Water quality performance report	<ul style="list-style-type: none"> • Comparison of water quality results recorded at the compliance site against investigation trigger limits specified in Table 1. • Use rolling annual mean as compliance metric. • Box and whisker plots should be utilised to illustrate monitoring results and to provide a comparison with investigation trigger values. • Analysis of performance in the context of stocking cycles and feed inputs to be provided. • Summary of adaptive management measures implemented in response to trigger value exceedances. 	Data for 12-month period, up to and including April of each year, to be analysed.	<i>For first annual report data available at the time to be utilised and median values to be calculated on that basis</i>
Benthic surveys (broad-scale monitoring)	<i>Results of benthic infauna and sediment surveys undertaken at BEMP monitoring sites.</i>	<i>Results relating to surveys undertaken in Spring of the reporting year.</i>	
Water quality measurements	Results of water quality monitoring, including nutrients, field parameters and phytoplankton to be summarise and analysed.	Data recorded for 12-month period, up to and including April of each year, to be summarised and analysed, with consideration to be given to illustrating seasonal and other relevant effects.	Refers to Attachments 11 and 12 for guidance on data presentation and analysis. For the first annual report, data available at that time to be reported.
Water currents (hydrodynamics)	Summary of real-time, in situ ADCP measurements. Interpretation of hydrodynamic patterns and associated adaptive management decisions.	Data recorded for a 6-month period to be summarised and analysed.	Refer to attachment 11 and 12 for guidance on data presentation and analysis.

<p>Ecology - reef & seagrass monitoring</p>	<p>Findings of reef and seagrass surveys to be analysed. Interpretation of observed changes against background conditions to be provided.</p>	<p>Rapid Visual Assessment reef surveys are to be undertaken bi-annually (late Winter and in late Summer). Edgar-Barret reef surveys are to be conducted every 5 years. Seagrass surveys to be undertaken annually in late Spring.</p>	
<p>Modelling - dispersion water quality</p>	<p>Outputs from water quality dispersion modelling to be included.</p>	<p>Model to incorporate at least 6 months ADCP data.</p>	<p>Guidelines outlining specific modelling requirements to be issued by Director, EPA.</p>
<p>Modelling - sediment dispersion</p>	<p>Outputs from DEPOMOD sediment modelling to be included.</p>	<p>Model to incorporate at least 6 months ADCP data.</p>	<p>Guidelines outlining specific modelling requirements to be issued by Director, EPA.</p>
<p>Video surveys (compliance sites)</p>	<p>Summary of main findings of video surveys undertaken in reporting period.</p>	<p>Surveys undertaken every 12 months or in accordance with stocking and fallowing regime. Surveys must be conducted within 30 days of peak production.</p>	<p>Detailed video survey reporting not required for Annual Environmental Report, as submission is already a requirement under 3V9.</p>
<p>Benthic surveys (compliance & control sites)</p>	<p>Results of benthic infauna and sediment surveys undertaken at compliance and control sites including those shown in Table 6.</p>	<p>Survey undertaken every 12 months or in accordance with stocking and fallowing regime. Surveys must be conducted within 30 days of peak production.</p>	<p>Sampling and reporting to occur on an annual basis.</p>

2. FAR FIELD ENVIRONMENTAL MONITORING

a. Benthic surveys – monitoring results

Information Requirement

Relevant section in EL10180/1: 3F2

Information Requirements: Results of benthic infauna and sediment surveys undertaken at BEMP monitoring sites.

Frequency: Results relating to surveys undertaken in Spring of the reporting year.

Location of information requirements

The information to satisfy the requirements for the Benthic surveys (broad-scale monitoring) is presented in detail in the 2020 BEMP report. Key findings are summarised briefly below.

Summary of Information

Soft Sediments: Visual Assessment and Sediment Chemistry

The visual descriptions of the sediment cores from the 2020 survey showed the dominant colour was either brown, olive grey, or a mixture of colours. The sediment type was either fine or very fine sand at most sites. No odour or gas bubbles were detected from any core.

In 2020, the mean redox potential of all sites was >100 mV and similarly mean sulphide concentrations were negligible, consistent with healthy and unimpacted sediments.

