

# NewDepomod Guidance for Aquaculture Applications

January 2024

## New updates in this version

* NewDepomod Flowchart

## Introduction

NewDepomod modelling is required to assess the likely localised impact from a fish farm. SEPA standards refer to the under cage and mixing zone impacts.

Marine modelling should also be undertaken to assess the far field associated risk. Pre-app screening will help determine the type of marine modelling required – please refer to the Interim Marine Modelling guidance for more information on this.

Default NewDepomod modelling is required for all sites for both Solids and EmBZ. The required settings are listed in the appendix and have been tested at a number of sites, with the aim of being mildly conservative. This is to ensure the modelled passing biomass can in reality be sustained at the site. Calibrated NewDepomod modelling cannot be undertaken at new sites.

After a production cycle, extensive monitoring with a minimum of 4 monitoring transects should be carried out. This will provide the ability for calibrated NewDepomod modelling to be undertaken, and the authorised biomass at the site to be potentially increased.

Calibrated NewDepomod modelling will not be accepted without extensive monitoring – the old far field monitoring comprising of one transect and two monitoring points is insufficient.

Always use the latest version of NewDepomod to have the latest parameters available and to avoid using potentially wrong calculations.

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## Standard Default NewDepomod

### Model Setup

The default model setup should be:

* + Domain Size: 2km x 2km
  + Cell Size: 25m x 25m squares
  + Bathymetry: Uniform – representative of depth under pens
  + Flow Field: Uniform – from 1 or more current meter deployments. Where the residual flow speed is ≥35% of the mean flow speed at the bed, the residual component should be removed from the flow data.
  + Flow Data Duration: 90 days or greater
  + Number of Flow Depth Records: 3 or greater. At least: <5m from water surface, Pen- bottom and <3m from bed.
  + Number of Particles: 10 per pen per timestep
  + Timestep: 60seconds

Requirements for the configuration of physical parameters used in the standard default method are described in Appendix A.

For the Standard Default Method (SDM) of NewDepomod the bathymetry depth and flowmetry depth should be the same. The average depth is calculated from the depths of the individual hydrographic datasets submitted to SEPA (see HG Data for Aquaculture Applications\_DRAFT\_yyyymmdd\_final.doc for more detail).

Should the farm be over or at the edge of a steep slope, but the current meter is in significantly deeper water (i.e. more than 10m difference), the depth used in the bathymetry and flowmetry files should be adjusted to better reflect the water depth in the vicinity of the farm.

In these cases, the bathymetry (site depth) and near-bed flowmetry depth in NewDepomod should use the average depth (or the most representative depth) of the seabed underneath the farm rather than the time-averaged deployment depth:

* SD = mean (or most representative) depth at site location
* Bed Flowmetry Value = (SD - Dav Bed Cell)\*-1
* Site Depth = (SD)\*-1

The flowmetry mid and surface cell depth calculation is unchanged.

## Calibrated NewDepomod

### Model Setup

The calibrated model setup should be:

* + Domain Size: 2km x 2km
  + Cell Size: 25m x 25m squares
  + Bathymetry: Uniform/Spatially varying
  + Flow Field: Uniform/Hydrodynamic (modelled) spatially varying flow field
  + Flow Data Duration: 90 days or greater
  + Number of Flow Depth Records: 3 or greater. At least: <5m from water surface, Pen- bottom and <3m from bed.
  + Number of Particles: 10 per pen per timestep
  + Timestep: 60 seconds

It is only appropriate to use a spatially varying representation of the local bathymetry when used in conjunction with a spatially varying flow field obtained from a Marine Model

When calibrating NewDepomod, the recommended SEPA method is to adjust the vertical dispersion until the size of the 250gm-2 contour matches the monitored 0.64 IQI footprint.

Other methods of calibration may be accepted; however, it is highly recommended that the proposed method is outlined as early as possible in the application process, via a method statement.

Should the IQIs of one or more of the benthic monitoring transects not reach good status, i.e. 2 consecutive sampling points of 0.64 IQI or higher per transect, an impact ellipse cannot be calculated. In this case the method of matching impact ellipses of measured vs. modelled ellipse area can’t be used. In this case an alternative acceptable method is to calibrate the site point by point by comparing modelled deposition with measured IQIs and establishing a flux contour corresponding to the 0.64 IQI threshold that correctly predicts IQI passes and fails.

Attempts to convert ITI to IQI will not be accepted.

Once the existing site setup is successfully calibrated the same model setup is used for the proposed setup. Please note, the new pens should be within 180m from the centre of the old pens unless it can be demonstrated that the bathymetry and flow conditions are sufficiently similar to the conditions experienced at the calibrated site and remain unchanged.

Please note, when reporting the size of the calculated mixing zone, the number refers to the 5%ile. The associated plot is for reference only and is the mean or median calculated eclipse.

## Organic Solids

### Model Setup and Processing

Simulations should be made to explicitly model impacts arising from the discharge of organic solids. These simulations should represent the maximum biomass which is intended to be held on site at any point in time, run at a constant level for a period of 365 days. Feed inputs should be based on an assumed feed rate of 7 kg t-1 d-1.

