

# NewDEPOMOD MODELLING REPORT

Reinraid Finfish Pen Site, Loch a' Chàirn Bhàin, Sutherland

Prepared for

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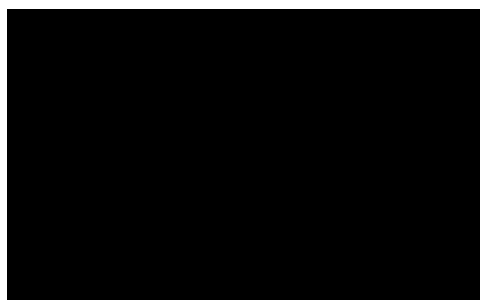
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## *Quality Assurance*

The data presented within this document have undergone a quality assurance review which follows established TransTech Ltd procedures. The information and results presented herein constitute an accurate representation of these data.

## *Document Details*

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## List of Abbreviations

ADCP	Acoustic Doppler Current Profiler	IQI	Infaunal Quality Index
AZE	Allowable Zone of Effects	MZ	Mixing Zone
CD	Chart Datum	OSGB36	Ordnance Survey Great Britain 1936
EMBZ	Emamectin Benzoate	SEPA	Scottish Environment Protection Agency
EQS	Environmental Quality Standards	UI	User Interface
GMT	Greenwich Mean Time		

## EXECUTIVE SUMMARY

This report has been prepared to meet the requirements of SEPA for assessing an application to modify the Reintraid pen site.

In June 2020, SEPA granted consent for the number of square pens at the Reintraid site to be increased to fourteen via the addition of two 24 x 24 m pens at the NW end of the grid. The current proposal is to replace all square pens with sixteen 80 m circumference pens in a 50 m x 50 m mooring grid. This will result in an increase in biomass from the currently consented 1,300.0 tonnes to 1,834.0 tonnes.

The solids modelling for the existing and modified site has been undertaken using the NewDEPOMOD User Interface (newdepomod-v1.4.1 rc03).

SEPA default runs were performed pre and post modification. For these runs the modified site complies with SEPA Environmental Quality Standards (EQS) for mean intensity, albeit it is overpredicting the 0.64 IQI (Infaunal Quality Index) depositional footprint.

For the pre and post modification benthic runs using default settings mean intensity, for the 5 runs performed for each, provides an average of 1,995.2 and 1,691.2 g/m<sup>2</sup>, a drop of c. 15.2%.

It is appreciated that these default settings are what SEPA bases any increase in mean intensity on. Nevertheless, solids were additionally modelled using calibration settings which were based on IQI benthic survey data to replicate as closely as possible the 250 g/m<sup>2</sup> (0.64 IQI) footprint. For the calibrated model a decrease in mean intensity at the modified site also appears likely i.e., for the average of 5 runs at the modified site mean intensity was 6,421.2 g/m<sup>2</sup> and for the selected calibration run for the existing site this was 8,551.6 g/m<sup>2</sup>, a drop of c. 24.9%.

Given that the proposed modification is predicted to reduce the intensity of waste on the seabed, the proposal is considered compliant with SEPA requirements.

SEPA's interim<sup>(1)</sup> EMBZ (Emamectin benzoate) EQS requires the area which exceeds 136 ng/kg (0.136 µg/kg) not to exceed the 100 m mixing zone area. As per SEPA requirements, the model was run for 118 days. However, a useable pass was not achieved for mean deposition after 116-118 days. Thus, EMBZ has been scoped out of this document.

# 1. INTRODUCTION

This report has been prepared to meet the specific requirements of the Scottish Environment Protection Agency for the assessment of applications for biomass consent. These must comply with the Environmental Quality Standards that are in place to protect the marine environment.

All hydrographic data used for the modelling was collected by Loch Duart and has been validated by SEPA for NewDEPOMOD modelling.

The methods described in this report closely adhere to those set out in SEPA's NewDEPOMOD modelling guidance for the aquaculture sector<sup>(2)</sup>, and the results are reported to satisfy consent application requirements.

Information on the existing Reintraid site and its proposed modification is given below.

## Pen group details pre and post modification

	<u>Pre modification</u>	<u>Post modification</u>
Biomax:	1,300.0 tonnes	1,834.0 tonnes
SW pen centre position*:	219129.6608 E, 934003.7002 N	219285.0000 E, 933857.0000
Group centre position*:	219083.0908 E, 934067.6595 N	219177.2142 E, 933997.1150
Number of pens (for production):	14	16
Pen group configuration:	2 x 7	2 x 8
Pen dimensions:	24 m square	80 m circle
Working depth:	11.0 m	15.0 m
Maximum stocking density:	14.655483 kg/m <sup>3</sup>	15.0100247902754 kg/m <sup>3</sup>
Grid size (x by y):	26.5 m x 26.0 m	50 m x 50 m
Pen group orientation:	314.3°	314.3°

\* NB: More decimal places used in the modelling.

## Hydrographic data

Please refer to report previously submitted to SEPA, entitled "Reintraid\_2023v1\_Hydrographic\_Report.pdf", dated 13 January 2023.

## Wave exposure index<sup>(3)</sup>

2.19 and 2.20 at north and south ends respectively of modified pen group.

## 2. NEWDEPOMOD MODELLING

### 2.1 Project set-up

For the modelling of the existing and modified site, projects were named 2023v1\_Reintraid\_Existing\_(14\_Squares) and 2023v1\_Reintraid\_Modified\_(16\_Circles). Calibration runs were also performed and for these projects the file names were followed by \_Calib.

For both pen layouts, the relevant files were set up in their respective directories with the bathymetry, pen information and flowmetry entered for each project as described below.

### 2.2 Flowmetry

The Acoustic Doppler Current Profiler (ADCP) bin heights used in the modelling and a summary of the data for these are provided in table 1.

Table 1. Current meter data summary.

Period Used in Model	Bin Height (above seabed)	Mean speed (m/s)	Residual speed (m/s)	Residual direction (°Grid N)
12/08/2022 12:00:00 GMT to 10/11/2022 12:02:57 GMT (6481 20 minute records)	Sub-Surface	0.0621	0.0341	317.8
	Net-Bottom	0.0548	0.0146	324.0
	Near-Bed	0.0351	0.0076	353.7

As per TransTech's "Reintraid\_2023v1\_ND\_Modelling\_Method\_Statement.pdf" dated 13 January 2023, the depth for the ADCP deployments has been entered into the depomodflowmetryproperties file as -59.23 and the bin heights were at meter depths of -55.87, -11.55 and -4.55.

Where sites have significant residual current speeds greater than 35-40% of the mean flow speed, particularly at the bed, material can move beyond the model boundaries. In this case SEPA requires the risk to be mitigated. One approach is to subtract the residual  $u$  and  $v$  components from the  $u$  and  $v$  components of each individual flow record in the dataset.

However, for Reintraid, the residual flow (0.0076 m/s) for the bottom bin during 15-day current meter dataset is 21.7% of the mean speed (0.0351 m/s). As such, there was no need to process the data to remove the residual  $u$  and  $v$  components from the  $u$  and  $v$  components of each individual flow record in the dataset.

The model was run with the residual and a  $vdsp$  (resuspension dispersion coefficient  $Z$ ) calculated from the mean speed of 0.003847.

## 2.3 Bathymetry/grid generation

A depomodbathymetryproperties file at a grid of 80 x 80 elements, georeferenced to OSGB36 datum, was used in the modelling, with a uniform depth of 59.23 m to represent that at which the ADCP was deployed. The 2 km<sup>2</sup> bathymetry file covered an area 218600 E to 220600 E and 932740 N to 934740 N.

## 2.4 Pen input

The pen locations and orientations were provided by Loch Duart and set-up in the UI from which the depomodcagesxml file was generated. These were then checked by looking at their profile/coordinates in the UI to ensure that they were in the correct position.

The UI pen layout plots are provided in figures 1 and 2.



Figure 1. Pre modification pen layout.



Figure 2. Post modification pen layout.