Soft sediments: Benthic Infauna Abundances and Communities

Overall, the number of families and abundances of annelids, in the sediments remained relatively similar between the spring 2019 and 2020 surveys. For both surveys (2019 and 2020), the sediment samples were dominated by the arthropod families Aoridae and Bodotriidae and the annelid families Spionidae and Lumbrineridae. In the 2020 survey, three indicator species of organic enrichment, and eight introduced species, and one threatened species were recorded in the sediments.

b. Water Quality – monitoring results and performance against trigger levels

i) Monitoring Results

Information Requirement

Relevant section in EL10180/1: 3F3

Information Requirements: Results of water quality monitoring, including nutrients, field parameters and phytoplankton to be summarised and analysed.

Frequency: Data recorded for 12-month period, up to and including April of each year, to be summarised and analysed, with consideration to be given to illustrating seasonal and other relevant effects.

Notes: Refers to EL 10180/1 attachments 11 and 12 for guidance on data presentation and analysis.

Location of Information Requirements

The information to satisfy the requirements for the Water Quality Measurements is presented in detail in the BEMP 2020 report. Key findings are summarised below.

Summary of Information

The Annual Environmental Review Report requires information that summarises results of water quality monitoring including nutrients, field parameters and phytoplankton. Data was recorded monthly up to and including April each year. Results are summarised with consideration to be given to illustrating seasonal and other relevant effects.

Water Column: Physico-chemical Parameters and Nutrients

Throughout the sampling the water temperature, nitrate, dissolved reactive phosphorus, and total nitrogen to a lesser extent, in the bottom waters showed seasonal trends, with elevated concentrations of nutrients and lower temperatures from May – September and lower levels of nutrients and higher temperatures from October – April. The increase in nutrients during spring and winter coincides with the strengthening of the Leeuwin and/or sub-Antarctic currents which are rich in nitrogen. During late spring and summer, the remaining nitrogen is rapidly absorbed by phytoplankton and the surrounding environment.

At the consistently monitored sites (i.e. SB1-SB9) the values of nitrate and dissolved reactive phosphorus in the bottom waters were generally higher in spring - summer of 2020/2021 and 2019/2020 than in 2018/2019. At these sites, the Total Ammoniacal Nitrogen (TAN) in the bottom waters was also highest in winter-spring 2020. From May 2020 to April 2021, the surface waters TAN concentrations were generally <0.012 mg-N/L however, occasional elevated concentrations of >0.017 mg-N/L have been recorded at some sites (SB4, SB6, SB11, SB12 and SB13), particularly during the spring-summer of 2020.

Water Column: Phytoplankton Biomass and Communities

The biomass of chlorophyll a showed a weak seasonal trend with higher values recorded in late winter - spring than other seasons. The biomass of chlorophyll a at some sites was greatest in the winter - spring of 2020. Sites with the greatest biomass of chlorophyll a (>5 mg/m³) during this time were SB3, SB8 and SB13. These peaks were considered unusual, both in magnitude and timing. The phytoplankton communities, as described from cell counts, were dominated by diatoms. A very small proportion of the cell counts, or species recorded were harmful algae species.

ii) Performance against trigger levels

Information Requirement

Relevant sections in EL10180/1: G2, 1 & 2

Information Requirements: (a) Comparison of water quality results recorded at the compliance site against investigation trigger limits specified in Table 2; (b) Use rolling annual mean as compliance metric; (c) Box and whisker plots should be utilised to illustrate monitoring results and to provide a comparison with investigation trigger values; (d) Analysis of performance in the context of stocking cycles and feed inputs to be provided; and (e) summary of adaptive management measures implemented in response to trigger value exceedances.

Frequency: Data for 12-month period, up to and including April of each year, to be analysed.

Note: The EPA identified an error when calculating the chlorophyll a annual rolling median trigger level for SB3. The level specified in EL10180/1 is 1.1 mg/m³ which is the median (50th percentile), and the correct value should be the 80th percentile which is 1.5 mg/m³. Until this variation to the EL is formally approved both values are shown in Table 2, however comparisons in this report will be against the corrected value.

