WPHC

Additional Modelling to Evaluate the Dispersal of Dredged Material in Carlingford Lough

LLE/WPHC/09/18

Final Report

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TABLE OF CONTENTS

1. GENERAL INTRODUCTION

1.1 Background

Presently sediment that is dredged in and around Warrenpoint harbour in Carlingford Lough is disposed of at a site located approximately 10 km outside of the lough. Alternative disposal sites that are more cost effective are being considered. However, it is also required that the material disposed of at the alternative sites may not induce any adverse effects, such as elevated suspended sediment concentrations and increased deposition, on the receiving environment. The potential in-lough placement site that is evaluated in this study, referred to here as the Far site, as well as the present disposal site, referred to as the Sea site, are illustrated in Figure 1.1.

In the previous modelling study (Longline, 2017), 400 000 m^3 of material was disposed at the different sites according to three different dredging scenarios. In the first scenario, the material was disposed at the Far site during the ebb tide only otherwise the material was disposed at the Sea site. For this scenario material was disposed three times at the Far site during an ebb tide followed by one disposal event at the Sea site. In the second scenario, material was disposed at the Far site during all phases of the tide. In third scenario, the material was disposed at the Sea site seawards of the lough during all phases of the tide.

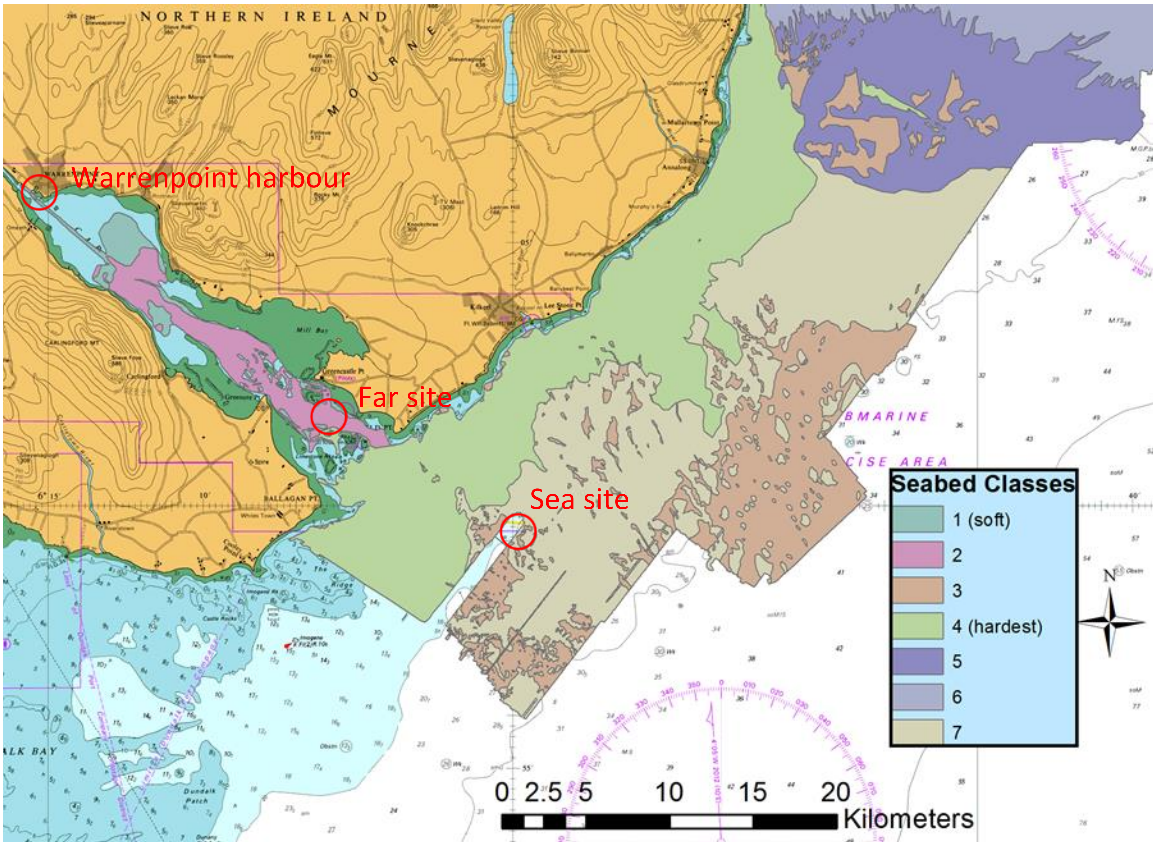

Figure 1.1 – Carlingford Lough with the existing and proposed disposal sites and the INIS-Hydro seabed classification.

The modelling results presented by Longline (2017) indicated that for the third scenario, no disposed sediments returned to the lough. For the first two scenarios, sediments migrated into the lough during the first three months after dredging operations ended. Except for a few locations, stable patterns of sediment deposition were maintained three months after the end of operations for the first two scenarios.

In these scenarios the maximum values of suspended sediment concentrations above the background concentrations were reached during the month of dredging operations. Generally, the elevated suspended sediment concentrations tapered off after the end of operations showing residual values after the first three months of simulation. In all cases, the elevated suspended sediment concentrations remained below the natural background concentrations with the first scenario showing significantly lower values of suspended sediment concentrations above the background inside the lough than for the second scenario.

Even though stable patterns of sediment deposition were maintained three months after the end of operations for all of the scenarios, small changes in deposition still occurred in the upper reaches of the lough. Therefore, it could not be ascertained whether a final equilibrium deposition pattern could be reached. In addition, the modelling also indicated that no erosion took place at the Far site after disposal of material ended. It was concluded that this absence of erosion needed further investigation.

The present study has two main objectives, namely to report on the evaluation of current measurement data taken at the Far site and to use these to verify the model setup of Longline (2017). The second objective is to simulate the disposal of 40 000 m^3, with possibly new model parameters, according to the dredge routines of the first two scenarios. Similar to Longline (20017), the results of the modelling include calculation of depositional thicknesses as well as the increases in suspended sediment concentrations above the background concentrations. Each of the discharge scenarios is simulated for the dredging period and for six months after the dredging operations have ended.

1.2 Structure of the report

The report is structured as follows:

Chapter 1: General Introduction - provides a general overview to the proposed project and outlines the objectives of the study and the report structure. An overview of the modelling approach and the scenarios that are simulated in the modelling study are provided.

Chapter 2: Description of environmental factors and project details - gives a brief overview of the marine components of the study area as well as some conclusions that were drawn from the sediment data that was collected during the project. This includes an overview of the expected background suspended sediment concentrations in the lough. A discussion on wind-driven waves in the area is also presented. The scenarios that are modelled and the disposal routines are discussed.

Chapter 3: Simulation of the dispersal of dredged material – provides a discussion of the application of the numerical model as well as the selection of modelling parameters. The method to analyse the model outputs is presented together with some example model results.

Chapter 4: Summary and conclusions – gives an overview of the scenarios that were modelled and highlights the most important findings.

Appendix A: Modelling results – contour plots are presented of the predicted maximum sediment concentration above the background concentration and the average elevated concentrations. These are determined over the following periods: the first half of the dredging campaign, the full campaign, the campaign and the following three months and the campaign and the following six months. Contour plots of the average suspended sediments concentration calculated over the same periods as above are also presented. These calculations are performed for the near-bottom, mid-depth and near-surface. Contour plots of the sediment deposition are also presented.

In addition, time series of the elevated concentrations above the background and the deposition at selected output stations, with appropriate statistics, are also provided.

1.3 Modelling approach

The purpose of the numerical modelling is to predict the transport and fate of the disposed dredged spoil. The modelling suite that is being used is Delft3D which consists of a number of different modules that can be coupled. The module being used for the hydrodynamics and sediment transport modelling, Delft3D-FLOW is essentially the same as the one used in the SMILE project. However, the version used in this study allows for the modelling by means of domain decomposition. The module Delft3D-WAVE is used for the calculation of short waves. For these modules, two physical domains are modelled, namely the greater Irish Sea and Carlingford Lough.

The Delft3D-FLOW module is a three-dimensional, finite volume hydrodynamic and transport model which simulates flow and transport resulting from tidal, meteorological forcing and wave forcing. In the present application, the hydrodynamic model solves the Navier-Stokes shallow water equations with hydrostatic and Boussinesq approximations (Deltares, 2010; Lesser *et al.*, 2004). An advantage of using the Delft3D-FLOW model is that when it performs the hydrodynamic computations it simultaneously calculates the transport of cohesive (mud) and non-cohesive (sand) sediment fractions.

The modelling approach also includes the simulation of short waves. The effects of short waves are to increase turbulence in the water column from white-capping and to increase the bottom shear stresses due to wave-current interactions. Where wave breaking occurs the wave energy dissipation rate is the driving force for longshore currents. The wave model that is included into the Delft3D suite, and referred to as Delft3D-WAVE, is the spectral wave transformation model SWAN (Holthuijsen, 2007; Van der Westhuysen, 2012). The waves and hydrodynamics are coupled in such a way that every three hours the water levels from Delft3D-FLOW are passed to Delft3D-WAVE where the waves are calculated and the various derived quantities are then passed back to Delft3D-FLOW.

For the sediment modelling, sediment disposal routines have been developed. Two scenarios are considered which have the same disposal rates and volumes but the scenarios differ in the locations where disposal takes place as well as in the scheduling of using the different sites. The two disposal sites that are being evaluated are referred to as the Far Site and the Sea Site as shown in Figure 1.1. The two different scenarios that are being evaluated are summarised in Table 1.1. For Scenario A, the scheduling between the Far site and Sea site is such that disposal at the Far site within the lough was preferred over disposal at the Sea site should the phase of the tide allow for a choice of sites.

Table 1.1 – Summary of the scenarios.

Scenario	Disposal location	Disposal schedule
A	Far site and Sea site	Ebb tide only at the Far site
B	Far site	All phases of the tide

The locations (in Northings and Eastings) of the proposed disposal sites using the Irish Grid coordinate system are presented in Table 1.2.

Table 1.2 – Locations of the disposal sites (TM65 Irish Grid).

Disposal site name	West-East	South-North
Far site (within the lough)	324599	310421
Sea site (outside the lough)	335140	303510

Important information that needs to be specified in the modelling is the dredging volumes and sediment composition (gravel, sand and mud) together with a disposal routine. The modelling parameters that govern the transport of the sediment as well as the settling-deposition-resuspension behaviour of the cohesive material are determined from measured data and literature and are the same as those used in Longline (2017).

To be able to relate the computed suspended sediment concentrations as an effect of the dredging operations, the scenarios are modelled without any background concentrations. The modelled scenarios are, therefore, modelled as excess models, that is, without any background concentration which provides a clear indication of the dredge related impacts.