## 2.5 Location of Reintraid site

A location plan of the existing and proposed modified Reintraid site is provided in figure 3 below.



Figure 3. Location plan.



### 3. RESULTS

#### 3.1 Benthic Runs for Existing Site with SEPA Default Settings

Note that the results presented below are for the current consent for which SEPA has TransTech’s modelling on record.

The nature of the NewDEPOMOD model means that each time it is run with identical configuration parameters the results differ because the model contains random processes (settling velocities and walk/release points of sediment from bed cells). As such, for each benthic scenario five model runs were performed, and the average calculated.

In accordance with SEPA requirements, the results reported are for time-averaged output from the model runs (i.e., avg.depomodresultssur file). For the reported benthic runs this is days 275-365.

The benthic results for mean intensities within the 250 g/m<sup>2</sup> mixing zone (from 2023v1\_Reintraid\_Existing\_(14\_Squares)-Cages depomod results log) are shown in table 2.

Table 2. Summary of benthic results for 1,300 tonnes at existing site with SEPA default settings.

Modelling:	Existing Site: 1,300 T (14 x 24 m square pens with 11 m deep nets, stocking density of 14.655483 kg/m <sup>3</sup> with SEPA defaults & vdsp of 0.003847				
Benthic run reference as per consented biomass application*:	ES1	ES2	ES3	ES4	ES5
Mixing zone contour area (m <sup>2</sup> ): [Eqs.benthic.mixingZone.area]	86,403				
Mixing zone mean intensity (g/m <sup>2</sup> ): [Eqs.benthic.mixingZone.boundary.contour.approx.meanFlux]	2,019.6	1,954.8	2,013.1	2,104.4	1,884.3
Average mean intensity for the 5 runs (m <sup>2</sup> ):	1,995.2				
250 g/m <sup>2</sup> mixing zone area for the 25 m <sup>2</sup> cells (m <sup>2</sup> ): [Eqs.benthic.mixingZone.approx.contourArea]	168,125	177,500	169,375	161,250	181,250
Average of 250 g/m <sup>2</sup> mixing zone areas (m <sup>2</sup> ) for the 5 runs:	171,500				
Average of 250 g/m <sup>2</sup> mixing zone areas (m <sup>2</sup> ) for the 5 runs as % of mixing zone contour area:	198.5				

\* The results for the above runs are contained within the ES1 to ES5 directories in 2023v1\_Reintraid\_Existing\_(14\_Squares)\depomod\results which accompanies this report.

The mixing zone area for Run ES3 was closest to the average for all 5 runs. The 250 g/m<sup>2</sup> footprint and 169,375 m<sup>2</sup> mixing zone area for this run is shown in figure 4.

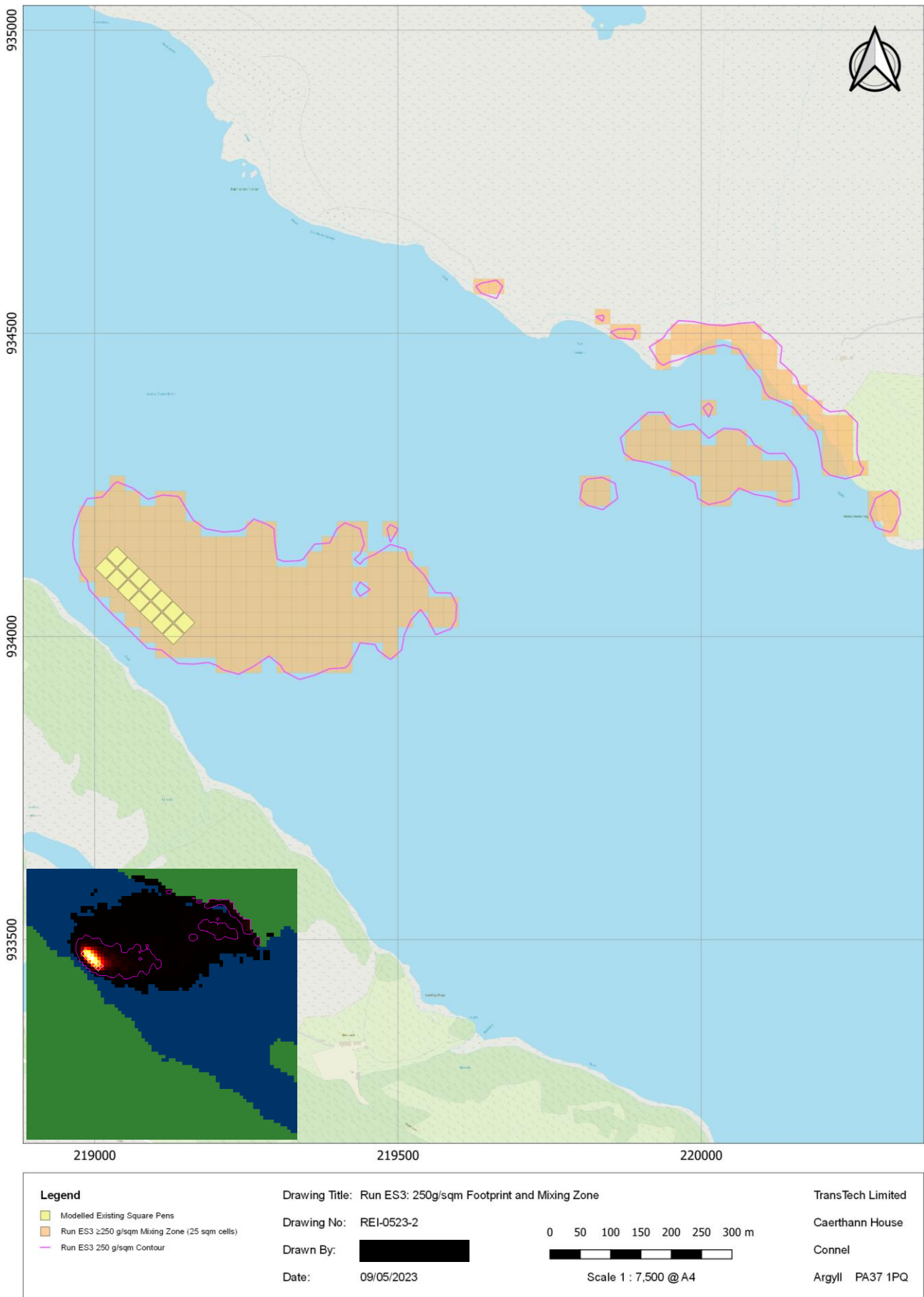


Figure 4. Run ES3 (average for days 275-365): 250 g/m<sup>2</sup> footprint, 169,375 m<sup>2</sup> mixing zone area along with the UI's display of this.

### 3.2 Benthic Runs for Modified Site with SEPA Default Settings

The modified site was modelled using the same default run settings as those used for the existing site, albeit with the proposed modified pens, biomass, net depth and stocking density.

Five benthic runs were performed and the predicted mean intensities within the mixing zone (from 2023v1\_Reintraid\_Modified\_(16\_Circles)-Cages depomod results log) are provided in table 3.

Table 3. Summary of benthic results for 1,834 tonnes at modified site with SEPA default settings.

Modelling:	Modified Site: 1,834 T (16 x 80 m circumference pens with 15 m deep nets, stocking density of 15.0100247902754 kg/m <sup>3</sup> ) with SEPA defaults & vdsp of 0.003847				
Benthic run reference*:	MS1	MS2	MS3	MS4	MS5
Mixing zone contour area (m <sup>2</sup> ): [Eqs.benthic.mixingZone.area]	146,862				
Mixing zone mean intensity (g/m <sup>2</sup> ): [Eqs.benthic.mixingZone.boundary.contour.approx.meanFlux]	1,752.4	1,624.3	1,805.1	1,613.8	1,660.4
Average mean intensity for the 5 runs (m <sup>2</sup> ):	1,691.2				
250 g/m <sup>2</sup> mixing zone area for the 25 m <sup>2</sup> cells (m <sup>2</sup> ): [Eqs.benthic.mixingZone.approx.contourArea]	296,875	323,125	288,125	325,625	315,000
Average of 250 g/m <sup>2</sup> mixing zone areas (m <sup>2</sup> ) for the 5 runs:	309,750				
Average of 250 g/m <sup>2</sup> mixing zone areas (m <sup>2</sup> ) for the 5 runs as % of mixing zone contour area:	210.9				

\* The results for the above runs are contained within the MS1 to MS5 directories in 2023v1\_Reintraid\_Modified\_(16\_Circles)\depomod\results which accompanies this report.