Table 2: Water quality investigative trigger levels

Parameter	Level
Ammonia (surface)	6.0 µg/L
Ammonia (bottom)	10.0 µg/L
Total Nitrogen (surface)	308.0 µg/L
Total Nitrogen (bottom)	330.0 µg/L
Nitrite & Nitrate (surface)	38.6 µg/L
Nitrite & Nitrate (bottom)	41.8 µg/L
Total Phosphorus (surface)	48.0 µg/L
Total Phosphorus (bottom)	40.0 µg/L
Dissolved Reactive Phosphate (surface)	12.8 µg/L
Dissolved Reactive Phosphate (bottom)	14.0 µg/L
Oxygen (surface)	7.7 mg/L (lower limit)
Oxygen (bottom)	7.1 mg/L (lower limit)
Chlorophyll a	1.1 mg/m ³ and 1.5 mg/m ³

Location of Information Requirements

The information to satisfy the requirements for the Water Quality Performance is presented in detail in the Water Quality performance Report 2020/2021 and Annual BEMP 2020/2021 report, which include indicative rolling annual medians for each analyte in relation to their respective investigation trigger levels (Table 2), and a series of box and whisker plots that illustrate the central tendency and variance of each analyte for the reporting period.

Summary of Information

Water Column: Performance against Investigative Trigger levels – Water Column

During the 12 months of sampling, the annual rolling median of total nitrogen, total phosphorous, TAN, nitrate + nitrate and dissolved reactive phosphorus at most sites and depths were below in the default guidelines. The annual rolling median for the chlorophyll a biomass was above the default guideline values (DGVs) investigative trigger levels for some sites (SB1, SB3, SB12, SB13, SB14, and SB15). The annual rolling medians of dissolved oxygen at most sites and depths were above the lower-level DGVs.

The median of chlorophyll a at some sites near to active leases (SB1, SB3, SB12, SB13, SB14, and SB15) were higher than the surrounding sites. However, there was no clear or consistent relationship between the cycle of feed inputs (and thus nitrogen emissions) and chlorophyll a biomass or the TAN concentration in the surface waters.

c. Water Current – ADCP data

Information Requirement

Relevant section in EL10180/1: 3F4

Information Requirements: Summary of real-time, in situ ADCP measurements. Interpretation of hydrodynamic patterns and associated adaptive management decisions.

Frequency: Data recorded for 6-month period to be summarised and analysed.

Notes: Refer to attachment 11 and 12 for guidance on data presentation and analysis.

Location of Information Requirements

The information to satisfy the requirements for the Water currents (hydrodynamics) is presented in detail the MF281 Yellow Bluff Depositional Modelling Report 2020.

Summary of Information

Both the EPA and IMAS were consulted prior to deployment of the Acoustic Doppler Current profiler (ADCP) to ensure data captured would include the period of first annual peak production. In accordance with this, the ADCP was deployed at the East of Yellow Bluff lease for the period shown in Table 3. The analysis showed that flow at Yellow bluff was largely driven by factors (wind, river flow) other than tidal forces.

Figure 2 below provides a more detailed description of the range of speeds and directions at three depths (surface, mid-water and bottom) for each period of current data. The currents were similar in speed and direction for each of the sampling periods, with most of the stronger currents in the mid-water and bottom flow going towards the coast of Bruny Island. However, mean directions for the residual flow is generally south to southeast for all depths.

Table 3: Current data taken from AWAC located in northwest section of Yellow Bluff.

Tidal components were estimated using *t-tide* (Matlab 2019a). The current data from February-March was used for validating NewDEPOMOD against benthic indices. The June – August and August – November current data were used to calculate depositional footprints for a range of production scenarios.

Date	Mean flow rate (ms ⁻¹)	Mean Direction (°)	Mean Residual flow (ms ⁻¹)	Mean Residual Direction (°)	Tidal component (%)
6/2/2020 – 10/3/2020	Bottom 0.08	Bottom 233	–	–	–
	Mid-water 0.09	Mid-water 247			
	Surface 0.52	Surface 186			
1/6/2020 – 10/8/2020	Bottom 0.078	Bottom 222	Bottom 0.075	Bottom 164	Bottom 6.7
	Mid-water 0.094	Midwater 244	Mid-water 0.089	Midwater 179	Mid-water 20.2
	Surface 0.668	Surface 223	Surface 0.662	Surface 124	Surface 3.2
11/8/2020 – 13/11/2020	Bottom 0.08	Bottom 214	Bottom 0.08	Bottom 170	Bottom 5
	Mid-water 0.09	Midwater 224	Mid-water 0.08	Midwater 188	Mid-water 14.1
	Surface 0.55	Surface 197	Surface 0.53	Surface 132	