The results of the modelling include calculations of depositional thicknesses as well as suspended sediment concentrations above the background concentrations. Each of the above discharge scenarios is simulated for the dredge period and an additional six months after disposal has ended.

2. ANALYSIS OF MEASURED ADCP DATA

2.1 Background

The numerical modelling that was conducted to evaluate the disposal of dredged material at the Far site and the Sea Site as reported in Longline (2017) indicated that disposed material is moving into the lough and that the transport of the material does not reach an equilibrium condition at all locations. Furthermore, the modelling also showed that a substantial volume (or mass) of disposed material will remain at the sea bed at the Far site on completion of the disposal campaign.

In an effort to aid interpretation of the modelling results, currents (magnitudes and directions) were measured at the location of the Far site with an Acoustic Doppler Current Profiler (ADCP). The period of measurements was from 5 September 2018 to 30 September 2018. The data consists of water levels, water temperatures near the bottom and current speed and directions at different depths.

2.2 Observations from the ADCP data

The measurements at two depths, namely 0.6 m and 18 m above the bottom are presented in Figure 2.1. The data shows large differences in the magnitudes of the surface and bottom currents. There are also large variations in the directions of the flow near the bottom whereas the surface currents are more stable. The speeds during ebb tides are substantially lower than the speeds during flood tides.

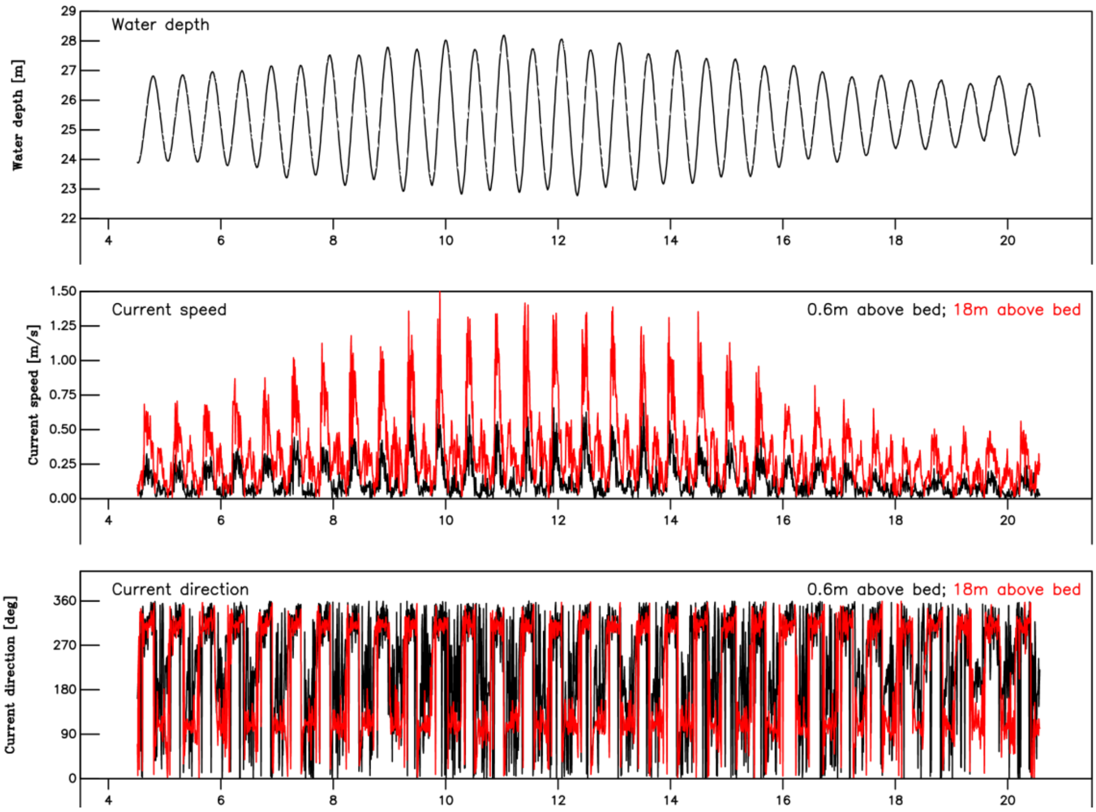

Figure 2.1 – The water surface elevations (top panel), near-bed and near-surface currents speeds (centre panel) and current directions (bottom panel) for the measurement period.

A detailed view of the data is presented in Figure 2.2 where the measurements at locations 0.6 m, 2 m, 9 m and 18 m above the bottom are presented for a two day period. From the data it is evident that there are large variations in speeds over the vertical with bottom speeds having maximum values around 0.5 m/s while the surface waters move at maximum velocities of about 1.25 m/s. The speeds measured at 9 m above the bed are also presented in Figure 2.2 and these values are very similar to the speeds at 18 m from the bottom. At this location the majority of the water body moves quite fast into the lough during flood tides. On the other hand, the near bottom velocities during neap tides are very small. There is, therefore, the potential that sediments that are disposed of at the Far site can move much farther into the lough that out to sea.

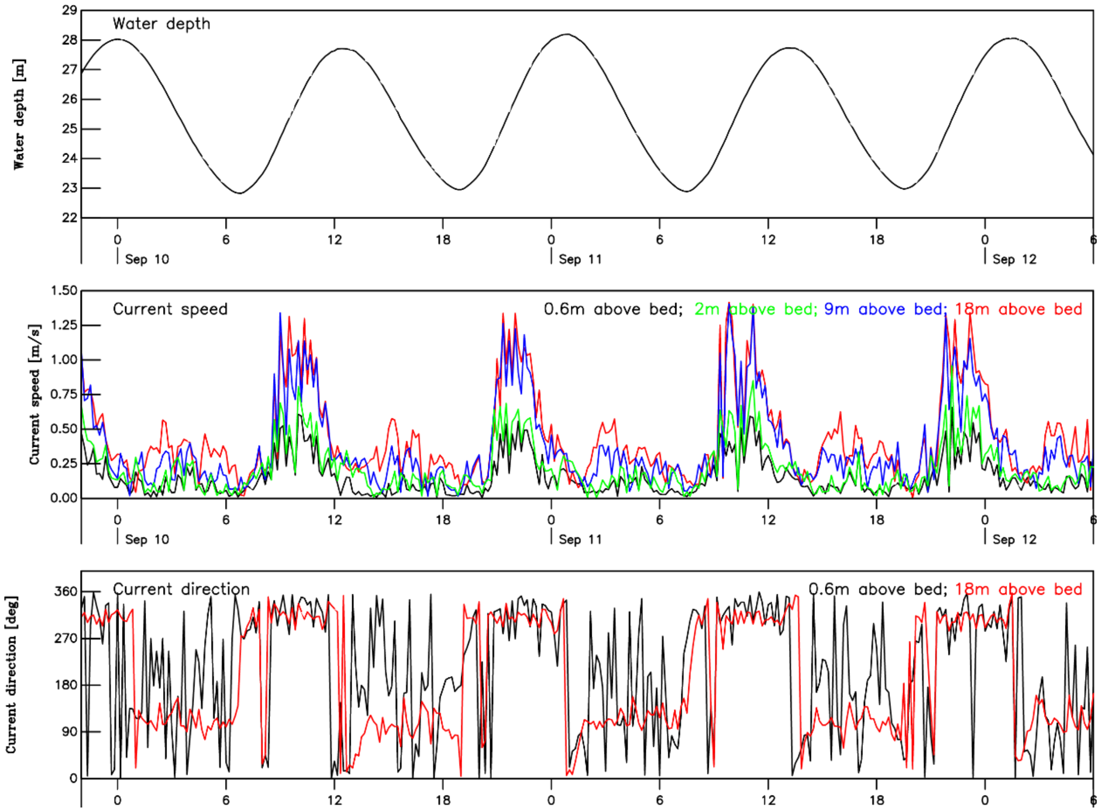

Figure 2.2 – The water surface elevations (top panel), currents speeds at different depths (centre panel) and surface and bottom current directions (bottom panel).

It may also be observed that the directions of the flow near the bed fluctuate substantially. This may be due to spiral motions effects which occur in river bends where the flow contains vortices. Higher up in the water column the directions do not fluctuate much.

2.3 Relation to sediment transport

Sediment transport processes induced by currents and/or waves are dominant in the near-bed region, but are also correlated to the depth-averaged flow velocity. The current measurements were used in calculating the depth-averaged velocities according to the approach of van Rijn (1993, p2.4). For these calculations the zero velocity level was taken as $k_a/30$ where the apparent roughness height, k_a = 0.18 m, includes grain roughness and form roughness. The depth-averaged current speeds determined from the data are presented in Figure 2.3. Also included in the figure are the measurements at 9 m above the bed. In general, the depth-averaged velocities show a strong correlation to speeds at a third of the height from the bottom, which in this case is near the 9 m level.

The near-bed velocity is often not well defined and it is sometimes preferred to use the depth-averaged velocity as a characteristic velocity in sediment transport calculations. An important process for sediment transport is the condition for the initiation of motion of sediments. This process includes information about the material, the sea bed characteristics and the flow conditions (near-bed and depth-averaged). For sand, the Shields parameter is often used to determine the conditions for the initiation of motion. The critical Shields parameter has been related to the depth-averaged velocity (van Rijn, 1993, p4.14) and this critical depth-averaged velocity is presented in Figure 2.3.

When the sea bed consists of silty and muddy materials, the cohesive forces between the sediment particles become important. These forces cause a distinct increase of the strength of the soil against erosion. A sand bed with small percentages of silts and clays already shows a distinctly increased resistance against erosion. The critical depth-averaged velocity for the situation where the material includes sand and mud is also shown in Figure 2.3.