For the SEPA defaults runs, the average mean intensity at the existing site is 1,995.2 g/m<sup>2</sup> and the average mean intensity for the proposed modification is 1,691.2 g/m<sup>2</sup>. Therefore, for the modified site there is a decrease of c. 15.2%.

The mixing zone area for MS5 was closest to the average for all 5 runs. The 250 g/m<sup>2</sup> footprint and the 315,000 m<sup>2</sup> mixing zone area for this run is shown in figure 5.



<p><b>Legend</b></p> <ul style="list-style-type: none"> <li>○ Modelled Circular Pens</li> <li>■ Run MS5 <math>\geq 250</math> g/sqm Mixing Zone (25 sqm cells)</li> <li>— Run MS5 250 g/sqm Contour</li> </ul>	<p>Drawing Title: Run MS5: 250g/sqm Footprint and Mixing Zone</p> <p>Drawing No: REI-0523-3</p> <p>Drawn By: [REDACTED]</p> <p>Date: 09/05/2023</p>	<p>0 50 100 150 200 250 300 m</p> <p>Scale 1 : 7,500 @ A4</p>	<p>TransTech Limited</p> <p>Caerthann House</p> <p>Connel</p> <p>Argyll PA37 1PQ</p>
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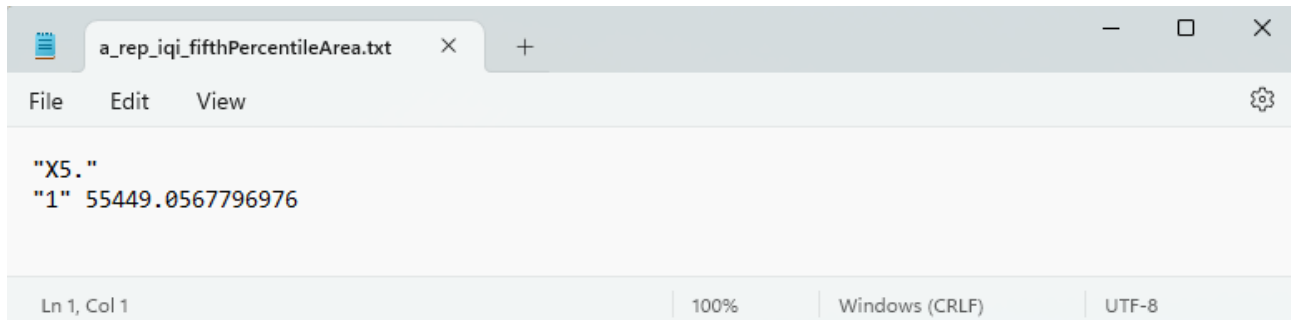
Figure 5. Run MS5 (average for days 275-365): 250 g/m<sup>2</sup> footprint, 169,375 m<sup>2</sup> mixing zone area along with the UI's display of this.

### 3.3 Model Calibration

To model the modified site the first step in doing so was to calibrate the model to the existing site.

To do so, a new project was created in newdepomod-v1.4.1 rc03 which was named 2023v1\_Reintraid\_Existing\_(14\_Squares)\_Calib.

The IQI benthic results for the 2020/2022 production cycle were obtained from the Pharmaq Analytiq's submission to SEPA (MPFF-EMS Results-v6-Reintraid 2022.xlsx). The extents of the 0.64 IQI ellipse area for the 2022 survey were obtained from configuring and running Kraken<sup>(4)</sup> in RStudio (figures 1 and 2). Kraken gives the 5<sup>th</sup> percentile area as 55,449 m<sup>2</sup> (figure 6)



```
a_rep_iqi_fifthPercentileArea.txt
File Edit View
"X5."
"1" 55449.0567796976
Ln 1, Col 1 | 100% | Windows (CRLF) | UTF-8
```

Figure 6. Kraken 5<sup>th</sup> percentile area output.

The existing site was then modelled using modified parameters to achieve the closest match to the ellipse area.

The same parameters were then used to model the modified site. The project for the modified site was named 2023v1\_Reintraid\_Modified\_(16\_Circles)\_Calib.

There is little information available on the accepted methods for calibration of the NewDEPOMOD model. Indeed, few published SEPA accepted model calibration reports are available given the infancy of the regulatory framework and the relative newness of the model.

### 3.4 Solids Calibration Runs for Existing Site

The biomax during the 2020/2022 production cycle was 1,026.3 tonnes. Therefore, for this biomass, the revisions made to the default settings are provided in table 4.

Table 4. Summary of benthic calibration run results for existing site.

Modelling:	Calibration Runs for Existing Site: 1,026.3 T (14 x 24 m square pens with 11 m deep nets, stocking density: 11.56994 kg/m <sup>3</sup> )								
Benthic run reference*:	Defaults	ESC1	ESC2	ESC3	ESC4	ESC5	ESC6	ESC7	
Suspension transport coefficient X (m <sup>2</sup> /s):	0.1	Defaults	Defaults	0	0	0	0	0	
Suspension transport coefficient Y (m <sup>2</sup> /s):	0.1			0	0	0	0	0	
Suspension transport coefficient Z (m <sup>2</sup> /s):	0.001			Defaults	0	0	0	0	0
Bed transport coefficient X (m <sup>2</sup> /s):	0.1				0	0	0	0	0
Bed transport coefficient Y (m <sup>2</sup> /s):	0.1				0	0	0	0	0
Bed transport coefficient Z (m <sup>2</sup> /s):	0				0	0	0	0	0
Resuspension transport coefficient X (m <sup>2</sup> /s):	0.1		0	0	0	0	0	0	
Resuspension transport coefficient Y (m <sup>2</sup> /s):	0.1		0	0	0	0	0	0	
Resuspension transport coefficient Z (m <sup>2</sup> /s):	0.001		Defaults				0	0	0
Minimum TauE (m/s):	0.02		Defaults					0	0
Bathymetry:	Uniform at -59.23							Chart	
Mixing zone contour area (m <sup>2</sup> ): [Eqs.benthic.mixingZone.area]	86,403								
Mixing zone mean intensity (g/m <sup>2</sup> ): [Eqs.benthic.mixingZone.boundary.contour.approx.meanFlux]	5,734.3	5,438.1	6,178.5	6,177.9	6,179.1	6,264.0	8,551.6		
250 g/m <sup>2</sup> mixing zone area for the 25 m <sup>2</sup> cells (m <sup>2</sup> ): [Eqs.benthic.mixingZone.approx.contourArea]	77,500	84,375	74,375	74,375	74,375	73,125	53,750		
Average of 250 g/m <sup>2</sup> mixing zone areas (m <sup>2</sup> ) for the run as % of mixing zone contour area:	89.7	97.7	86.1	86.1	86.1	84.6	62.2		

Eqs.BenthicImpactedAreaEQS.eqsResult:	HIGH	LOW
Eqs.benthic.pass:	LOW	HIGH
Eqs.control.eqsResult:	LOW	
Eqs.critical.eqsResult:	HIGH	
Eqs.warning.eqsResult:	LOW	

\* The results for the above runs are contained within the ESC1 to ESC7 directories in 2023v1\_Reintraid\_Existing\_(14\_Squares)\_Calib\depomod\results which accompanies this report.

The smallest 250 g/m<sup>2</sup> footprint using uniform bathymetry is for Run ESC6 (73,125 m<sup>2</sup>) which is shown in figure 7. It is clear from the modelling that the footprint extends too far NW, not far enough SE, and is too wide.