The model setup for solids should be:

* + Run Duration: 365 days
  + Biomass: Peak
  + Feed Rate: 7 kg t-1 d-1
  + Waste Rate: 3%
  + Feed Water Content: 9%
  + Feed Digestibility: 85%
  + Feed Carbon Content: 49%
  + Faeces Carbon Content:30%
  + Output Period: Last 90 days
  + Output Resolution: 3-hourly or greater

Outputs should be produced at a 3-hourly resolution (or greater) for the last 90 days of the model run.

Model output from the last 90 days should be time-averaged in order to produce a representation of the average (mean) deposited mass in each domain grid cell for that period.

The impacted area should be then calculated by summing up the areas of each time-averaged grid cell which exceeds the EQS. Do not use a contouring algorithm. The mean under-cage impact value is the average of the concentrations in all grid cells which exceed the EQS.

### Standards

Screening should be undertaken to identify issues and assess the risk of remote impacts beyond the mixing zone. The required processes and outcomes for solids modelling, which includes intensity standard, mixing zone boundary standard and remote impact checks, are explained in Figure 1.

NewDepomod does not explicitly model IQI conditions. Therefore local-scale mixing zone and pen edge standards have been associated with the following model requirements. See section Solids EQS Standards for new sites (for monitoring and modelling).

Areas subject to wave exposures of 2.8 or greater have been shown to be able to support higher biomasses. As waves are not incorporated in NewDepomod, modelled standards for both pen edge and mixing zone are higher than in areas with low wave exposure. (Please note: This allowance is in relation to modelled footprints only. All farms must meet the solids EQS standards given in the section below.)

#### Solids EQS Standards for new sites (for monitoring and modelling)

Pen Edge Intensity Standard:

Definition:

>1 species of enrichment polychaete at densities >1000 m-2 at pen edge locations

Model Requirement:

Mean deposited mass within the 250 g m-2  impact area should not exceed 2000 g m-2  where wave exposure is less than 2.8, or 4000g m-2 where wave exposure is 2.8 or greater. For existing farms, 15% increase in under cage intensity is allowed (Figure 1.)

Mixing Zone Extent Standard:

Definition:

Total area (m2) impacted to worse that 0.64 IQI should not exceed the 100 m composite mixing zone area (m2 ).

Model Requirement:

Total area (m2) with a mean deposited mass in excess of 250 g m-2  should not exceed the 100 m mixing zone area (m2 ) where wave exposure is less than 2.8, or 120% of the mixing zone area (m2 ), where wave exposure is 2.8 or greater.

Process for solids modelling. 
1. Screening required to identify issues, including whether marine modelling is required to assess risk of remote impacts beyond mixing zone
1.1 forward to Check 1: Intensity standard (at pen edge)
1.2 forward to Check 2: Mixing zone boundary standard
1.3 forward to Check 3: Remote impacts

2. Check 1: Intensity standard (at pen edge)
2.1 forward to Are there any failures in previous 2 comparable production cycles?

3. Are there any failures in previous 2 comparable production cycles?
3.1 if yes forward to No increase in NewDepomod deposition allowed
3.2 if no forward to Has default NewDepomod been used? (Only acceptable if either; new framework monitoring does not exist OR default has been validated against new framework monitoring for the Mixing Zone

4. No increase in NewDepomod deposition allowed
4.1 forward to Increase in biomass could be allowed if Allowed Mixing Zone area is increased and hence deposition rate is sufficiently reduced e.g. by changes to the number or size of pens 

5. Has default NewDepomod been used? (Only acceptable if either; new framework monitoring does not exist OR default has been validated against new framework monitoring for the Mixing Zone
5.1 if yes forward to Calculate biomass increase allowed up to deposition rate of 2000/4000g/m2. If existing deposition is above this threshold, increase in NewDepomod deposition rate of 15% allowed as long as ecology is not close to failure.
5.2 if no forward to Increase in Calibrated NewDepomod deposition rate of 15% allowed

6. Calculate biomass increase allowed up to deposition rate of 2000/4000g/m2. If existing deposition is above this threshold, increase in NewDepomod deposition rate of 15% allowed as long as ecology is not close to failure.
6.1 forward to Biomass increase may be allowed. Lowest of the biomass limit allowed by intensity standard, mixing zone boundary standard and avoidance of impacts beyond the mixing zone (remote impacts). 

7. Increase in Calibrated NewDepomod deposition rate of 15% allowed
7.1 forward to Biomass increase may be allowed. Lowest of the biomass limit allowed by intensity standard, mixing zone boundary standard and avoidance of impacts beyond the mixing zone (remote impacts). 

8. Check 2: Mixing zone boundary standard
8.1 forward to Does new framework monitoring exist for the site?

9. Does new framework monitoring exist for the site?
9.1 if yes forward to Calibrate (or validate default settings) NewDepomod to calculate the increase in biomass which complies with mixing zone
9.2 if no forward to Use default NewDepomod to calculate increase in biomass which complies with the Mixing zone standard

10. Calibrate (or validate default settings) NewDepomod to calculate the increase in biomass which complies with mixing zone
10.1 forward to Biomass increase may be allowed. Lowest of the biomass limit allowed by intensity standard, mixing zone boundary standard and avoidance of impacts beyond the mixing zone (remote impacts). 