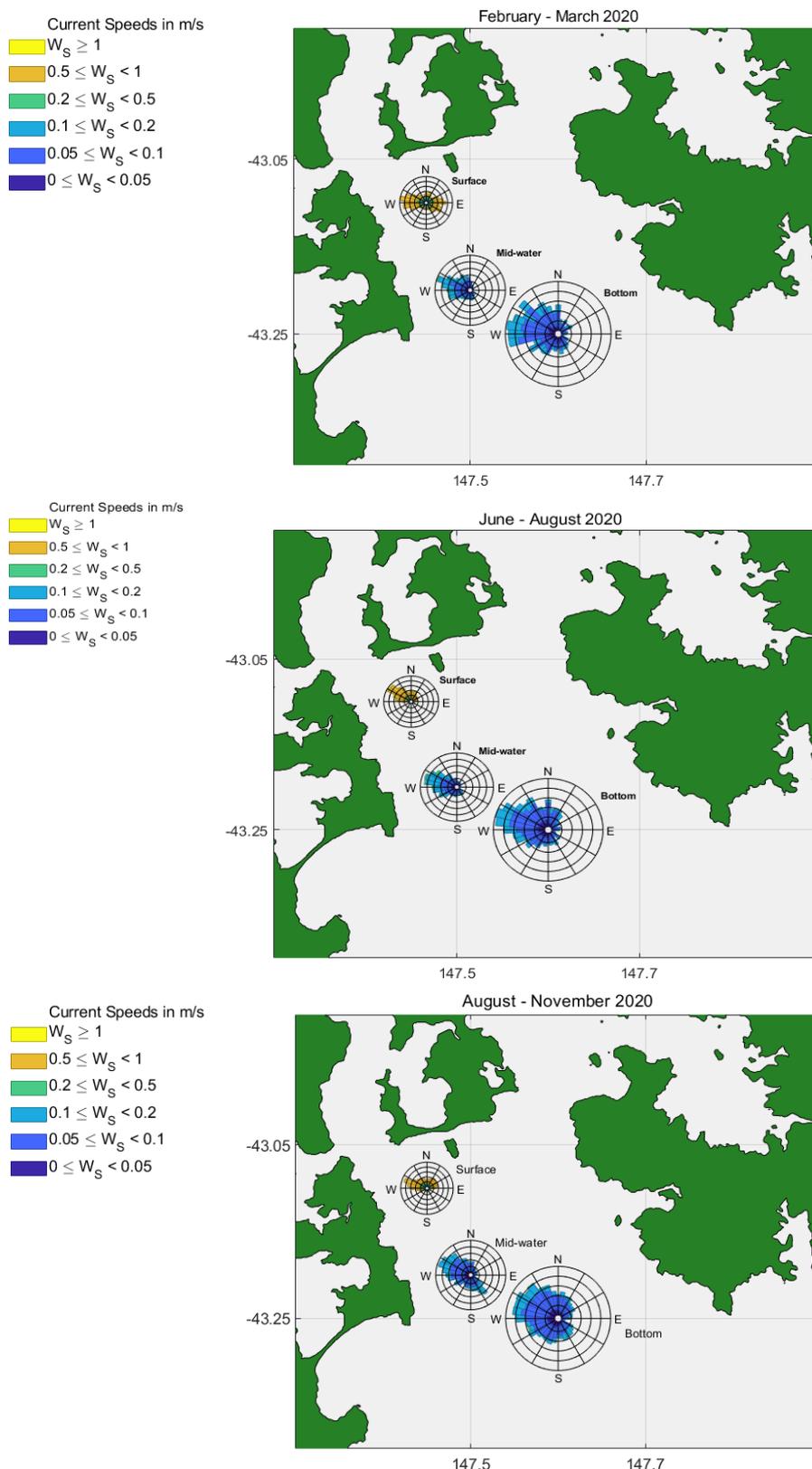


Figure 2 : Water currents (speed and direction) for surface, midwater and bottom at Yellow Bluff. The figures are for February – March (top), June – August (middle) and August – November (bottom) 2020.

d. Reef – inshore and deep reef survey results

Information Requirement

Relevant section in EL10180/1: 3F5

Information Requirements: Findings of reef surveys to be analysed. Interpretation of observed changes against background conditions to be provided.

Frequency: Rapid Visual Assessment (RVA) reef surveys are to be undertaken bi-annually (late Winter and in late Summer). Edgar-Barret reef surveys are to be conducted every 5 years.