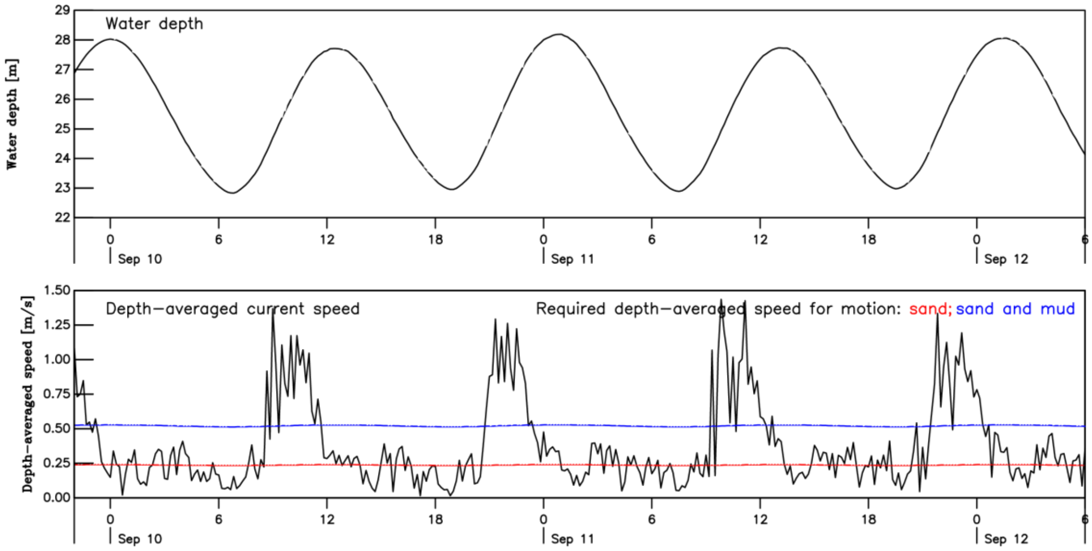

Figure 2.3 – The water surface elevations (top panel) and the calculated depth-averaged velocities (centre panel) and the estimated minimum required depth-averaged velocities to initiate sand motion.

For the situation where the sediments consist only of sand, the comparison of the depth-averaged currents in Figure 2.3 indicates that sediments will always be moved during the flood tide but not for all times during the ebb tide. Should the presence of the mud in the sand be taken into account, then very little sand will be mobilised during ebb tides.

2.4 Comparison between data and numerical model

Direct comparison between the model results presented in Longline (2017) and the measured data is not possible since the measurement period has not been simulated in the model. To aid comparison, typical simulated water levels that resemble the cycle of the data were selected for a month during the simulation period and are presented in Figure 2.4. As can be seen in Figure 2.4, the simulated and measured water levels compare favourably although the measured water levels exhibit larger amplitudes during the spring tide for the chosen interval. These differences are however circumstantial given that the tidal comparison made in Longline (2017) placed the maximum amplitude difference lower at 0.22 m, for the M2 harmonic constituent.

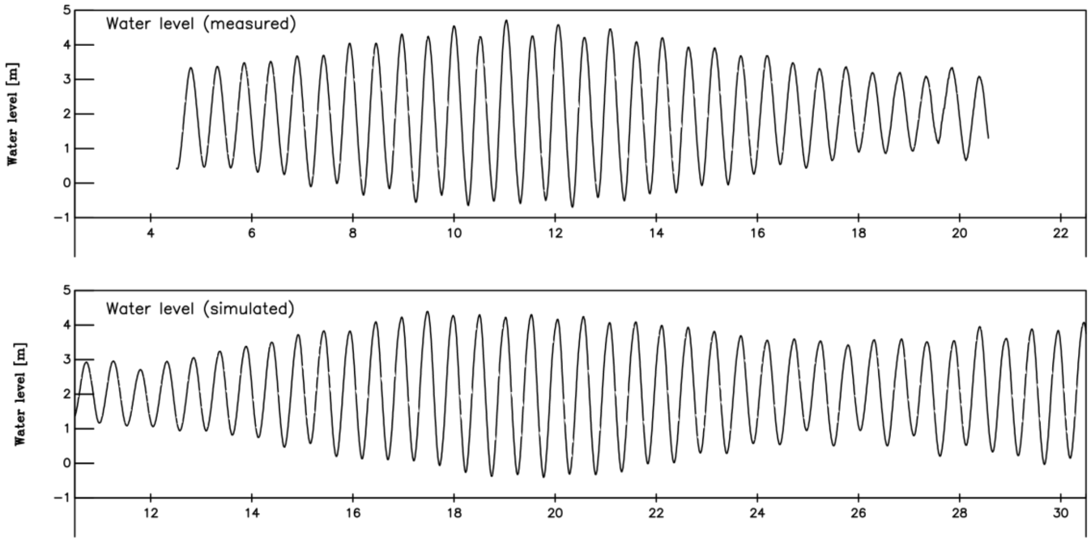

Figure 2.4 – The measured and simulated water levels.

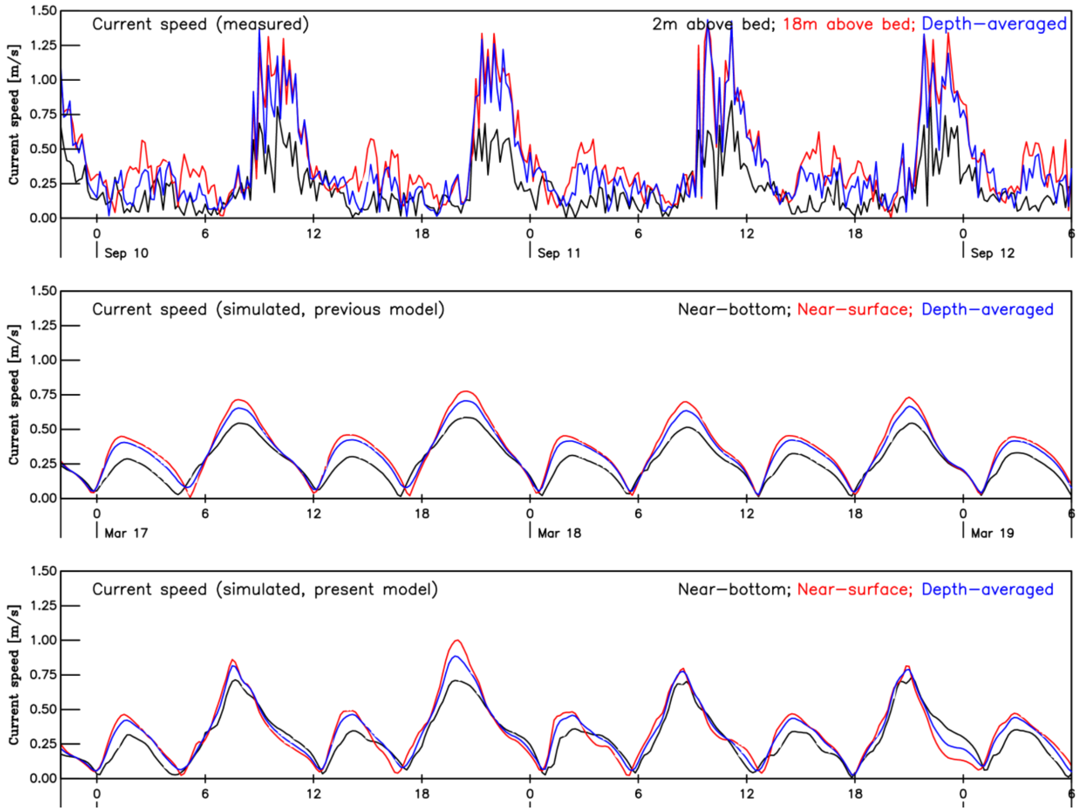

Figure 2.5 – The measured (top panel) and previously simulated (centre panel) and presently simulated (bottom panel) current speeds at different depths as well as the depth-averaged currents.

The magnitudes of the measured currents at 2 m and 18 m from the bottom are presented in Figure 2.5. The measurements at these depths can be compared to the modelled currents in the bottom layer and near-surface layer. As shown in Figure 2.5, the simulated bottom speeds from the previous study (Longline, 2017) are smaller, but comparable to the data during the flood tide, but larger during the ebb tide. However, the simulated surface currents and the depth-average currents are substantially smaller than the equivalent measured currents.

The modelling in the present study builds on the work done in the SMILE project (Ferreira et al., 2007). The circulation in Carlingford Lough and adjacent shelf was modelled by upgrading the SMILE model with higher resolution in the lough and improved bathymetric measurements. The numerical model was also extended to be able to simulate the transport and dispersal of disposed dredged material. The model parameters for the Longline (2017) study were kept the same as in the original model. However, to increase the bottom current magnitudes for the present study the horizontal viscosity is set to 1 m^2/s. The simulated currents are presented in Figure 2.5 (bottom panel) which shows the approximate 0.15 m/s increase in bottom currents and the more pronounced difference between ebb and flood current velocities. This is the only change to the 2017 model and is the model that is used for the simulation of the disposal in the present study.

Despite the differences still present in the surface currents, this new parametrization of the horizontal eddy viscosity causes a marked difference in behaviour of the model. Before the change, erosion of deposited material was negligible at both sites. With the new parametrization there are significant differences in erosion between the sites which make the model more fit to concord with anecdotal reports of scouring at the Far site.

3. SIMULATION OF THE DISPERSAL OF DREDGED MATERIAL

3.1 Introduction

In this chapter the fate of the disposed material at the two sites according to the two scenarios is assessed. The approach followed here is the same as for the Longline (2017) study except that the volume of material in the present study is substantially less than in Longline (2017).

3.2 Dredging inputs

3.2.1 Sediments

The size distributions of the dredged material to be disposed of are listed in Table 3.1. The distributions were calculated using sediment and dredge information provided by Anthony D Bates Partnership LLP.

Table 3.1 – Size distributions.

Type	Size range (mm)	% of dry material
Gravel	>2.0 to 64.0	0.95
Sand	>0.0625 to 2.0	20.77
Silt	>0.00391 to 0.0625	66.54
Clay	<0.00391	11.4

For the study, the material to be disposed of is considered to consist of gravel (0.9%), sand (20.8%) and mud (78.3%). The cohesive properties of the clay content are reflected in the modelling parameters of the mud fraction.

3.2.2 Dredging routine and scenarios

There are two sites where disposal can take place. The site that is effectively being evaluated is referred to as the Far site and it is located within the lough approximately 12.8 km from Warrenpoint harbour. The second disposal site is the existing disposal site outside of the lough approximately 25.6 km from Warrenpoint harbour and it is referred to here as the Sea site. For the modelling the cycle time between disposal events at the Far site is 2.6 hours and the cycle time for disposal at the Sea site is 4 hours. The cycle time from disposal at one of the sites to the harbour and then disposing at the other site is 3.2 hours. The cycle times include the 11 minutes disposal duration. The disposal rates and volumes are the same at both sites. The dredging or disposal routines are as follows:

Scenario A

In Scenario A, the material is disposed of at the Far site during the ebb tide only otherwise the material is disposed of at the Sea site. The sequence is such that the first disposal event starts at the Far site, 1 hour before High Water slack tide for 11 minutes and the next event will be 2.6 hours later also at the Far site according to the cycle time. The next disposal event will preferably also be at the Far Site even if the dredger has to wait so that it can start disposing at least an hour before High Water slack tide. The next disposal event will be at the Sea site and it will take place 3.2 hours after disposing at the Far site. Depending on the tide, if another disposal should be done at the Sea site, this will be 4 hours later. However, if the next event should be at the Far site, it will be 3.2 hours later, with some delay time possible. Depending on the tidal asymmetry, it is attempted to dispose of material three times at the Far site during an ebb tide, with two undertaken if the works suffer delays. With no delays only one disposal event at the Sea site should occur, although delays may increase this to two on occasion. Following this scheduling, the dredge duration is 2.08 days.