11. Use default NewDepomod to calculate increase in biomass which complies with the Mixing zone standard
11.1 forward to Biomass increase may be allowed. Lowest of the biomass limit allowed by intensity standard, mixing zone boundary standard and avoidance of impacts beyond the mixing zone (remote impacts). 

12. Check 3: Remote impacts
12.1 forward to Does marine modelling indicate impacts which would exceed standards or affect third parties/protected features?

13.Does marine modelling indicate impacts which would exceed standards or affect third parties/protected features?
13.1 if yes forward to No increase in biomass allowed
13.2 if no forward to Biomass increase may be allowed. Lowest of the biomass limit allowed by intensity standard, mixing zone boundary standard and avoidance of impacts beyond the mixing zone (remote impacts). 


Figure 1: Flowchart describing the checks and processes required for solids modelling.

|  |
| --- |
| **Notes on Flow Chart:** |
|  |
| \*1. Two comparable production cycles. We mean that the production cycles are similar in nature. Similar biomass peaks and feed usage. For example, the two production cycles would not be comparable if the biomass limit had been changed over the past two years. |
| \*2. Validating default NewDepomod against new framework monitoring is essential, to be able to evaluate the accuracy of default NewDepomod predictions and to avoid cases where default NewDepomod modelling is allowing a biomass not supported by monitoring.  \*3. Modelled deposition is derived from NewDepomod, which may use the default SEPA settings or be calibrated against transect monitoring data. The current modelled deposition rates for default NewDepomod were derived from testing against observed data. The lower limit applies at sites with a wave threshold less than, or equal to, 2.8 as defined by information on the [**Marine Scotland Wave Exposure map**](https://marinescotland.atkinsgeospatial.com/nmpi/default.aspx?layers=780.)  \*4. Where ecology can be demonstrated to be in very good condition, SEPA can take this into account as part of the determination and where appropriate allow for increases greater than 15%. For example, if the IQI was close to the moderate/poor boundary or better.  [\*5. This step will only be required if marine modelling has been identified as being required at the pre-application screening stage.](https://www.sepa.org.uk/regulations/water/aquaculture/screening-modelling-and-risk-identification-report/) |

## Emamectin Benzoate

### Model Setup and Processing

Simulations should be made to explicitly model impacts arising from the discharge of emamectin benzoate (EmBz) if such a consent is sought. These simulations should represent a single discharge of the total quantity under consideration.

Runs should be made over a duration of 118 days and configured according to the modelling setup described in Table 5.

Seabed impact outputs should be averaged over the final two days (day 116-118) of the run at a 3-hourly resolution or greater.

The impacted area should be then calculated by summing up the areas of each time-averaged grid cell which exceeds the EQS. Do not use a contouring algorithm. The mean under-cage impact value is the average of the concentrations in all grid cells which exceed the EQS.

The model setup for EmBz should be:

* + Run Duration: 118 days
  + Biomass: Peak
  + Feed Rate: 7 kg t-1 d-1
  + Waste Rate: 3%
  + Feed Water Content: 9%
  + Feed Digestibility: 85%
  + Feed Carbon Content: 49%
  + Faeces Carbon Content:30%
  + Treatment Duration: 7 days
  + Linear Excretion Period: 7 days
  + Quantity Excreted During Linear Excretion Period: 10%
  + Excretion Half-Life: 36 days
  + Decay Half-Life:250 days
  + Density of Mud: 1400 kg m-3
  + Output Period: Last 2 days
  + Output Resolution: 3 hourly or greater

### Standards

The following criteria are then used to identify a scenario which is likely to comply with local-scale “mixing zone” standards:

#### EmBZ EQS Standards for new sites (for monitoring and modelling)

Mixing Zone Extent Standard:

* + - Model Requirement: Total area (m2 ) which exceeds the EQS (272 ng/kg of marine sediment - dry weight, 136 ng/kg of marine sediment - wet weight), should not exceed the 100 m composite mixing zone area (m2 )

### NewDepomod Emamectin Benzoate (SLICE) Modelling

The SEPA [interim position statement on discharges of emamectin benzoate](https://www.sepa.org.uk/media/594684/position_statement_embz-march-2023-approved.pdf) should be followed.

On 23rd March 2023, the UK Technical Advisory Group1 published revised recommendations2 on [environmental quality standards for emamectin benzoate](https://www.sepa.org.uk/media/594684/position_statement_embz-march-2023-approved.pdf). These revised recommendations replace our previous interim regulatory position on emamectin benzoate, published in July 2022.

The new recommended standards set out by the advisory group will be taken into account by SEPA and are listed in Table 6.

The EQS for Emamectin Benzoate (EmBZ) at the edge of the 100m mixing zone of 272 ng/kg dry wt marine sediment. To be able to assess EmBZ modelling results from NewDepomod the dry weight (wt) EQS has to be converted to a wet weight EQS, which is 136 ng/kg. To analyse the output the runs “with decay” are to be used.

Calculating the contour level: 272 ng/kg (dry wt) x (700/1400) = 136 ng/kg (wet wt) (Eq. 1)

Where 1400 kg/m3 is the wet bulk density and 700 kg/m3 is the dry bulk density.