Run ESC7, for which bathymetry obtained from [emapsite.com](http://emapsite.com) was used, produced the smallest footprint (53,750 m<sup>2</sup>, figure 8) of all calibration runs and its position relative to the pen locations is also better (see figure 7). This run was the closest match to the 2022 benthic survey 5<sup>th</sup> percentile ellipse area of 55,449 m<sup>2</sup>. Note that the bathymetry at the weighted ADCP deployment position (figures 7 and 8) is according to the bathymetry file - 60.39 m which is close to the weighted deployment depth of -59.23 m.

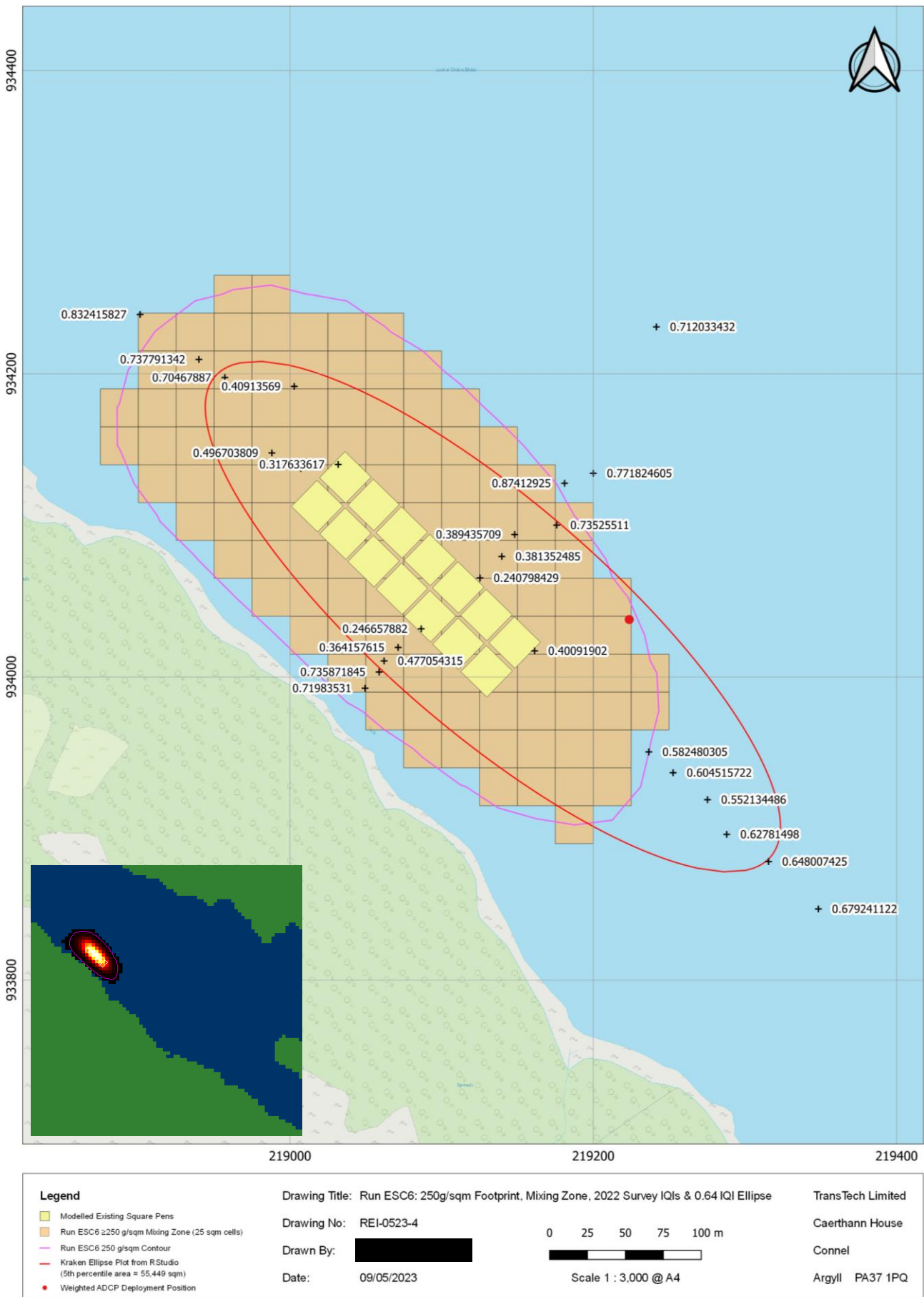


Figure 7. Run ESC6 (average for days 275-365): 250 g/m<sup>2</sup> modelled footprint, 73,125 m<sup>2</sup> mixing zone area, 2022 benthic survey IQIs and 0.64 IQI ellipse from Kraken (NB: this is the RStudio plotted ellipse (area = 57,273 m<sup>2</sup>) which is slightly larger than the 5<sup>th</sup> percentile area of 55,449 m<sup>2</sup>). UI plot also shown.



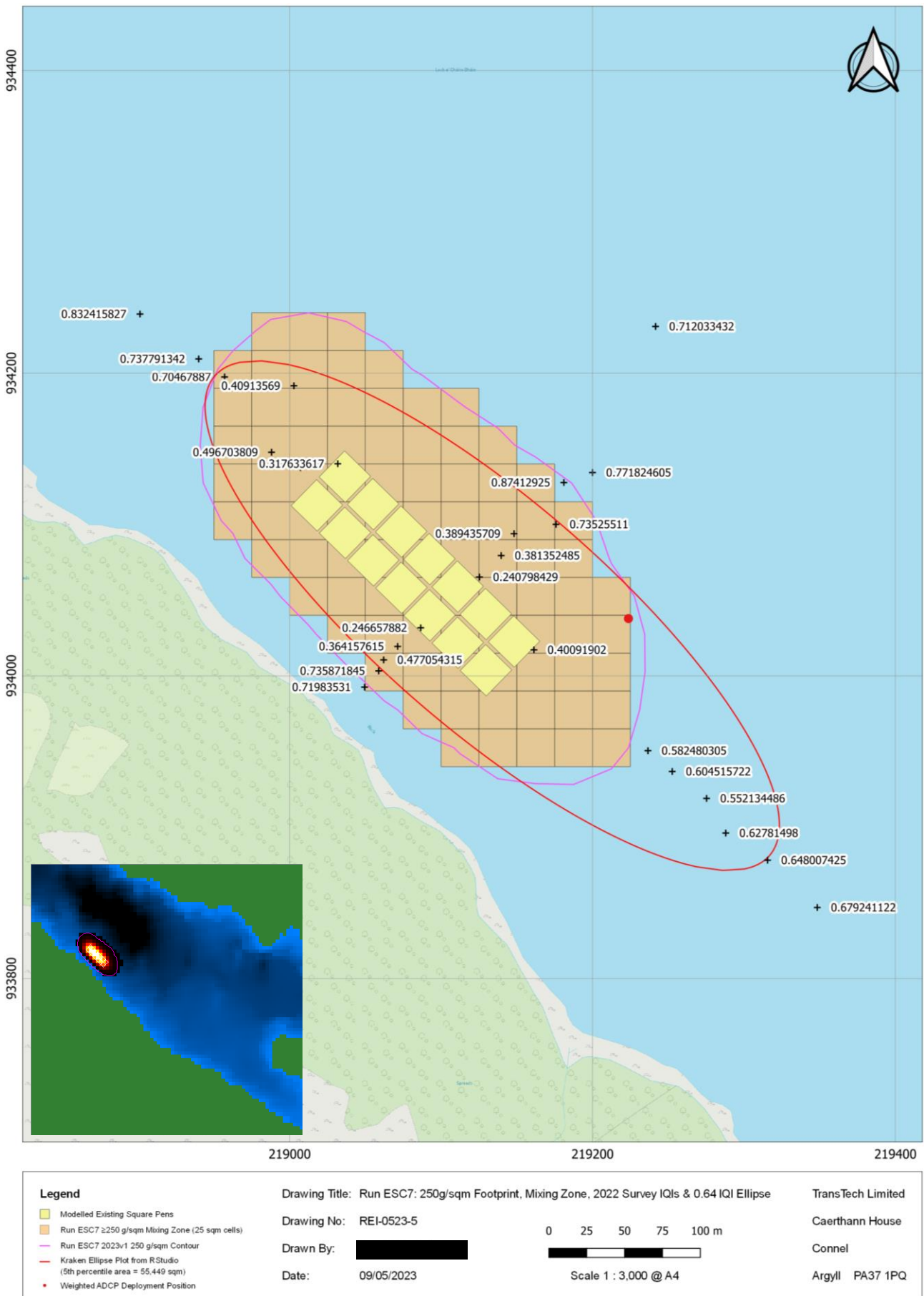


Figure 8. Run ESC7 (average for days 275-365): 250 g/m<sup>2</sup> modelled footprint, 53,750 m<sup>2</sup> mixing zone area, 2022 benthic survey IQIs and 0.64 IQI ellipse from Kraken (NB: this is the RStudio plotted ellipse (area = 57,273 m<sup>2</sup>) which is slightly larger than the 5<sup>th</sup> percentile area of 55,449 m<sup>2</sup>). UI plot also shown.