Scenario B

In Scenario B, the material is disposed of at the Far site during all phases of the tide. With a cycle time of 2.6 hours inclusive of the disposal duration of 11 minutes, the total dredge duration is 1.74 days.

It is acknowledged that the modelling will not be able to replicate every aspect of every dredging cycle but the schedule attempt to be as realistic as possible. Additional details about the scenarios are presented in Table 3.2.

Table 3.2 – Summary of the dredge-disposal calculations for the different scenarios.

Scenario	Total dry mass (tonnes) (1000 kg)	Dry weight density in the hopper (kg/m^3)	Total volume to be dredged (m^3)	Number of loads	Dry mass per load (tonnes)	Cycle time (h)	Dredge duration (days)
A	30400	760	40000	17	1881	2.6, 4.0, 3.2	2.08
B	30400	760	40000	17	1881	2.6	1.75

The number of loads was calculated by using a hopper capacity of 4500 m^3 and a maximum hopper load factor of 0.55. For all three scenarios the simulations were conducted for a period of at 6 months after the dredge campaign was completed to assess post disposal dispersal of the material. The total simulation period is therefore 7 months. The following were determined for each scenario:

- The maximum and average increases in suspended sediment concentrations above the background concentrations in the near-bed layer, at mid-depth and at the near-surface layer. These were determined over the first half of the dredge campaign, over the total duration of the campaign, over the campaign and the three months following the campaign ended and the period extending over the campaign and the following 6 months after the campaign ended.
- The maximum depositional thicknesses were also determined over the same periods as for the concentrations. Instantaneous depositional thicknesses are also plotted midway

through the campaign, at the end of the campaign, as well as three and six months after the campaign ended.

- Instantaneous depositional thicknesses are also plotted for two phases during a spring tide and for two phases during a neap tide.

- Time series variations of the suspended sediment concentrations over the total simulation period in the near-bed layer and at mid-depth are provided for selected output locations. The time series of the thickness of the predicted sediment deposition at these selected output locations are also plotted.

3.3 Hydrodynamic modelling

Delft3D-FLOW is a three-dimensional hydrodynamic model that includes formulations and equations to represent external momentum input by tides, wind and waves and buoyancy input by changes in heat and salinity at the ocean, land and atmospheric boundaries. Barotropic and baroclinic pressure terms are calculated using the advection and dispersion of momentum, heat and salt under the effect of earth's rotation (Coriolis force). From this pressure field, currents and water properties are evaluated at each time step for each point of the computational grid. The equations and their numerical implementation are described in detail in Deltares (2010) and a clear exposition is also presented by Lesser *et al.* (2004).

Tidal forcing, temperature and salinity specified at the open boundaries were the same as those specified in the Delft3D-FLOW model used in the SMILE project (Ferreira *et al.*, 2007). Bottom friction is modelled with a Chézy coefficient obtained from the White-Colebrook formulation defined by the Nikuradse roughness length which was set to 0.03 m. Other modelling parameters are provided in Table 3.3. The modelling time interval was conditioned by the availability of the data and model used in the SMILE project and is from January 1995 to the end of July 1995. In the simulations, disposal starts on 4 January 1995.

Table 3.3 – Hydrodynamic model parameters.

Parameter	Value
Horizontal eddy viscosity	1 m^2/s
Background vertical eddy viscosity	0.001 m^2/s
Horizontal eddy diffusivity	1 m^2/s
Background vertical eddy diffusivity	1.0×10^{-6} m^2/s
Time step	0.5 minute

Examples of the simulated near-surface currents during the ebbing and flooding of a neap tide are shown in Figure 3.1 and in Figure 3.2, while the surface currents during the ebbing and flooding of a spring tide are shown in Figure 3.3 and in Figure 3.4.

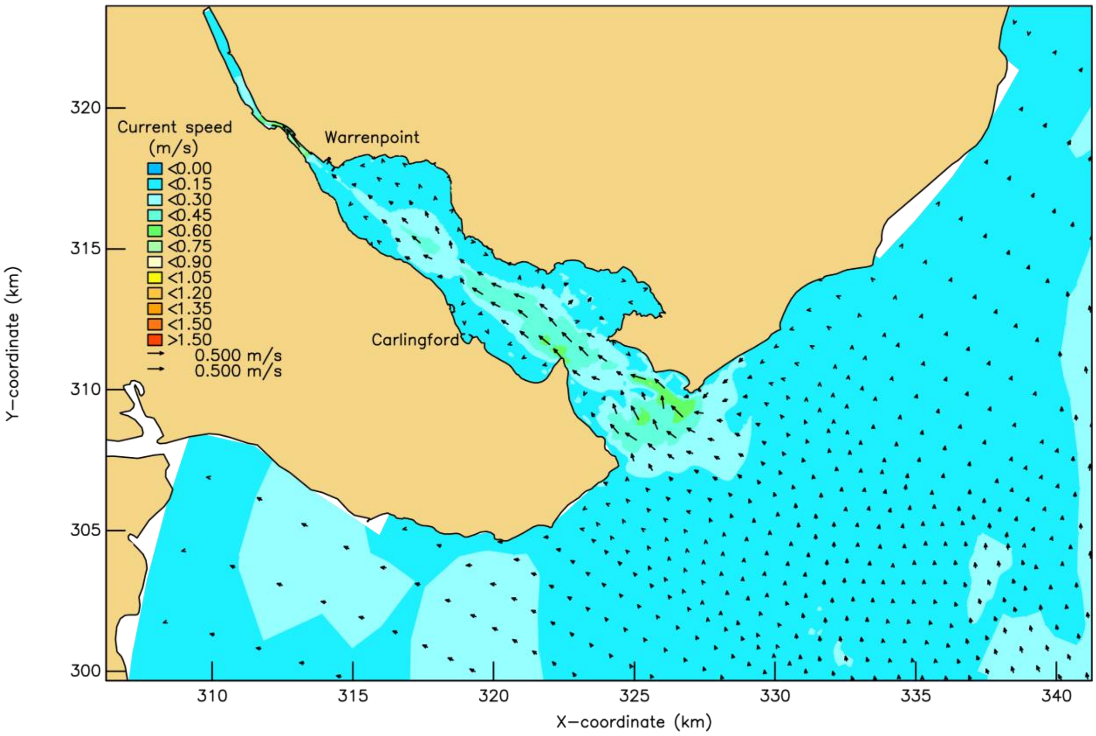

Figure 3.1 – An example snapshot of the simulated near-surface currents during a neap tide flooding.

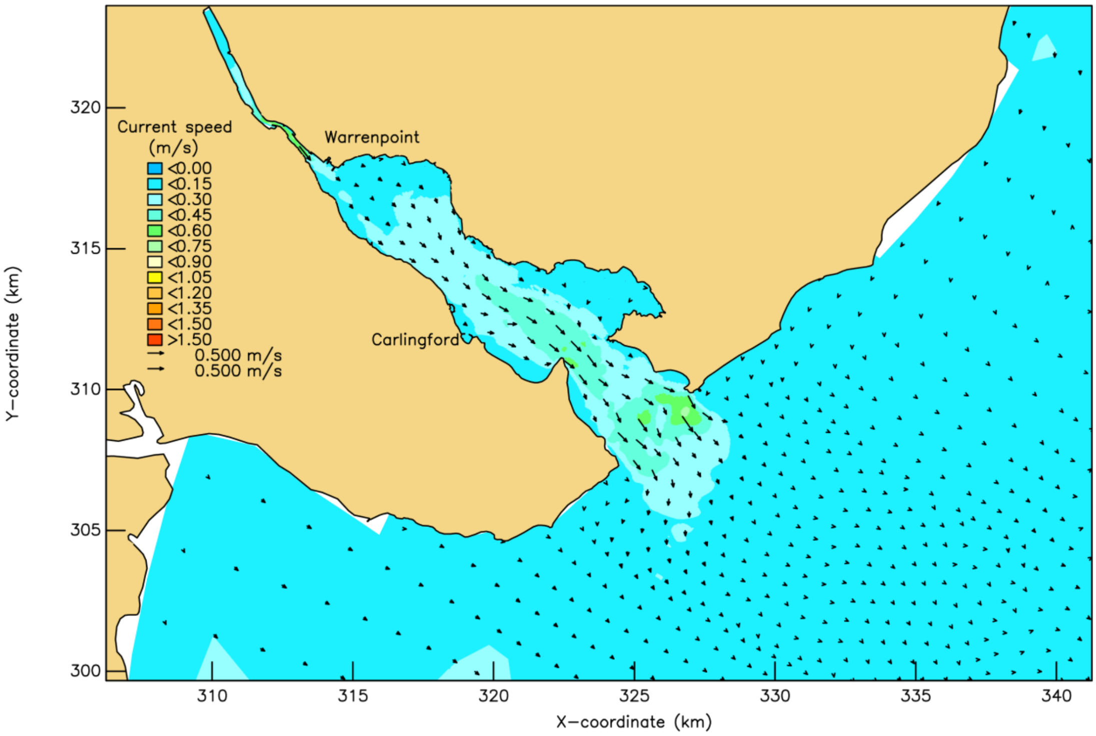

Figure 3.2 – An example snapshot of the simulated near-surface currents during a neap tide ebbing.