#### New Farm/ Application

EmBZ EQS at the edge of the 100m mixing zone cannot be larger than 272 ng/kg dry weight or 136 ng/kg wet weight. This is for both Standard Default and calibrated runs. Therefore, the size of the area at the 136 ng/kg wet weight contour has to be established.

#### Existing Farm/ Application

No increase in EmBZ can be authorised at farms which are currently permitted at the old EQS of 763 ng/kg wet weight. The currently authorised EmBZ (or a lower) quantity, previously called the TAQ (Total Allowable Quantity), now called the modelled maximum quantity, should be modelled for the application. Modelling of a higher quantity will be refused.

No new areas of seabed can be impacted at the old EQS. In order to ensure this, farms should be modelled with the existing cage layout and consented EmBZ amount and compared to the new cage layout and applied EmBZ quantity. This is for both Standard Default and calibrated runs. Areas of seabed impacted at the new EQS (136 ng/kg wet wt) should be compared. Up to 15% new seabed impact is deemed acceptable to allow for model variation.

If the area of new seabed is greater than 15% then subsequent runs should be undertaken with lower EmBZ amounts, until there is less than a 15% increase in new seabed impacted. An example can be found in Figure 2.

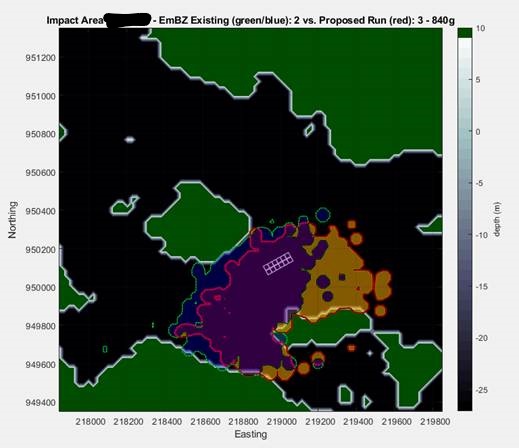


Figure 2. Modelled EmBz impact area at existing location (blue/green) vs. impact area at new location with new EmBZ, (purple/pink), both at modelled at new EQS. Yellow/red shows the area of new seabed impacted at the new EQS. This area must be less than 15% of existing area.

### EmBZ retreatment/ Permit Conditions

With the new Aquaculture Framework terminology has changed:

TAQ was the maximum amount of EmBZ that could be used to treat the fish. This is now called the modelled max quantity.

MTQ (Modelled Total Quantity) is no longer used. The dosage rate is now set on the licence instead.

Previously, the TAQ (Total Allowable Quantity) and MTQ (Maximum Allowable Quantity) were in the permit. These have been replaced by the MEQ (Maximum Environmental Quantity) and dosage rate.

The MEQ is the amount of EmBZ on the seabed which is associated with the predicted compliance with EQS and mixing zone criteria.  It is not a treatment or release amount.

The MEQ takes the modelled max quantity and multiplies it by the maximum fraction of treatment mass, to calculate the peak quantity in the environment, if the modelled max quantity was used as a single treatment.

This peak in the environment is 72% of the treatment amount, so MEQ is 0.72 \* modelled max quantity(or 0.72 \* TAQ).

The MEQ is a fixed value relative to the modelled maximum quantity.

More information can be found in Appendix A.

# Model Settings:

## Calculating the vertical dispersion coefficient:

The vertical dispersion coefficient for the resuspension phase (σz,r) is defined in the **model run physical properties** file according to the label:

Transports.resuspension.walker.dispersionCoefficientZ=’To\_be\_calculated’

The value of this parameter should be set as function of the mean flow speed at the bed (*u*, in m/s) as follows:

σz,r = 0.0003 *u*-0.762  (Eq. 2)

and the ‘To\_be\_calculated’ part must be replaced by the numerical value calculated using the equation above.

Note that this parameterisation represents a method for accommodating the numerical structure and associated emergent behaviour of the model. It is not considered to reflect true differences in the physical processes between sites of differing flow characteristics.

## Model Templates

Please download the [NewDepomod model templates from GitHub](https://github.com/OceanMetSEPA) which uses the settings listed in the appendix.

As noted above, the ‘Transports.resuspension.walker.dispersionCoefficientZ’ parameter must be calculated for each model run.

## Reporting of Model Results from the Solids and EmBz Runs

The following model results are to be reported to SEPA. The parameters can be found in the run log (run log.txt) in the Results folder created by NewDepomod:

Eqs.benthic.mixingZone.area = the 100m Mixing zone target area (m2)

Eqs.benthic.mixingZone.boundary.contour.approx.meanFlux= mean undercage Intensity EQS within the 250 g m-2 contour, for Solids only. This is calculated using squares instead of contours.

Eqs.benthic.mixingZone.approx.contourArea = deposition area Extent EQS (m2) at the 250 g m-2 contour for both Solids and EmBZ. This is calculated using squares instead of contours.

For existing applications, we require both the existing setup and the proposed setup.

If an existing site has been calibrated, we require both the calibrated runs and the Standard Default runs for solids and EmBZ (if applied for).