### 3.5 Solids Runs for Modified Site Using Run ESC7 Calibration Settings for Existing Site

The results for the modified site using the calibration settings for the existing site are presented below (table 5).

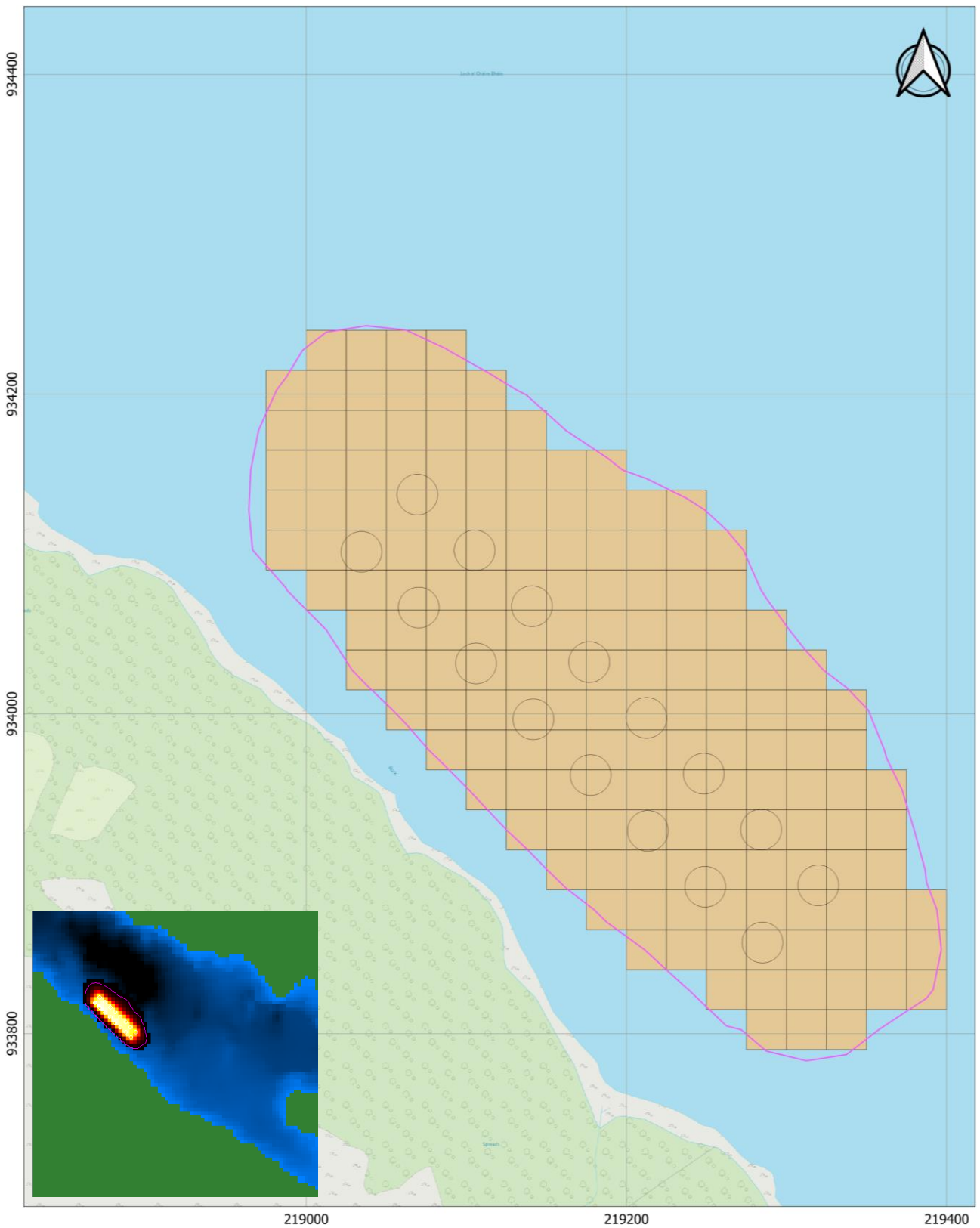
Table 5. Summary of benthic results for modified site with calibration settings.

Modelling:	Modified Site: 1,834 T (16 x 80 m circumference pens with 15 m deep nets, stocking density of 15.0100247902754 kg/m <sup>3</sup> ) with Run ESC7 calibration settings				
Benthic run reference*:	MSC1	MSC2	MSC3	MSC4	MSC5
Mixing zone contour area (m <sup>2</sup> ): [Eqs.benthic.mixingZone.area]	146,862				
Mixing zone mean intensity (g/m <sup>2</sup> ) [Eqs.benthic.mixingZone.boundary.contour.approx.meanFlux]:	6,407.8	6,443.9	6,405.0	6,444.2	6,405.1
Average mean intensity for the 5 runs** (g/m <sup>2</sup> ):	6,421.2 <i>(24.9% lower than calibration Run ESC7 (8,551.6, table 4) albeit this was for 1,026.3 T as opposed to the consented biomass of 1,300 T)</i>				
250 g/m <sup>2</sup> mixing zone area for the 25 m <sup>2</sup> cells (m <sup>2</sup> ): [Eqs.benthic.mixingZone.approx.contourArea]	101,250	100,625	101,250	100,625	101,250
Average 250 g/m <sup>2</sup> mixing zone area (m <sup>2</sup> ):	101,000				
Average of 250 g/m <sup>2</sup> mixing zone areas (m <sup>2</sup> ) for the 5 runs as % of mixing zone contour area:	68.8				
Eqs.BenthicImpactedAreaEQS.eqarResult:	LOW				
Eqs.benthic.pass:	HIGH				
Eqs.control.eqarResult:	LOW				
Eqs.critical.eqarResult:	HIGH				
Eqs.warning.eqarResult:	LOW				

\* The results for the above runs are contained within the MSC1 to MSC5 directories in 2023v1\_Reintraid\_Modified\_(16\_Circles)\_Calib\depomod\results which accompanies this report.

\*\* % difference in mean intensity although it is acknowledged that SEPA only requires this for the default benthic runs (§3.1 and §3.2).

The 250 g/m<sup>2</sup> contour area for Runs MSC1, MSC3 and MSC5 was closest to the average of all 5 runs. An example of the 250 g/m<sup>2</sup> 101,250 m<sup>2</sup> footprint for these runs is provided in figure 9.



<b>Legend</b> ○ Modelled Circular Pens ■ Run MSC3 ≥250 g/sqm Mixing Zone (25 sqm cells) — Run MSC3 2023v1 250 g/sqm Contour	<b>Drawing Title:</b> Run MSC3: 250g/sqm Footprint and Mixing Zone	<b>TransTech Limited</b>	
	<b>Drawing No:</b> REI-0523-6	0 25 50 75 100 m	<b>Caerthann House</b>
	<b>Drawn By:</b> [Redacted]		<b>Connel</b>
	<b>Date:</b> 09/05/2023	<b>Scale 1 : 3,000 @ A4</b>	<b>Argyll PA37 1PQ</b>

Figure 9. Run MSC3 (average for days 275-365): 250 g/m<sup>2</sup> modelled footprint and 101,250 m<sup>2</sup> mixing zone area along with the UI's display of this.