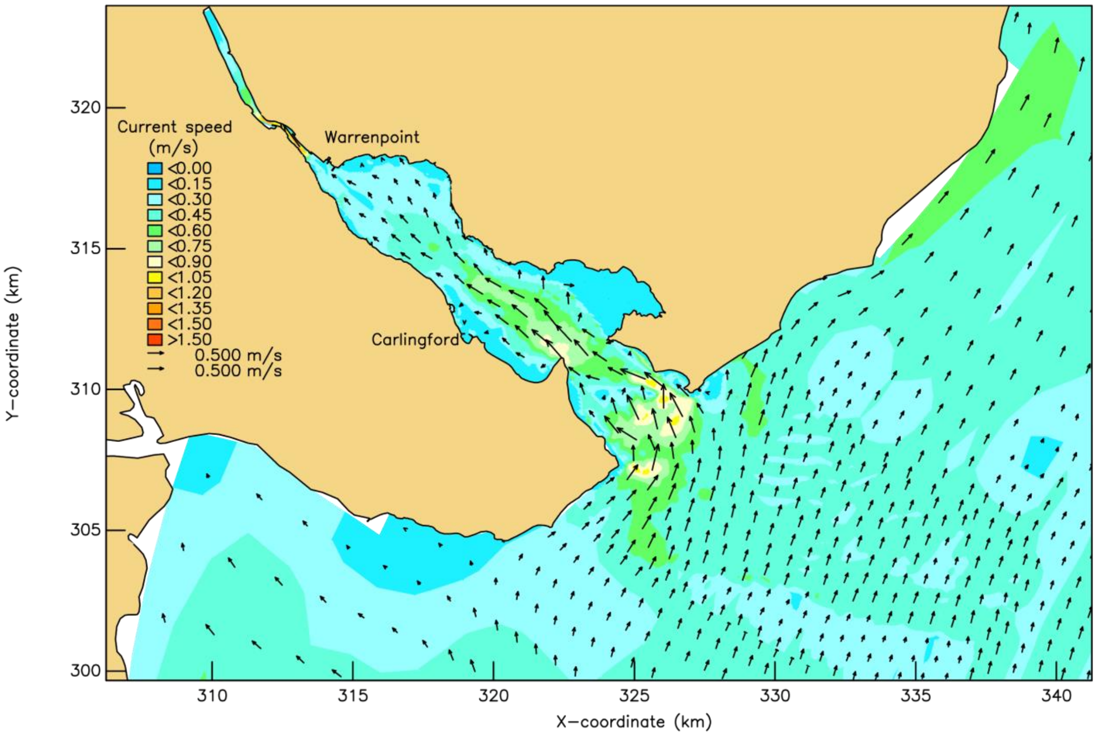

Figure 3.3 – An example snapshot of the simulated near-surface currents during a spring tide flooding.

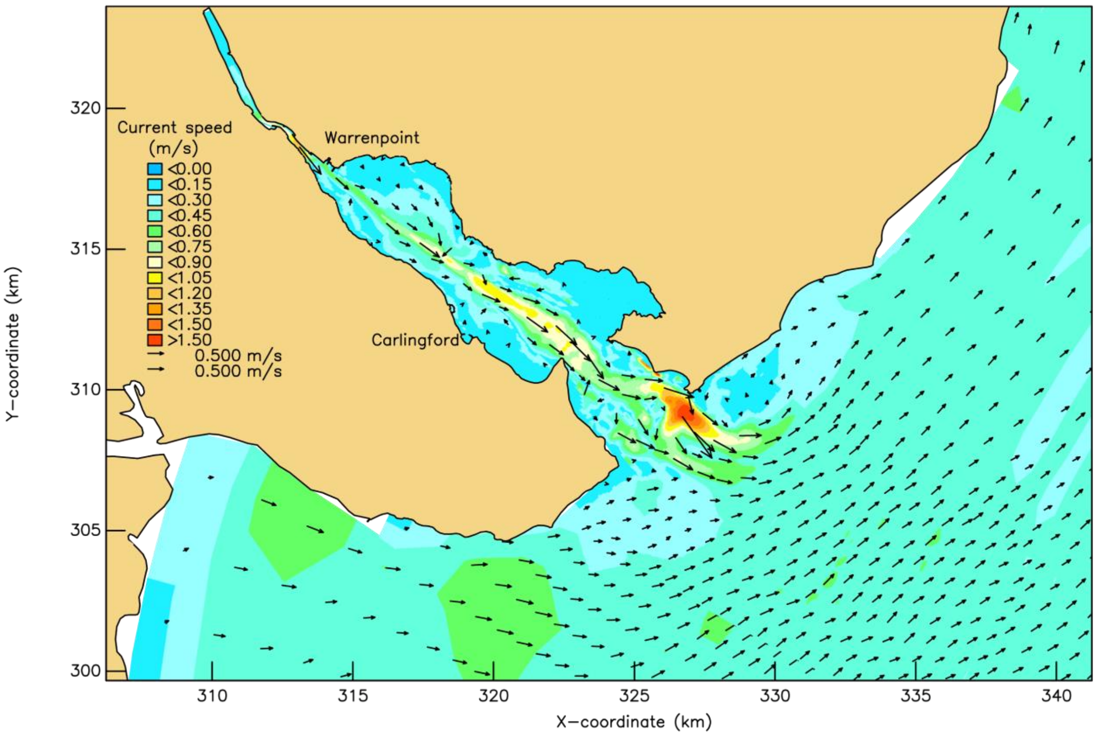

Figure 3.4 – An example snapshot of the simulated near-surface currents during a spring tide ebbing.

In general, the simulated currents show similar patters as those in Longline (2017) since the highest velocities occur during ebbing of the spring tide. However, the currents are more focused and less diffuse than those in Longline (2017) and during the ebb tide the currents are now more concentrated in the main channel in the upper parts of the lough.

3.4 Sediment modelling

The online sediment module forms part of the Delft3D-FLOW model and the local velocities and eddy diffusivities are based on the results of the hydrodynamic computations. The parameters for the sediment modelling are the same as those used in Longline (2017). A discussion of the online sediment component of Delft3D-FLOW is presented by Lesser *et al.* (2004). Additional information regarding the transport of cohesive sediments is presented by Van Ledden *et al.* (2004a).

3.5 Analysis of the model results

The maximum increases in suspended sediment concentrations at all depths are at the disposal sites for both the scenarios. However, after the disposal has ended, the excess suspended sediment concentrations above the background concentrations at both the disposal sites decrease to below 20 mg/l as soon as the disposal ends. At many sites the suspended sediment concentrations do not reach the background value of 20 mg/l and for those sites that do reach the background value, the concentrations decreases as soon as disposal ends. Even though the disposed sediments migrate into the lough during ebb tides, the excess suspended concentrations above the background in the inner lough remain substantially below the reported background concentrations which could, on average, be as high as 40 mg/l for the inner area.

The maximum values of the elevated suspended sediment concentrations remain less than the reported maximum background concentrations for the post-campaign simulation period. However, the elevated suspended sediment concentrations above the background show short term peaks which are often higher than the average background values but rarely as high as the maximum background values. These sporadic peaks occur at different times and at different locations and are due to numerical calculations or sporadic energetic events at the particular sites especially when the water levels at the sites are low during the turning of the tides.

Comparisons of the maximum elevated suspended sediment concentrations in the near-bed layer for Scenarios A and B indicate that material moves into the lough. In the near-bed layer, this movement is substantially less for the latter three months as seen when the figures for the maximum elevated suspended sediment concentrations in the near-bed layer for three and six months after the campaign ended are compared. This appears to a lesser extend for Scenario A than for Scenario B, but suspended sediments still migrate into the lough for Scenario A. A further comparison of the maximum increase in elevated concentrations shows the improvement of Scenario A above Scenario B. It may be concluded that the spatial patterns of increases above the background are the same for Scenario A and Scenario B, but Scenario A definitely has less elevated suspended sediment concentrations in the lough.

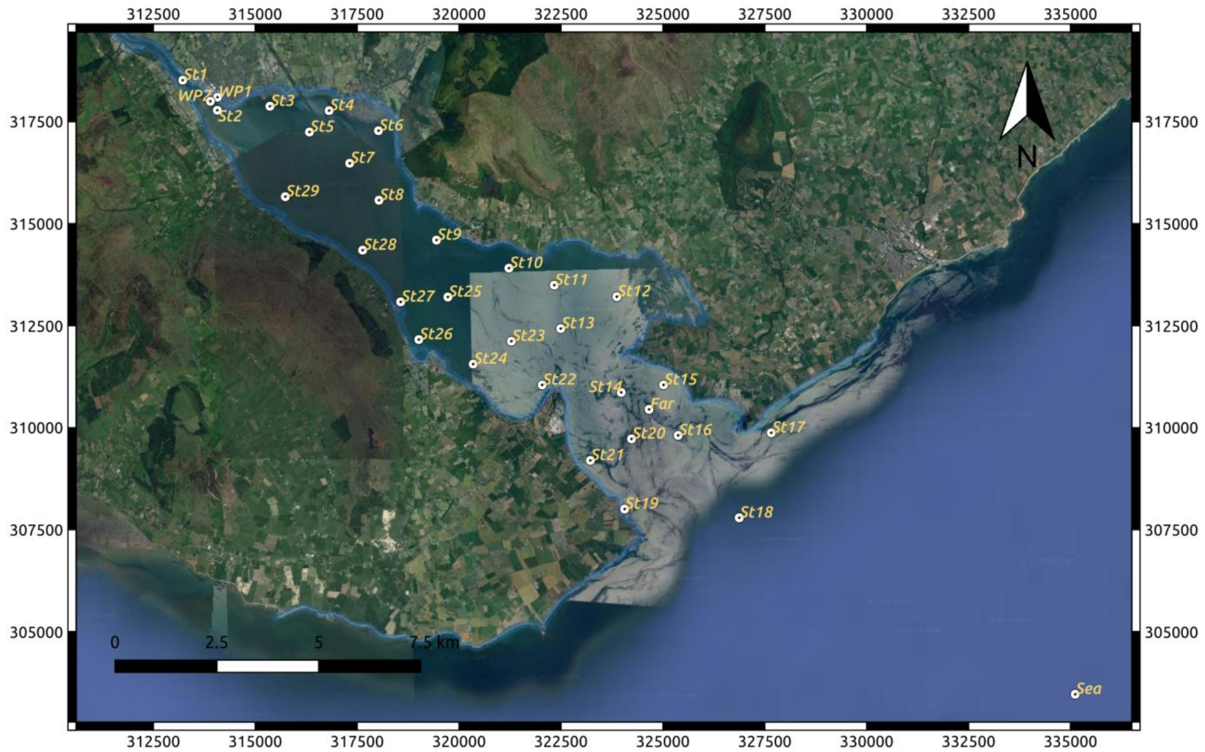

Figure 3.7 – The locations of the output stations for the time series graphs.

The movement of sediments into the lough is also evident in the figures showing the maximum sediment deposition. The largest depositional thicknesses are around the disposal sites. Other notable areas where deposition occurs are along the edges of the channel into the lough. This may be due to reduced flow speeds in those areas that allow deposition to occur. The absence of deposition in the main channel near the centre of the lough is also evident in the figures showing the deposition thickness at specific instants. However, material is deposited as far back into the lough as the dredged area near Warrenpoint harbour.

The increase in suspended sediment concentration maximum above the background during the disposal campaign is more pronounced in along the region covered by the stations St8, St13 and St14 for both scenario A and scenario B. These areas of enhanced turbidity do not correspond to a local maximum of deposition thickness and is due to a localised increase in bottom shear stress and indicates that these are areas of transport and not deposition.

The contour plots of the sediment deposition over a neap tide and over a spring tide do not show much variation in the depositional thickness. This is as expected, since the material that is deposited is mostly fine silt and a fair amount of material is required to produce significant deposition. However, the fluctuations in the sediment transport are illustrated in the time series graphs of the excess suspended sediment concentrations where the increase and decrease of the suspended sediments above the background concentrations over the tidal cycles are clearly visible.