Location of Information Requirements

The information to satisfy the requirements for the Ecology – reef monitoring is presented in detail in the BEMP report (2020).

Summary of Information

For the inshore reefs, the cover of canopy algae species was above 50% for both the winter 2020 and summer 2021 surveys. The understory community was dominated by brown and red algae, with the more exposed sites recording lower cover of foliose understory algae and higher cover of encrusting pink algae than the more sheltered sites. When the enrichment parameters were examined, the epiphytic algae had the highest cover (up to 25% at SBIR14) and was consistently recorded at low levels (<5%) at nearly all sites. Only limited occurrences of other enrichment status species (i.e. filamentous algae, nuisance green and nuisance red) were recorded.

When compared with the results from the previous years' BEMP, the cover of canopy-forming macroalgae was consistently higher in the summer and lower in the winter across both years. The cover of epiphytic algae was higher in the winter of 2020 than in the winter of 2019, which appears to be a broadscale trend throughout Storm Bay.

The deep reef benthos was dominated by red algae of various forms including branching *Rhodomenia* spp., and *Callophyllis* spp. and prostrate and encrusting forms of *Peyssonnelia* spp. Sponges dominated the invertebrate community, with erect laminar, erect branching, simple massive and cup forms of sponges all recorded, along with soft foliaceous bryozoans and feather stars. The most common fish species were Butterfly perch (*Caesioperca lepidoptera*), Barber perch (*Caesioperca razor*) and Rosy wrasse (*Pseudolabrus rubicundus*), consistent across both 2020 and 2021 sampling.

e. Seagrass – survey results

Information Requirement

Relevant section in EL10180/1: 3F6

Information Requirements: Findings of seagrass survey to be analysed. Interpretation of observed changes against background conditions to be provided.

Frequency: Seagrass surveys to be undertaken annually in late Spring.

Location of Information Requirements

The information to satisfy the requirements for the Ecology – seagrass monitoring is presented in detail in the BEMP report (2020).

Summary of Information

The cover of *Zostera* spp. was similar at Bull Bay and Adventure Bay and consistent with baseline conditions. The epiphytic cover on the seagrass in Bull Bay was “low”, whereas at Adventure Bay “very high” values were recorded on all transects. The cover of epiphytes on the seagrass beds in Bull Bay was lower in the 2020 and 2019 surveys than the baseline while the opposite trend was observed at Adventure Bay. The variation in the epiphytic cover on the seagrass beds between the baseline survey and the EL survey could be linked to a range of factors including natural variability and differences in survey methods.

3. Modelling

a. Water Quality Dispersion – being undertaken by CSIRO

Information Requirement

Relevant section in EL10180/1: 3M2

Information Requirements: Outputs from water quality dispersion modelling to be included.

Frequency: Model to incorporate at least 6 months ADCP data.

Notes: Guidelines outlining specific modelling requirements to be issued by Director, EPA.

Location of Information Requirements

The information to satisfy the requirements for the Modelling – dispersion water quality is currently being undertaken by CSIRO. This work is currently being finalised; CSIRO have projected the report being finalised in 2022 (see section 3M2 of EL10180/1)

Summary of Information

See above

b. Sediment Dispersion - DEPOMOD

Information Requirement

Relevant section in EL10180/1: 3M3

Information Requirements: Outputs from DEPOMOD sediment modelling to be included.

Frequency: Model to incorporate at least 6 months ADCP data.

Notes: Guidelines outlining specific modelling requirements to be issued by Director, EPA.

Location of Information Requirements

The information to satisfy the requirements for the Water currents (hydrodynamics) is presented in detail the MF281 Yellow Bluff Depositional Modelling Report 2020.

Summary of Information

Both the EPA and IMAS were consulted prior to deployment of the Acoustic Doppler Current profiler (ADCP) and sediment traps to ensure data captured would include the period of first annual peak production. In accordance with this consultation the ADCP was deployed at the East of Yellow Bluff lease for the period shown in Table 3; the sediment trap validation study was conducted in September

2020 and the benthic survey was conducted in March 2020. Additionally, feed data for these periods were also provided to help validate the model.

Visual inspection of the relationship between modelled and observed deposition (sediment trap validation) showed a reasonably good match, and further model validation metrics returned a good fit to observations. The same inspections against the benthic study showed a reasonable match between predicted and observed but with some variation between transects. The results provide confidence that the model reliably predicts deposition.