## 4. CONCLUSIONS

SEPA default runs were performed pre and post modification. For these runs the modified site complies with SEPA EQS for mean intensity, albeit it is overpredicting the 0.64 IQI depositional footprint.

For the pre and post modification benthic runs using default settings, mean intensity does not exceed SEPA's 2,000 g/m<sup>2</sup> threshold i.e., the average of the 5 runs performed is 1,995.2 and 1,691.2 g/m<sup>2</sup> respectively. It is appreciated that these default settings are what SEPA bases any increase in mean intensity on.

Solids were also modelled using calibration settings. Likewise, for these a decrease in mean intensity appears likely. The average for the calibration 5 runs at the modified site was 6,421.2 g/m<sup>2</sup> which is 24.9% lower than the calibration run at the existing site (8,551.6 g/m<sup>2</sup>), albeit the calibration run at the existing site was for 1,026.3 tonnes as opposed to the consented biomass of 1,300 tonnes.

Given that the proposed modification is predicted to reduce the intensity of waste on the seabed, the proposal is considered compliant with SEPA requirements.

## FILES ACCOMPANYING THIS REPORT

- Results reported herein contained within the following directories:  
ES Runs: 2023v1\_Reintraid\_Existing\_(14\_Squares)\depomod\results  
MS Runs: 2023v1\_Reintraid\_Modified\_(16\_Circles)\depomod\results  
ESC Runs: 2023v1\_Reintraid\_Existing\_(14\_Squares)\_Calib\depomod\results  
MSC Runs: 2023v1\_Reintraid\_Modified\_(16\_Circles)\_Calib\depomod\results
- Also provided is:  
2023v1\_Reintraid modelling\_metadata\_template\_v6.xlsx

## FILES THAT HAVE BEEN PREVIOUSLY SUBMITTED TO SEPA

- Hydrographic report and associated SEPA validated datasets which were used for the modelling:  
Reintraid\_2023v1\_Hydrographic\_Report.pdf, 13 January 2023.  
Reintraid\_90 days\_hgdata\_analysis\_v7-B.xls.  
Reintraid\_90 days\_hgdata\_analysis\_v7-M.xls.  
Reintraid\_90 days\_hgdata\_analysis\_v7-S.xls.
- Method statement for TransTech's modelling of the Reintraid site:  
Reintraid\_2023v1\_ND\_Modelling\_Method\_Statement.pdf, 13 January 2023.
- Marine Pen Fish Farm Monitoring Survey Results for 2020/2022 production cycle. Report by Pharmaq Analytiq Ltd:  
MPFF-EMS Results-v6-Reintraid 2022.xlsx, 20 January 2023.

## REFERENCES

- (1) SEPA Position Statement. Interim position statement for protecting the water environment in relation to emamectin benzoate in finfish farm regulation. Scottish Environment Protection Agency. March 2023.
- (2) New Depomod Draft Guidance. Scottish Environment Protection Agency. April 2023.
- (3) Wave Exposure Index (Wave Fetch Model). The Scottish Association for Marine Science. WMS layer. Date last updated: Tuesday, May 26, 2015.  
[Website link.](#)
- (4) Kraken IQI Ellipse Calculator. [Website link.](#)

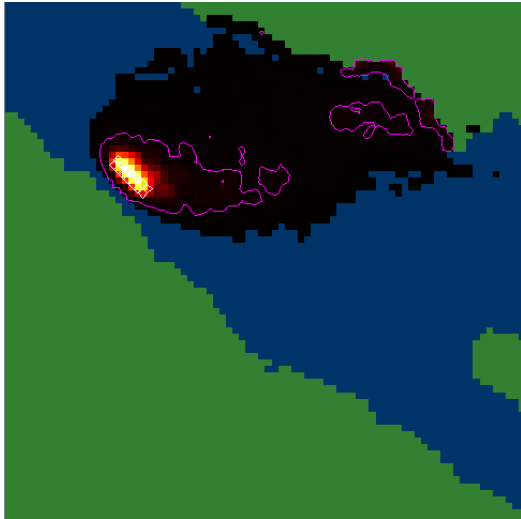
## BIBLIOGRAPHY

- NewDEPOMOD User Guide. Scottish Association for Marine Science. 8 February 2022.

## APPENDIX A: Plots for Benthic Runs using SEPA Defaults – Existing Site

Plots of the benthic runs for the existing site (Reintraid\_Existing\_(14\_Squares)-Cages-NONE-N-solids-g0-avg.depomodresultssur) are provided below:

**Existing Site (14 square pens) 1,300 tonnes (stocking density 14.655483 kg/m<sup>3</sup>) with SEPA defaults & vdsp of 0.003847. 250 g/m<sup>2</sup> contour and mean intensity:**



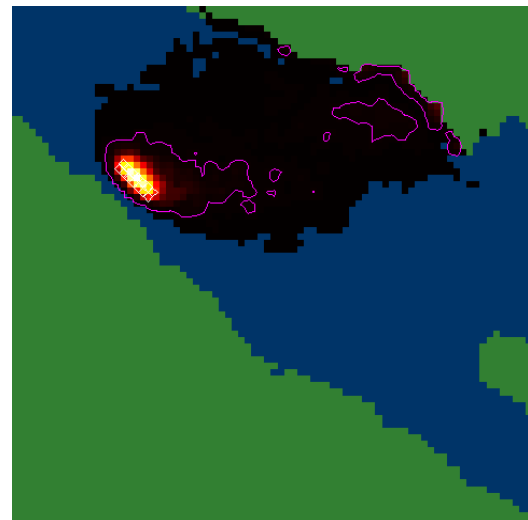
Run ES1



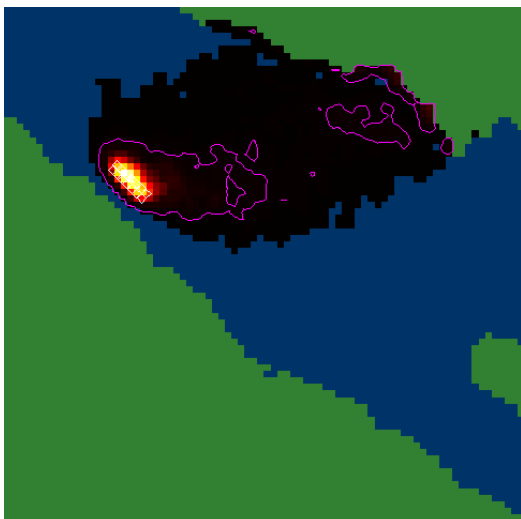
Run ES2



Run ES3



Run ES4

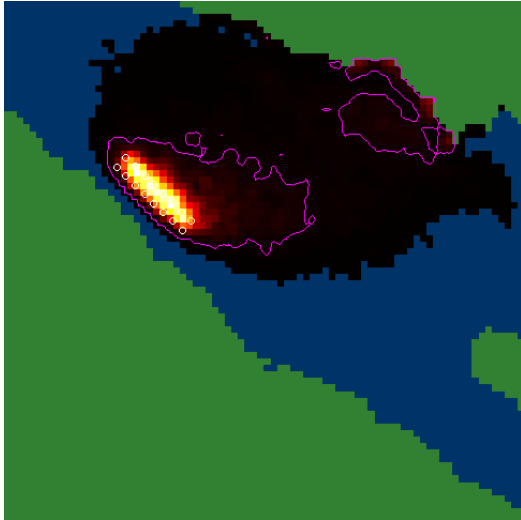


Run ES5

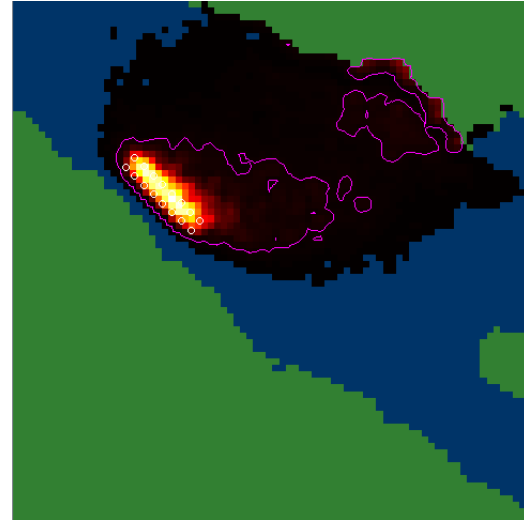
## APPENDIX B: Plots for Benthic Runs using SEPA Defaults – Modified Site