Besides the contour plots, time series of elevated suspended sediment concentrations above the background concentrations and depositional thickness were also obtained at a selected number of stations. The locations of the stations for detailed time series results are shown in Figure 3.7. There are often substantial differences between the peak values and the 99th percentiles indicating that the time series maxima are often of short duration. This may be due to numerical calculations or a sporadic event causing sediments to suspend.

Few stations show elevated concentrations above the background during the campaign and the months thereafter. For the stations that experience excess concentrations above the background the suspended sediment concentrations taper off very quickly.

The time series graphs for the depositional thickness show that the deposition at the Far site is approximately 27 cm for Scenario A and 32 cm for Scenario B. There is a continuous reduction in the depositional thickness at these over the following months. According to the modelling, the sand fraction is mobilized as bedload during flood tides while the mud fraction in mobilized during all phases of the tide but travels further into the lough than outwards.

Stations where deposition occurs and is maintained are St26, St27, St29, St5, St2 and WP1. However, it must be noted that the predicted depositional thickness at some of these latter sites are 2 cm and less. It is also important to note that the modelling was not developed to give such small deposition values very accurately and the results are more indicative of the fact that deposition can occur at these sites but there will be uncertainty in the exact values.

4. SUMMARY AND CONCLUSIONS

The measured ADCP current data indicates that there are substantial differences between the current speeds during ebb tides and flood tides. It may be inferred from these current measurements that sediments disposed of at the Far site may not travel as far seawards as anticipated. Furthermore, sediments that reach the bottom at the disposal site will generally deposit and move back into the lough and will only move seawards on occasion.

At the Far site, the modelled velocities in the near-bed region are comparable to the measured currents. On the other hand, higher up in the water column the modelled currents and measured currents differ markedly. This localised departure does not prevent the model to show the expected erosion behaviour at the Far site.

This may be attributed to the flow at the site being particular and that the model does not capture all the details of the flow at that site. As shown in Longline (2017) further into the lough the model compared favourably to measured ADCP currents.

Two scenarios have been assessed, namely:

- Scenario A where the material is disposed of at the Far site (within the lough) during the ebb tide only, otherwise disposal takes place at the Sea site which is the present disposal location. This effectively leads to three consecutive disposal events within the lough and then one event at the Sea site before disposing in the lough again.
- Scenario B where the material is disposed of at the Far site (within the lough) during all phases of the tide.

The numerical model used in the SMILE project has been refined and extended to include the effects of short waves and to simulate the dispersal of cohesive and non-cohesive sediments. The numerical model used in Longline (2017) has been adapted by using a lower horizontal eddy diffusivity that resulted in increased bottom currents at the Far site.

In both the scenarios the maximum values of suspended sediment concentrations above the background concentrations are reached at the disposal sites during the days of operations. Generally, the elevated suspended sediment concentrations taper off after the end of operations showing residual values soon after disposal ended. For the other sites, the elevated suspended sediment concentrations remain below the natural background concentrations.

In both Scenarios A and B sediments are shown to migrate into the lough with Scenario A showing significantly lower values of suspended sediment concentrations above the background inside the lough than Scenario B.

Generally, a stable pattern of sediment deposition will be reached once all the disposed material has moved away from the Far site and redistributed through the lough. This process will not lead to elevated suspended sediment concentrations above the background.

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Appendix A Modelling results

This appendix contains the modelling results for all the discharge scenarios as summarised in the table below.

Scenario A	Far site (in the lough) and Sea site
Scenario B	Far site

The results consist of the following:

- Contour plots are presented of the maximum suspended sediment concentrations and average concentrations in the area just above the seabed, at mid-depth and in the near-surface area calculated over the following periods:
  - the first half of the campaign;
  - the full campaign;
  - the campaign and the following three months;
  - the campaign and the following six months.

- Contour plots are presented of the maximum thickness of sediment deposition calculated over the following periods:
  - the first half of the campaign;
  - the full campaign;
  - the campaign and the following three months;
  - the campaign and the following six months.

- Contour plots of the instantaneous deposition thickness at the following times:
  - midway through the campaign;
  - at the end of the campaign;
  - three months after the campaign has ended;
  - six months after the campaign has ended.

- Contour plots of the instantaneous deposition thickness at the following times:
  - a neap tide flooding;
  - a neap tide ebbing;
  - a spring tide flooding;
  - a spring tide ebbing.

- Time series plots are presented of the elevated suspended sediment concentrations above the background concentrations in the area above the seabed and at mid-depth as well as the sediment thickness of deposition at selected locations. A map showing the output stations is provided with the time series plots. It may be noted that if a particular line in the legend does not appear in the particular time series figure then it implies that the values are zero. It may also be noted that the scales on the vertical axes may differ between figures enhance the details in a figure.

Scenario A

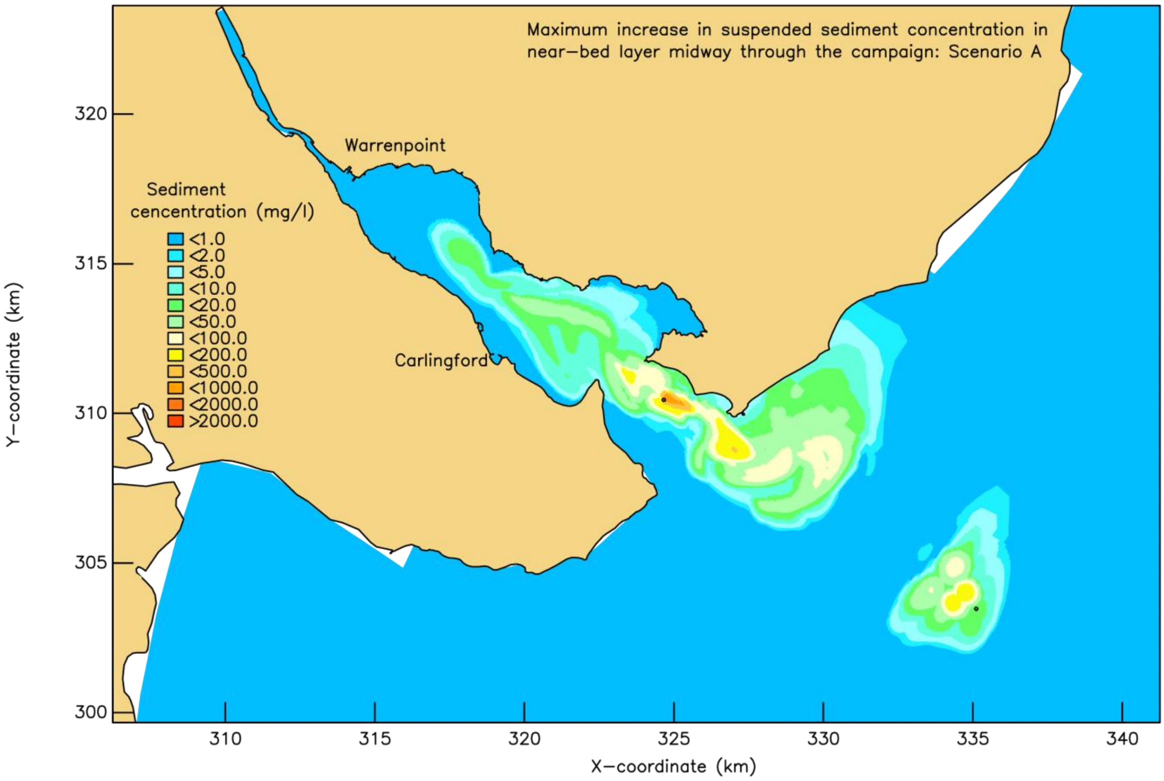

Figure A 1 – Scenario A: Maximum increase in suspended sediment concentration above the background in the near-bed layer over the first half of the campaign.

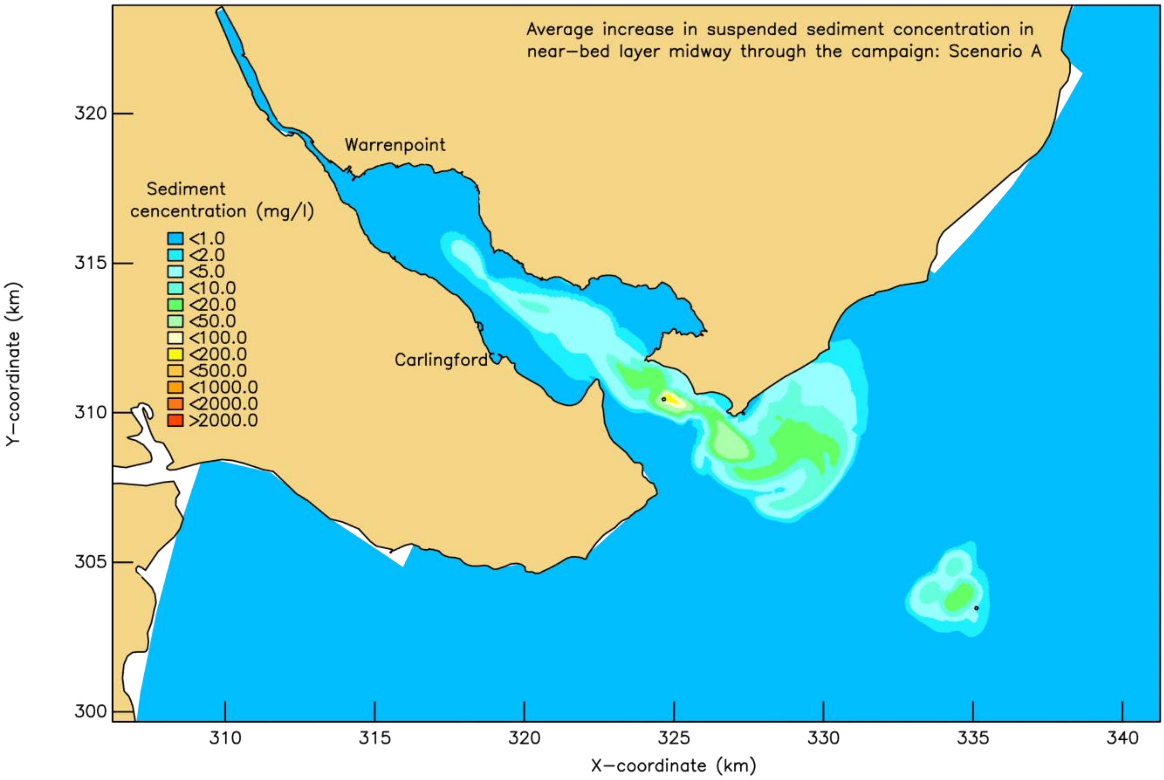

Figure A 2 – Scenario A: Average increase in suspended sediment concentration above the background in the near-bed layer over the first half of the campaign.