When several runs of the same setup are conducted, all model results should be reported individually, as well as the average of the predicted impact area and under-cage mean deposition of these runs.

Please submit all the output files from the reported runs.

The most recent modelling metadata template should be filled in modelling\_metadata\_template\_vXX.xlsx

## Appendix A: Terminology Used in the Permit and the Retreatment Spreadsheet

### TAQ – Total Allowable Quantity

The TAQ is the amount modelled in NewDepomod, and historically in AutoDepomod, which is shown to meet the environmental quality standards. (It was capped at 5 x MTQ or 5 maximum individual treatment amounts under the old regime). Where there were high amounts of export out of the model grid, a calculation was made to restrict the TAQ, often to the amount needed to treat peak biomass once.

The TAQ is now called the modelled max quantity in the new retreatment spreadsheet.

### MEQ and MTQ are not comparable

The MEQ is not a release amount, it’s a compliance level. It ensures that compliance is likely to be achieved in line with modelled predictions, which are established with reference to the EQS and mixing zone.

### MTQ – Maximum treatment quantity

The MTQ was the amount required to treat the fish with a standard dose when the site was at full biomass (which is biomass \* 0.35 for the dosage conversion).

The MTQ ensured that the rate of EmBZ released into the environment followed the release curve from the fish which is expected at 100% dosage.

(The dosage rate is now set in the permit instead.)

### MEQ – Maximum Environmental quantity

The MEQ is the amount of EmBZ on the seabed which is associated with the predicted compliance with EQS and mixing zone criteria. It is not a treatment or release amount.

The MEQ takes the modelled max quantity and multiplies it by the maximum fraction of treatment mass, to calculate the peak quantity in the environment, if the modelled max quantity was used as a single treatment.

The maximum fraction of treatment mass is a proportion of material released at the peak of the release curve, which, due to decay and excretion (export is not taken into consideration), occurs 118 days after treatment and is 72% of the initial treatment amount. (The calculation for that can also be found in the retreatment spreadsheet)

Hence, MEQ is 0.72 \* TAQ.

MEQ is a fixed value relative to the modelled maximum quantity.

A site can be treated with a mass of EmBZ, as long as it stays within the MEQ. To do successive treatments and determine the cumulative amount on the seabed the new amount has to be tested in the retreatment spreadsheet, what mass can be used to meet the MEQ (predictive treatment).

### Effective TAQ

This is the same as the MEQ.

### Dosage Rate

The dosage rate of EmBZ is 60 µg/ kg of fish per day over a 7 day period.

## Appendix B: NewDepomod Standard Approach Configuration

### NewDepomod depomodinputsproperties - Benthic and EmBZ Run settings.

#### File location:

NewDepomodProjects\SiteName\depomod\inputs

#### File name:

SiteName-1-NONE-allCages.depomodinputsproperties

Particle.characteristicLengthOfFaeces.dispersion=0.000500  
Particle.characteristicLengthOfFaeces.distribution=UNIFORM  
Particle.characteristicLengthOfFaeces.location=0.005000  
Particle.characteristicLengthOfFeed.dispersion=0.001100  
Particle.characteristicLengthOfFeed.distribution=UNIFORM  
Particle.characteristicLengthOfFeed.location=0.011000  
Particle.consolidationTimeOfFaeces=0.0  
Particle.consolidationTimeOfFeed=0.0  
Particle.degradeT50Carbon=Infinity  
Particle.degradeT50Chemical=21600000  
Particle.densityOfFaeces.dispersion=10.800000  
Particle.densityOfFaeces.distribution=UNIFORM  
Particle.densityOfFaeces.location=1080.000000  
Particle.densityOfFeed.dispersion=11.800000  
Particle.densityOfFeed.distribution=UNIFORM  
Particle.densityOfFeed.location=1180.000000  
Particle.diameterOfFaeces.dispersion=0.000300  
Particle.diameterOfFaeces.distribution=UNIFORM  
Particle.diameterOfFaeces.location=0.003000  
Particle.diameterOfFeed.dispersion=0.000900  
Particle.diameterOfFeed.distribution=UNIFORM  
Particle.diameterOfFeed.location=0.009000  
Particle.lengthUnitsSiConversionFactor=1.000000  
Particle.massUnitsSiConversionFactor=1.000000  
Particle.settlingVelocityOfFaeces.dispersion=0.003200  
Particle.settlingVelocityOfFaeces.distribution=GAUSSIAN  
Particle.settlingVelocityOfFaeces.location=-0.032000  
Particle.settlingVelocityOfFeed.dispersion=0.009500  
Particle.settlingVelocityOfFeed.distribution=GAUSSIAN  
Particle.settlingVelocityOfFeed.location=-0.095000  
Particle.velocityUnitsSiConversionFactor=1.000000