Mean bottom currents at Yellow Bluff were approximately 0.08 ms⁻¹ and based on previous work it is reasonable to assume that resuspension is likely at this lease.

Annual deposition rates around pens at the lease was modelled (Figure 3) using actual production data from February – September 2020. The 1500 (g solids m⁻²y⁻¹) contour (white line) is provided as a reference and this extends in a relatively uniform pattern approximately 50m from the pens. The outer (dark blue) contour which captures lower deposition (≥ 50 g solids m⁻²y⁻¹) is slightly asymmetric extending more to the south - southeast. The difference in deposition seen both between pen groups and between pens within each group, was largely driven by the differences in the feed inputs and biomass.

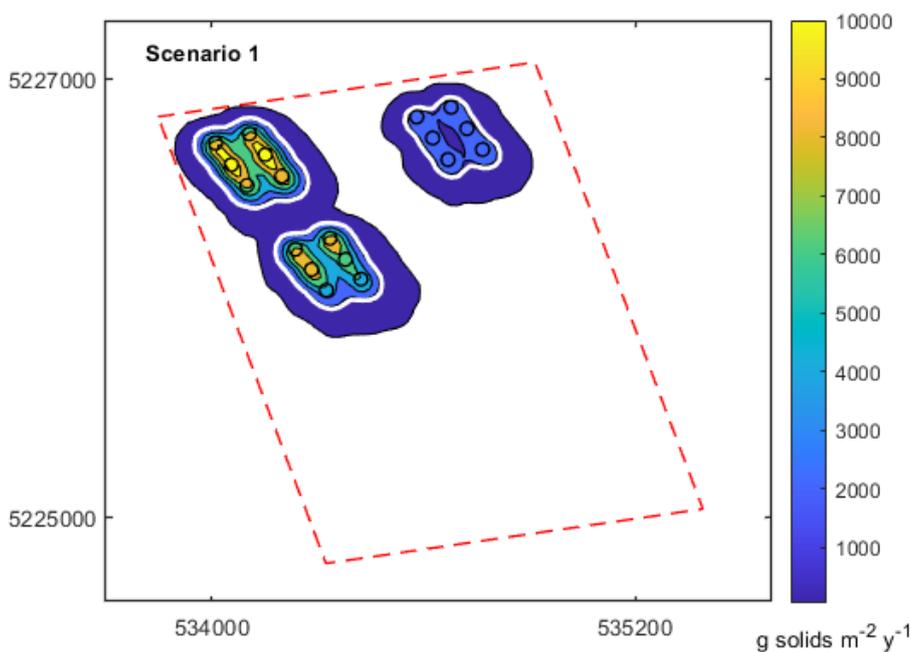


Figure 3: Deposition rate for peak production period in 2020.

Also shown is the lease boundary (red dashed line) and cages (black circles). The contour for 1500 g solids m⁻² y⁻¹ (white solid line) is also included. The lowest deposition rate shown (dark blue) is ≥ 50 g solids m⁻² y⁻¹. The production data (feed and biomass) used were actual production values for the period February – September 2020.

4. Near Field/Lease Environmental Monitoring

a. Video Sediment Survey – compliance annual video surveys undertaken by Huon Aquaculture

Information Requirement

Relevant section in EL10180/1: 3V

Information Requirements: Summary of main findings of video surveys undertaken in reporting period.

Frequency: Surveys undertaken every 12 months or in accordance with stocking and fallowing regime. Surveys must be conducted within 30 days of peak production.

Notes: Detailed video survey reporting not required for Annual Environmental Review Report, as submission is already a requirement under 3V9.

Summary of Information

The peak biomass period for the calendar year 2021 did not fall within the survey period for this AER report.

b. Benthic Sediment Survey – Baseline compliance points and control sites undertaken by IMAS

Information Requirement

Relevant section in EL10180/1: 3V12

Information Requirements: Results of benthic infauna and sediment surveys undertaken at compliance and control sites including those shown in Table 6.

Frequency: Survey undertaken every 12 months or in accordance with stocking and fallowing regime. Surveys must be conducted within 30 days of peak production.

Note: Sampling and reporting to occur on an annual basis.

Summary of Information

The peak biomass period for the calendar year 2021 did not fall within the survey period for this AER report.