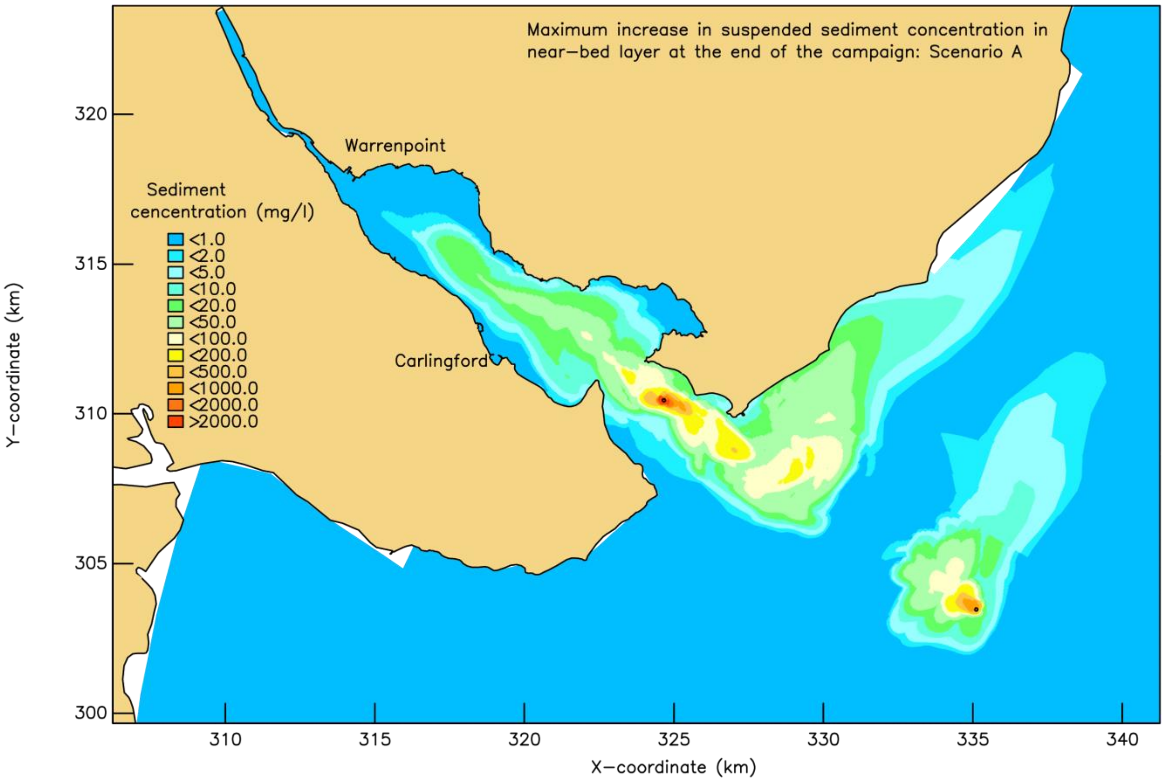

Figure A 3 – Scenario A: Maximum increase in suspended sediment concentration above the background in the near-bed layer over the campaign period.

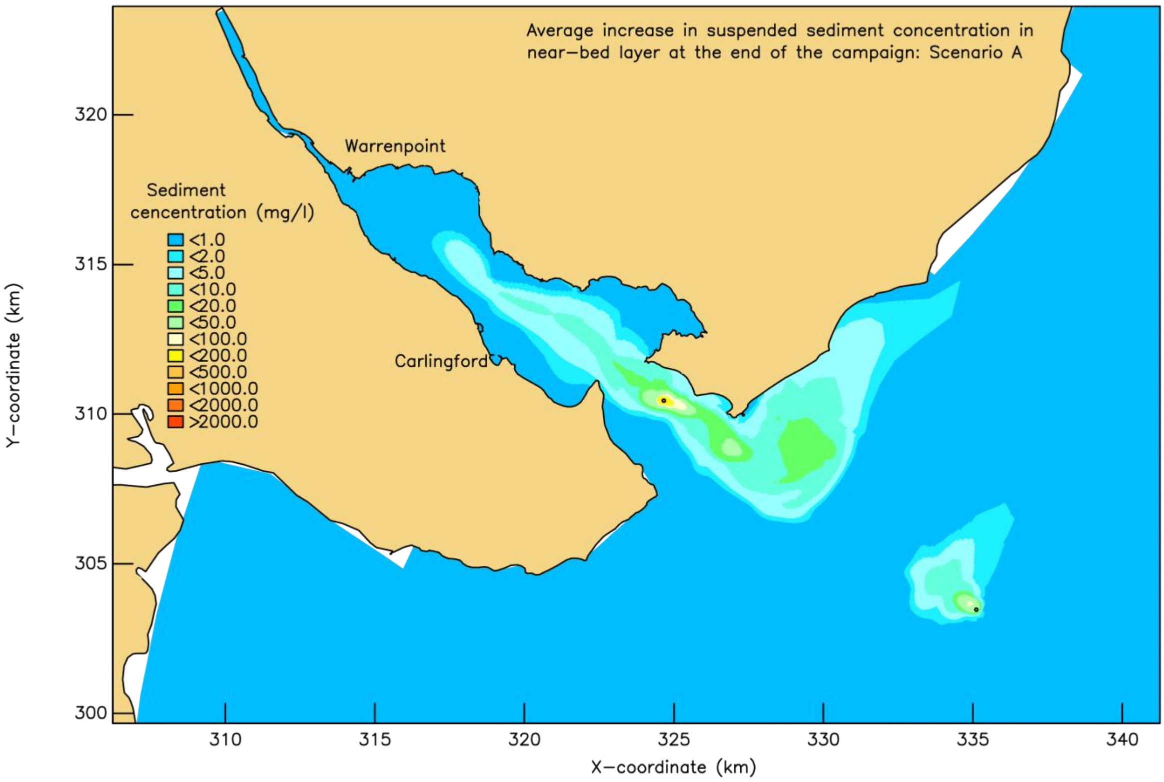

Figure A 4 – Scenario A: Average increase in suspended sediment concentration above the background in the near-bed layer over the campaign period.

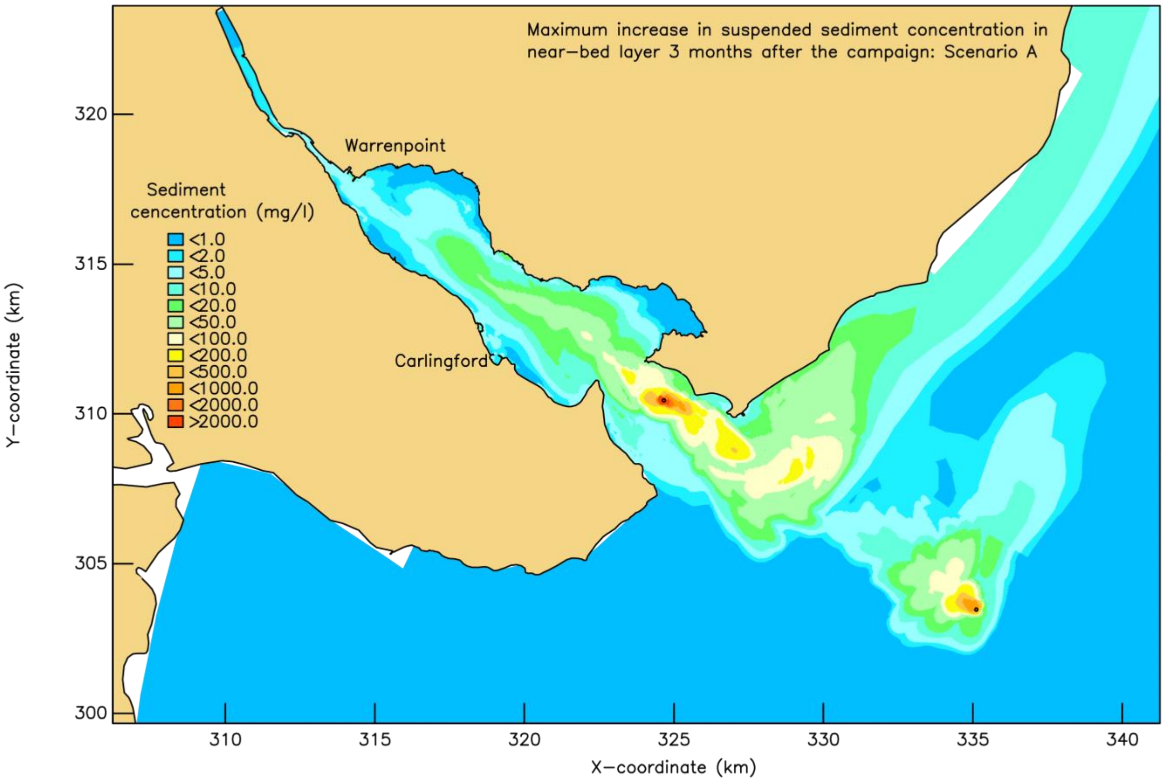

Figure A 5 – Scenario A: Maximum increase in suspended sediment concentration above the background in the near-bed layer over the campaign period and the three months thereafter.