### NewDepomod Physicalproperties – Benthic and EmBZ Run settings.

#### File location:

NewDepomodProjects\SiteName\depomod\models

#### File name:

SiteName-1-NONE.depomodphysicalproperties

Bathymetry.minimumSurfaceDX=25.0  
Bathymetry.minimumSurfaceDY=25.0  
Bathymetry.surfaceDX=25.0  
Bathymetry.surfaceDY=25.0  
Eqs.Benthic.impactedArea.contourLevel=4.0  
Eqs.Benthic.impactedArea.targetArea=500000  
Eqs.Benthic.impactedArea.targetAreaPercentageTolerance=1.0  
Eqs.Benthic.minimumItiValue=10.0  
Eqs.Benthic.minimumItiValuePercentageTolerance=1.0  
Eqs.Benthic.samplingIti=30.0  
Eqs.benthic.defaultBenthicFarField.critical=true  
Eqs.benthic.defaultBenthicFarField.enable=true  
Eqs.benthic.defaultBenthicImpactedArea.critical=true  
Eqs.benthic.defaultBenthicImpactedArea.enable=true  
Eqs.benthic.defaultBenthicNearField.critical=false  
Eqs.benthic.defaultBenthicNearField.enable=true  
Eqs.benthic.defaultBiomassStep.enable=true  
Eqs.benthic.defaultChemicalFarField.critical=false  
Eqs.benthic.defaultChemicalFarField.enable=false  
Eqs.benthic.defaultChemicalNearField.critical=false  
Eqs.benthic.defaultChemicalNearField.enable=false  
Eqs.benthic.defaultFauxFarField.enable=true  
Eqs.benthic.defaultFauxImpactedArea.enable=true  
Eqs.benthic.defaultFauxNearField.enable=true  
Eqs.benthic.defaultOverTreatmentFactorStep.enable=false  
Eqs.biomass.step=50.00  
Eqs.cageAreaPercentageTolerance=1.0  
Eqs.cageVolumeAdjustment=1.0  
Eqs.calcide.farFieldContour=0.002  
Eqs.calcide.nearFieldContour=10  
Eqs.calcide.rhoBulk=1216.0  
Eqs.chemical.defaultBenthicFarField.critical=false  
Eqs.chemical.defaultBenthicFarField.enable=true  
Eqs.chemical.defaultBenthicImpactedArea.critical=false  
Eqs.chemical.defaultBenthicImpactedArea.enable=true  
Eqs.chemical.defaultBenthicNearField.critical=false  
Eqs.chemical.defaultBenthicNearField.enable=true  
Eqs.chemical.defaultBiomassStep.enable=false  
Eqs.chemical.defaultChemicalFarField.critical=true  
Eqs.chemical.defaultChemicalFarField.enable=true  
Eqs.chemical.defaultChemicalNearField.critical=false  
Eqs.chemical.defaultChemicalNearField.enable=true  
Eqs.chemical.defaultFauxFarField.enable=true  
Eqs.chemical.defaultFauxNearField.enable=true  
Eqs.chemical.defaultOverTreatmentFactorStep.enable=true  
Eqs.farFieldAreaAdjust=0.0  
Eqs.farFieldAreaDistance=100  
Eqs.farFieldAreaPercentageTolerance=1.0  
Eqs.fluxTrigger=10000.0  
Eqs.massBalancePercentage=80.0  
Eqs.massBalancePercentageTolerance=1.0  
Eqs.nearFieldAreaDistance=25  
Eqs.nearFieldAreaPercentageTolerance=1.0  
Eqs.nearFieldContourPercentageTolerance=1.0  
Eqs.none.carbon.farFieldContour=1.0  
Eqs.none.carbon.nearFieldContour=3.0  
Eqs.none.iti.farFieldContour=10.0  
Eqs.none.iti.nearFieldContour=30.0  
Eqs.none.solids.farFieldContour=192.75  
Eqs.none.solids.nearFieldContour=1555.97  
Eqs.overTreatmentFactor.step=0.01  
Eqs.parameter.limit=true  
Eqs.slice.defaultChemicalExport.critical=true  
Eqs.slice.defaultChemicalExport.enable=true  
Eqs.slice.defaultChemicalExport.exportLimit=0.922  
Eqs.slice.defaultChemicalExport.exportTime=10195200  
Eqs.slice.defaultFauxChemicalExport.enable=true  
Eqs.slice.defaultRecordSurfaces=true  
Eqs.slice.defaultRecordTimes=10195200,19612800  
Eqs.slice.farFieldContour=0.763  
Eqs.slice.nearFieldContour=7.63  
Eqs.slice.rhoBulk=1400.00  
FeedInputs.activeIngredientFormulationConcentrationEmbz=10.0  
FeedInputs.activeIngredientFormulationConcentrationTfbz=2.0  
FeedInputs.activeIngredientPresentationConcentrationEmbz=0.05  
FeedInputs.activeIngredientPresentationConcentrationTfbz=10.0  