Plots of the benthic runs for the proposed modification (2023v1\_Reintraid\_Modified\_(16\_Circles)-Cages-NONE-N-solids-g0-avg.depomodresultssur) are provided below:

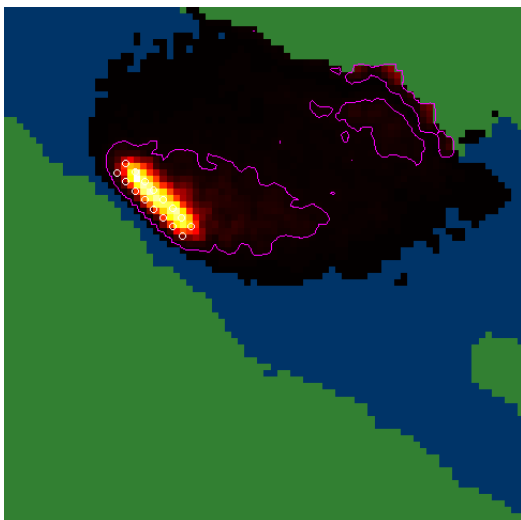
**Modified Site (16 circular pens) 1,834 tonnes (stocking density 15.0100247902754 kg/m<sup>3</sup>) with SEPA defaults & vdsp of 0.003847. 250 g/m<sup>2</sup> contour and mean intensity:**



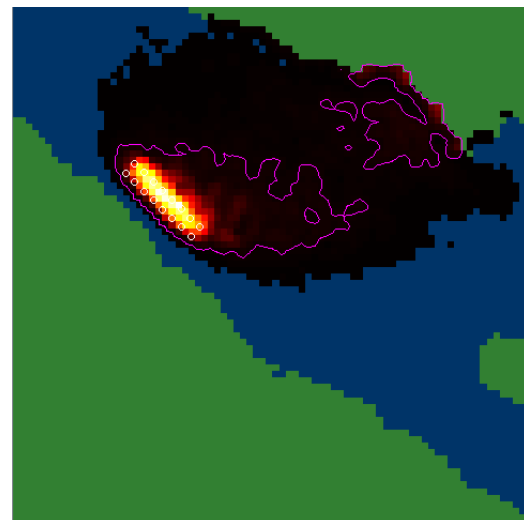
Run MS1



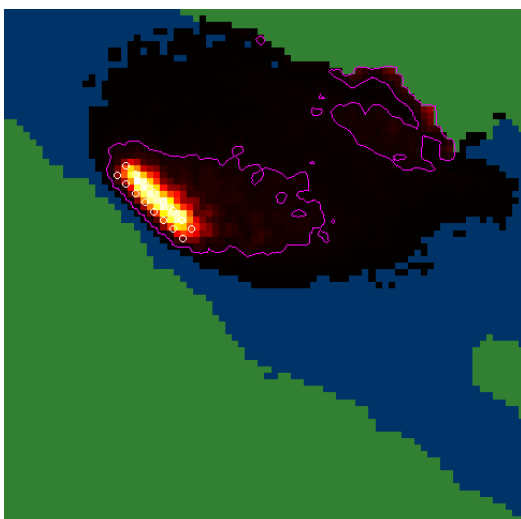
Run MS2



Run MS3



Run MS4

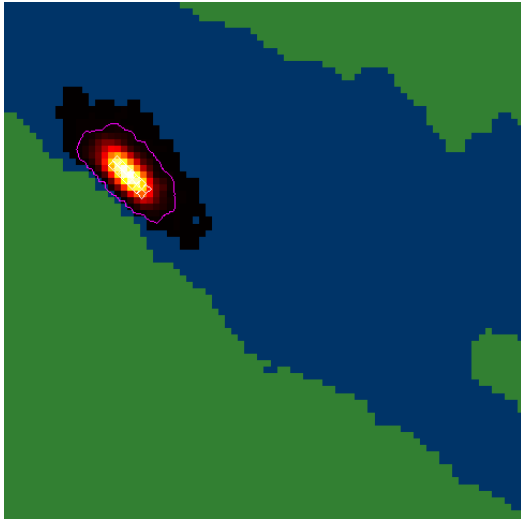


Run MS5

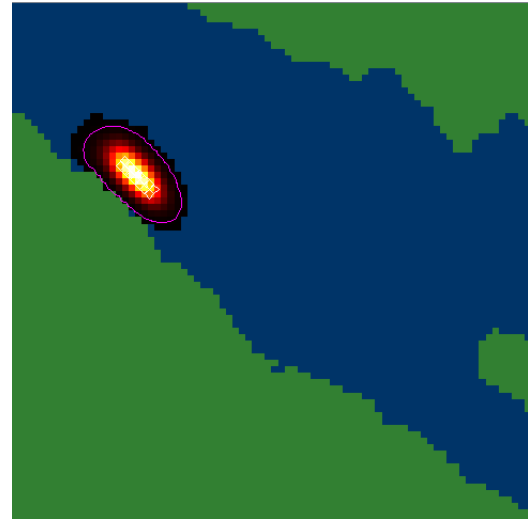
## APPENDIX C: Plots for Benthic Calibration Runs – Existing & Modified Site

Plots of the calibration runs for the existing site (Reintraid\_Existing\_(14\_Squares)\_Calib-Cages-NONE-N-solids-g0-avg.depomodresultssur) are provided below.

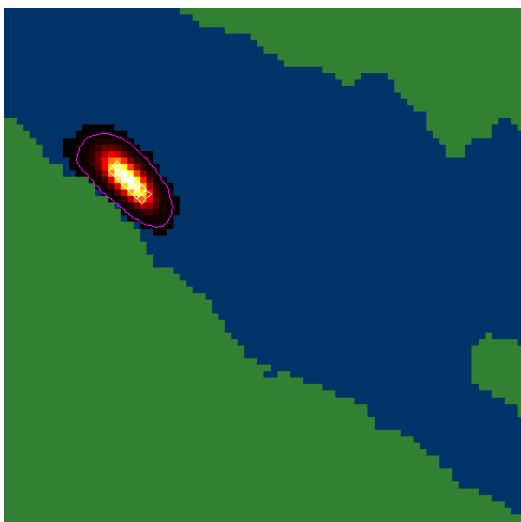
**Existing Site (14 square pens) 1,026.3 tonnes (stocking density 11.56994 kg/m<sup>3</sup>) with calibration settings provided in table 4. 250 g/m<sup>2</sup> contour & mean intensity:**