FeedInputs.biomass=  
FeedInputs.compoundName.embz=EMBZ  
FeedInputs.compoundName.none=NONE  
FeedInputs.compoundName.tfbz=TFBZ  
FeedInputs.deltaT=3600.0  
FeedInputs.faecesCarbonPercentage=30  
FeedInputs.faecesCompoundConcentration=13.18681  
FeedInputs.feedAbsorbedPercentage=85  
FeedInputs.feedCarbonPercentage=49  
FeedInputs.feedCompoundConcentration=2  
FeedInputs.feedWastedPercentage=3  
FeedInputs.feedWaterPercentage=9  
FeedInputs.massUnitsSiConversionFactor=1.0  
FeedInputs.nullInputId=badf00d0-0123-4567-badf-00d0badf00d0  
FeedInputs.numberOfTimeSteps=3600  
FeedInputs.plugLoadPeriod=  
FeedInputs.timeUnitsSiConversionFactor=1  
Flowmetry.deltaT=  
Flowmetry.lengthUnitsSiConversionFactor=1.0  
Flowmetry.meterDepth=  
Flowmetry.meterDepths=  
Flowmetry.neapSpringNeapStartSample=  
Flowmetry.numberOfTimeSteps=  
Flowmetry.siteDepth=  
Flowmetry.siteTide=  
Flowmetry.siteXCoordinate=  
Flowmetry.siteYCoordinate=  
Flowmetry.springNeapSpringStartSample=  
Flowmetry.timeUnitsSiConversionFactor=1.0  
Model.biomassLimit=Infinity  
Model.defaultCageVolumeAdjust=1.0  
Model.defaultOverTreatmentFactor=1.0  
Model.defaultSpecificFeedingRatePercent=0.7  
Model.defaultStockingDensity=23  
Model.iterationParameter.embz=OVERTREATMENTFACTOR  
Model.iterationParameter.none=STOCKINGDENSITY  
Model.iterationParameter.tfbz=OVERTREATMENTFACTOR  
Model.maximumSpecificFeedingRatePercent=1.0  
Model.maximumStockingDensity=30  
Model.minimumSpecificFeedingRatePercent=0.1  
Model.minimumStockingDensity=10  
Model.run.number=-1  
Model.run.numberOfParticles.embz=10  
Model.run.numberOfParticles.none=1  
Model.run.numberOfParticles.tfbz=10  
Model.run.plugLoadPeriod.embz=5352  
Model.run.plugLoadPeriod.none=0  
Model.run.plugLoadPeriod.tfbz=168  
Model.run.runType.embz=REFINING  
Model.run.runType.none=SCOPING  
Model.run.runType.tfbz=REFINING  
Model.run.tide.embz=N  
Model.run.tide.none=N  
Model.run.tide.tfbz=N  
Model.run.useNumber=true  
Model.specificFeedingRatePercentUseMax=FALSE  
Model.stockingDensityUseMax=TRUE  
ModelTime.delta=60000  
ModelTime.endTime.embz=10195200000  
ModelTime.endTime.none=31989600000  
ModelTime.endTime.tfbz=1728000000  
ModelTime.releasePeriod.embz=10195200000  
ModelTime.releasePeriod.none=31557600000  
ModelTime.releasePeriod.tfbz=1296000000  
ModelTime.startTime=0  
ModelTime.timeUnitsSiConversionFactor=0.001  
Particle.calcide.degradeT50Chemical=9936000  
Particle.characteristicLengthOfFaeces.dispersion=0.0005  
Particle.characteristicLengthOfFaeces.distribution=UNIFORM  
Particle.characteristicLengthOfFaeces.location=0.005  
Particle.characteristicLengthOfFeed.dispersion=0.0011  
Particle.characteristicLengthOfFeed.distribution=UNIFORM  
Particle.characteristicLengthOfFeed.location=0.011  
Particle.consolidationTimeOfFaeces=0.0  
Particle.consolidationTimeOfFeed=0.0  
Particle.degradeT50Carbon=Infinity  
Particle.degradeT50Chemical=21600000  
Particle.densityOfFaeces.dispersion=10.80  
Particle.densityOfFaeces.distribution=UNIFORM  
Particle.densityOfFaeces.location=1080  
Particle.densityOfFeed.dispersion=11.80  
Particle.densityOfFeed.distribution=UNIFORM  
Particle.densityOfFeed.location=1180.0  
Particle.diameterOfFaeces.dispersion=0.0003  
Particle.diameterOfFaeces.distribution=UNIFORM  
Particle.diameterOfFaeces.location=0.003  
Particle.diameterOfFeed.dispersion=0.0009  
Particle.diameterOfFeed.distribution=UNIFORM  
Particle.diameterOfFeed.location=0.009  
Particle.lengthUnitsSiConversionFactor=1  
Particle.massUnitsSiConversionFactor=1.0