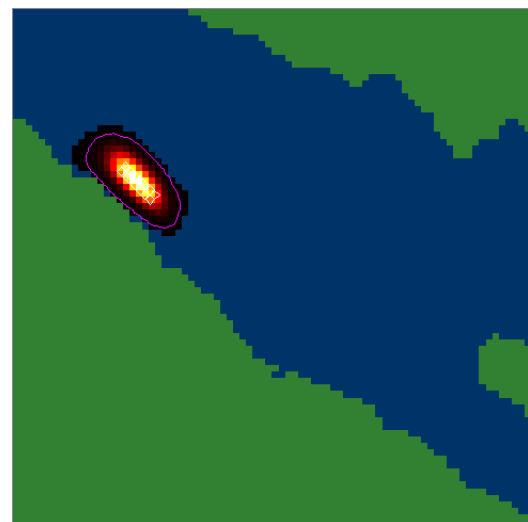
Run ESC1



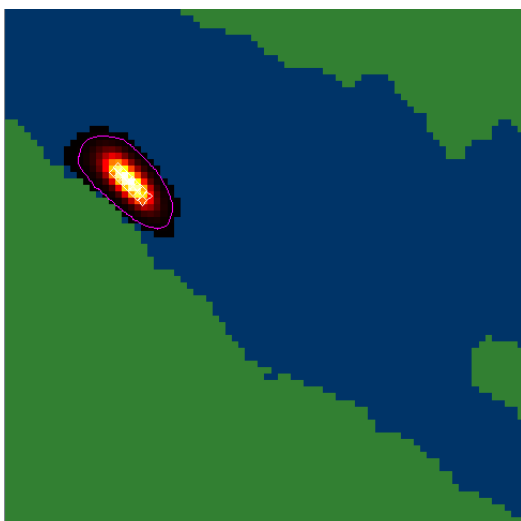
Run ESC2



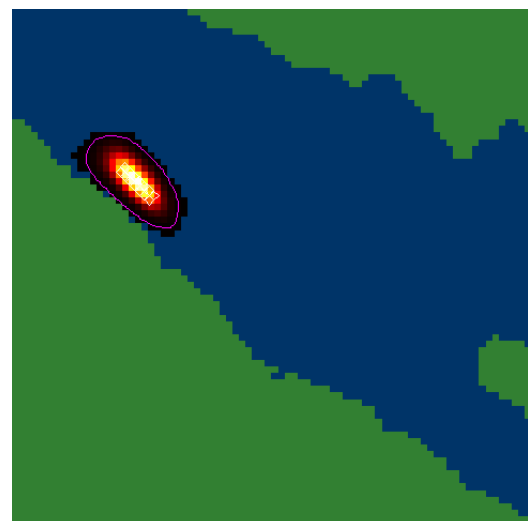
Run ESC3



Run ESC4

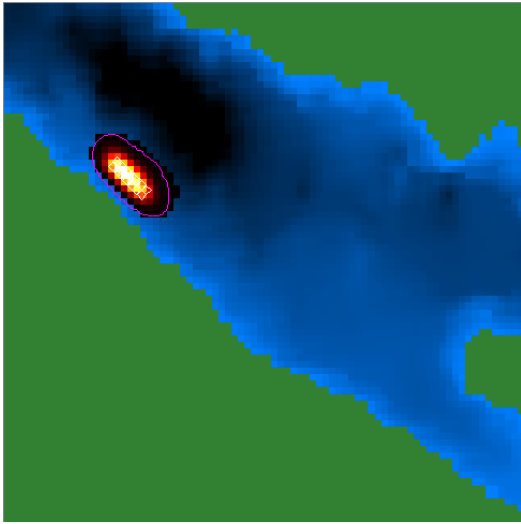


Run ESC5



Run ESC6

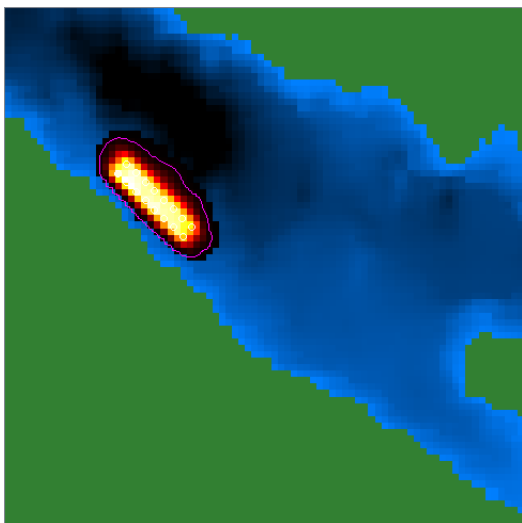




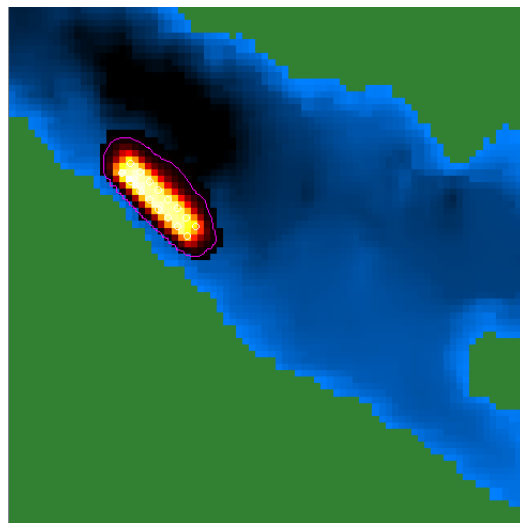
Run ESC7

Plots of the calibration runs for the modified site (2023v1\_Reintraid\_Modified\_(16\_Circles)-Cages\_Calib-NONE-N-solids-g0-avg.depomodresultssur) are provided below.

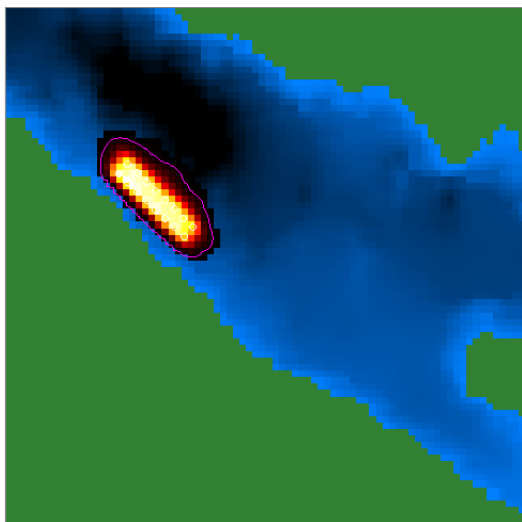
**Modified Site (16 circular pens) 1,834 tonnes (stocking density 15.0100247902754 kg/m<sup>3</sup>) with calibration settings provided in table 4 for Run ESC7. 250 g/m<sup>2</sup> contour & mean intensity:**



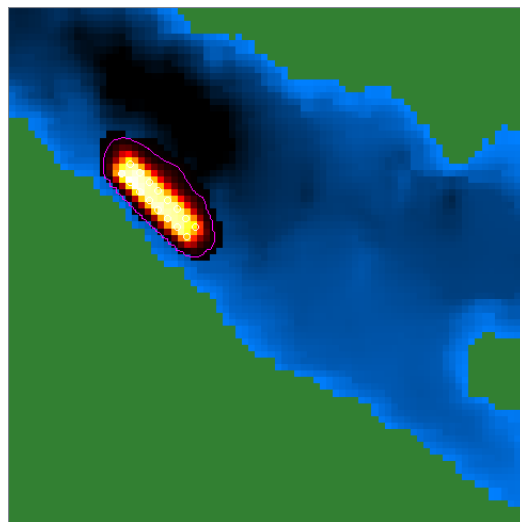
Run MSC1



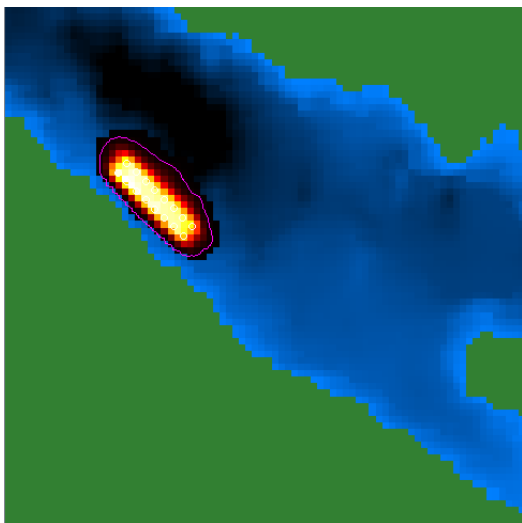
Run MSC2



Run MSC3



Run MSC4



Run MSC5