Particle.none.degradeT50Chemical=Infinity

Particle.settlingVelocityOfFaeces.dispersion=0.0032

Particle.settlingVelocityOfFaeces.distribution=GAUSSIAN

Particle.settlingVelocityOfFaeces.location=-0.032

Particle.settlingVelocityOfFeed.dispersion=0.0095

Particle.settlingVelocityOfFeed.distribution=GAUSSIAN

Particle.settlingVelocityOfFeed.location=-0.095  
Particle.slice.degradeT50Chemical=21600000  
Particle.velocityUnitsSiConversionFactor=1  
SeaWater.default.densityOfSeaWater=1027.0  
SeaWater.default.kinematicViscosity=0.000001212  
SeaWater.default.pressure=0.0  
SeaWater.default.salinity=35.0  
SeaWater.default.temperature=10.0  
Transports.BedModel.bioTurbationMixingCoefficient=0.1  
Transports.BedModel.characteristicLengthOfSediment.dispersion=0.00011  
Transports.BedModel.characteristicLengthOfSediment.distribution=UNIFORM  
Transports.BedModel.characteristicLengthOfSediment.location=0.0011  
Transports.BedModel.contractionT50=Infinity  
Transports.BedModel.dLayerMass=3375  
Transports.BedModel.densityOfFaeces.dispersion=10.0  
Transports.BedModel.densityOfFaeces.distribution=UNIFORM  
Transports.BedModel.densityOfFaeces.location=1080.0  
Transports.BedModel.densityOfFeed.dispersion=10.0  
Transports.BedModel.densityOfFeed.distribution=UNIFORM  
Transports.BedModel.densityOfFeed.location=1180.0  
Transports.BedModel.densityOfMud.dispersion=0.0  
Transports.BedModel.densityOfMud.distribution=DIRAC  
Transports.BedModel.densityOfMud.location=1400.00  
Transports.BedModel.expansionT50=1.000000  
Transports.BedModel.internalFrictionAngle=23  
Transports.BedModel.massErosionCoefficient=0.031  
Transports.BedModel.massErosionExponent=1  
Transports.BedModel.minimumSurfaceDX=25.00000000  
Transports.BedModel.minimumSurfaceDY=25.00000000  
Transports.BedModel.mixingDepth=0.05  
Transports.BedModel.numberOfLayers=3  
Transports.BedModel.releaseHeight.height=0.00000000  
Transports.BedModel.releaseHeight.instanceName=CARTESIANBEDRELEASEHEIGHTFIXED  
Transports.BedModel.releaseParticles.particlesPerArea=0.00160000  
Transports.BedModel.releasePosition.instanceName=CARTESIANBEDRELEASEPOSITION  
Transports.BedModel.releasePosition.position=CENTRE  
Transports.BedModel.settlingVelocityOfSediment.dispersion=0.00057  
Transports.BedModel.settlingVelocityOfSediment.distribution=GAUSSIAN  
Transports.BedModel.settlingVelocityOfSediment.location=-0.0057  
Transports.BedModel.surfaceDX=25.00000000  
Transports.BedModel.surfaceDY=25.00000000  
Transports.BedModel.tauECritMin=0.020000  
Transports.bed.instanceName=CARTESIANBEDNOTRANSPORT  
Transports.bed.walker.dispersionCoefficientX=0.1  
Transports.bed.walker.dispersionCoefficientY=0.1  
Transports.bed.walker.dispersionCoefficientZ=0.0  
Transports.bed.walker.type=LATTICEWALKER  
Transports.bedSlope.criticalAngle=30.0  
Transports.bottomRoughnessLength.rough=0.054  
Transports.bottomRoughnessLength.smooth=0.001273  
Transports.consolidation.instanceName=DEFAULTCONSOLIDATION  
Transports.degrader.instanceName=DEFAULTPPARTICLEDEGRADER  
Transports.g=9.80665  
Transports.regime.frictionvelocity.type=LAWOFTHEWALL  
Transports.regime.rough.constant=4.9  
Transports.regime.rough.factor=5.6  
Transports.regime.smooth.constant=0.0  
Transports.regime.smooth.factor=0.65  
Transports.regime.transitional.constant=0.0  
Transports.regime.transitional.factor=8.18  
Transports.release.instanceName=CARTESIANRELEASE  
Transports.resuspension.instanceName=CARTESIANRESUSPENSIONTRANSPORT  
Transports.resuspension.settling.allowBuoyant=false  
Transports.resuspension.settling.modifiedSettling=false  
Transports.resuspension.walker.dispersionCoefficientX=0.10000000  
Transports.resuspension.walker.dispersionCoefficientY=0.10000000  
Transports.resuspension.walker.dispersionCoefficientZ=’To\_be\_calculated’  
Transports.resuspension.walker.type=LATTICEWALKER  
Transports.settling.alpha=0.64  
Transports.settling.intercept.absoluteAccuracy=0.1  
Transports.settling.intercept.maxVal=100  
Transports.settling.intercept.maximalOrder=5  
Transports.shieldsParameterJames.coefficientOfDrag=1.100  
Transports.shieldsParameterJames.k10=1.0  
Transports.shieldsParameterJames.k4=0.0  
Transports.shieldsParameterJames.k5=1.0  
Transports.shieldsParameterJames.k7=1.0  
Transports.shieldsParameterJames.lambda=1.0  
Transports.shieldsParameterJames.mu=0.375  
Transports.shieldsParameterJames.theoreticalBedHieght=0.001  
Transports.shieldsParameterJames.velocityProfileFactor=1.0625  
Transports.suspension.instanceName=CARTESIANSUSPENSIONTRANSPORT  
Transports.suspension.settling.allowBuoyant=false  
Transports.suspension.settling.modifiedSettling=false  
Transports.suspension.walker.dispersionCoefficientX=0.10000000  
Transports.suspension.walker.dispersionCoefficientY=0.10000000  
Transports.suspension.walker.dispersionCoefficientZ=0.00100000  
Transports.suspension.walker.type=LATTICEWALKER  
Transports.vonKarmanConstant=0.41  
endOfDataMarker=endOfDataMarker  
startOfDataMarker=startOfDataMarker

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