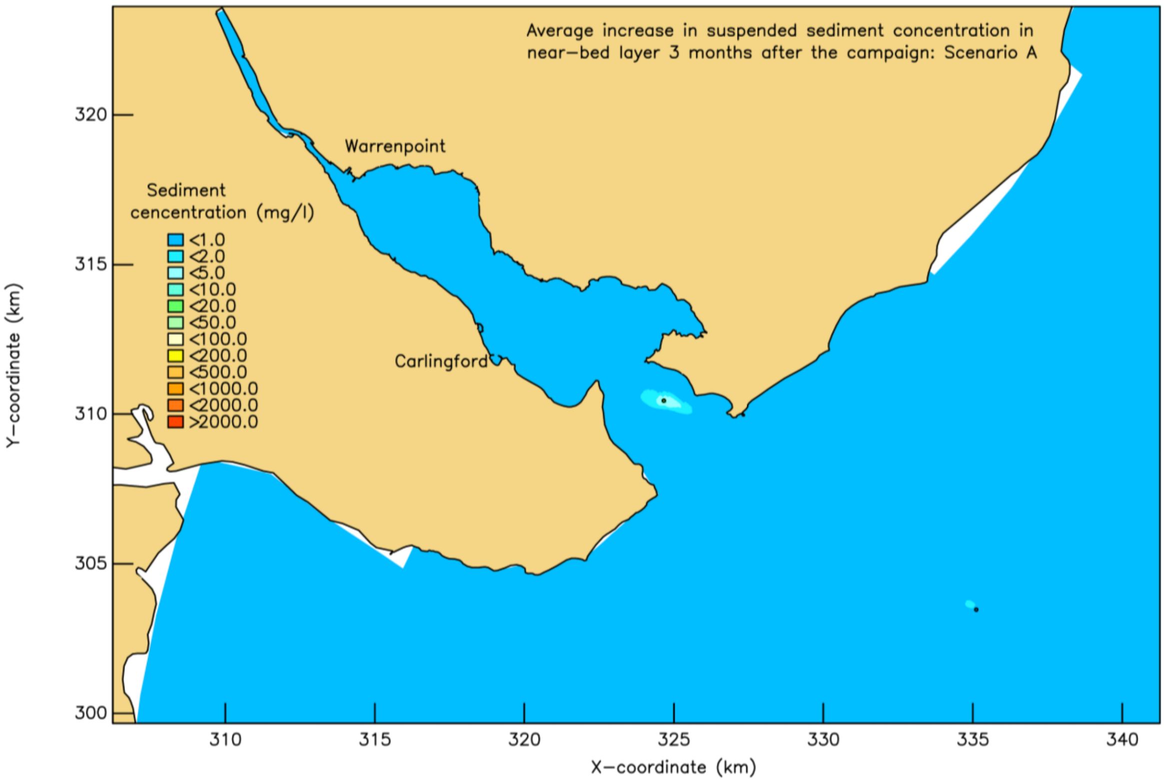

Figure A 6 – Scenario A: Average increase in suspended sediment concentration above the background in the near-bed layer over the campaign period and the three months thereafter.

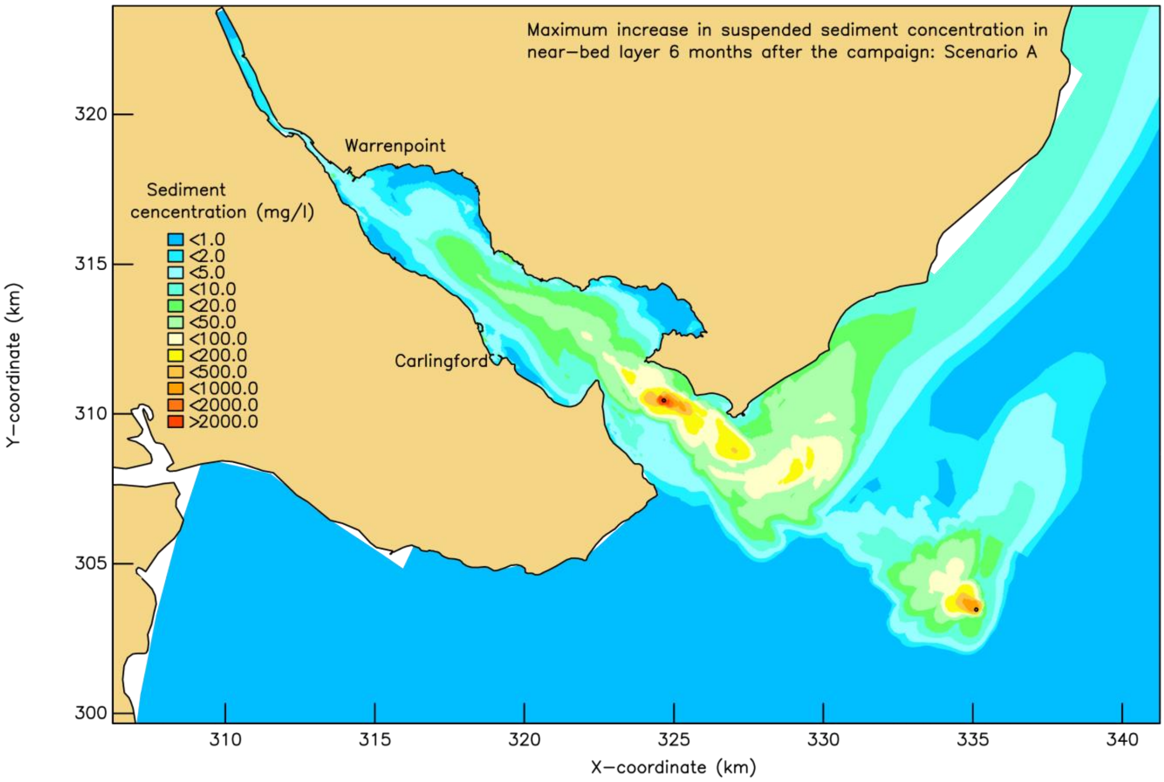

Figure A 7 – Scenario A: Maximum increase in suspended sediment concentration above the background in the near-bed layer over the campaign period and the six months thereafter.

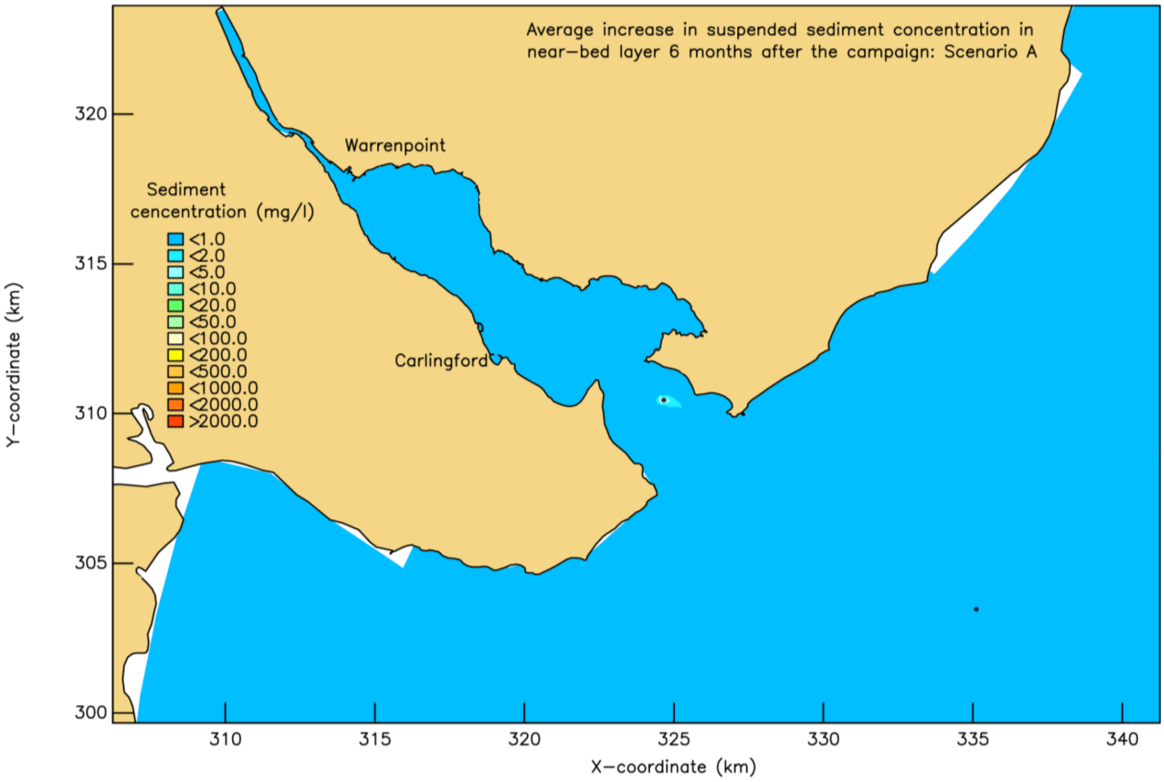

Figure A 8 – Scenario A: Average increase in suspended sediment concentration above the background in the near-bed layer over the campaign period and the six months thereafter.

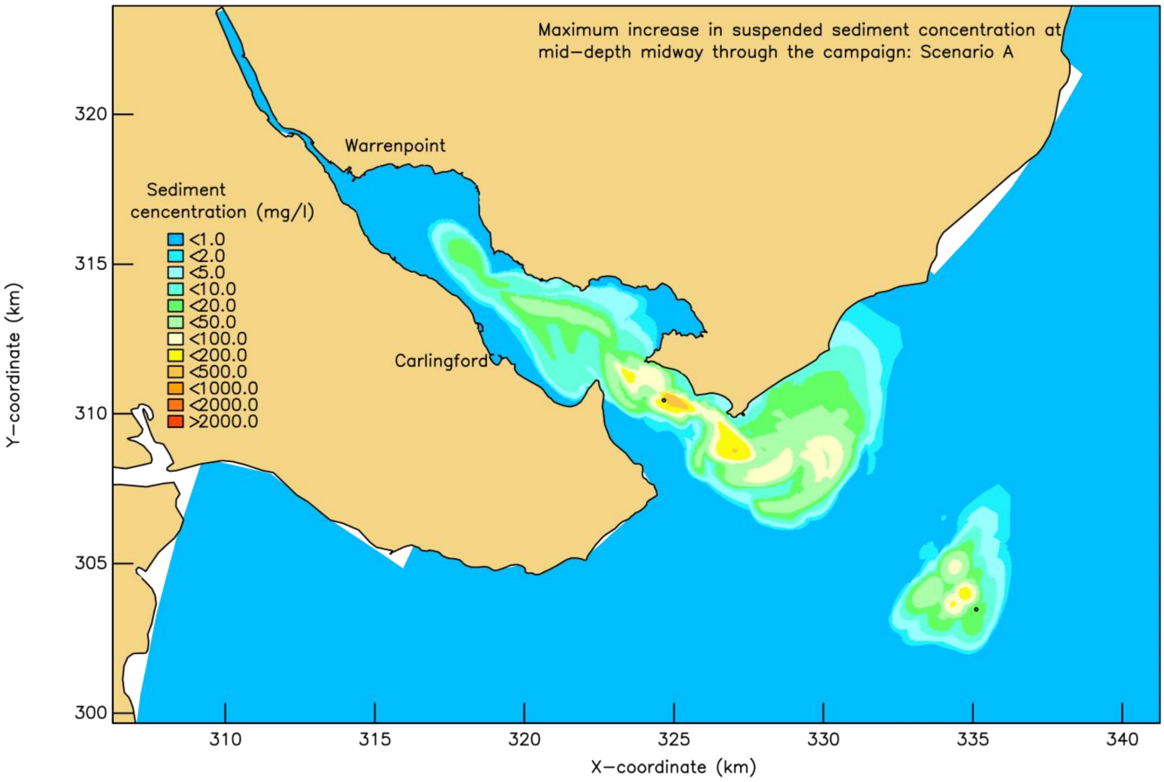

Figure A 9 – Scenario A: Maximum increase in suspended sediment concentration above the background at mid-depth over the first half of the campaign.

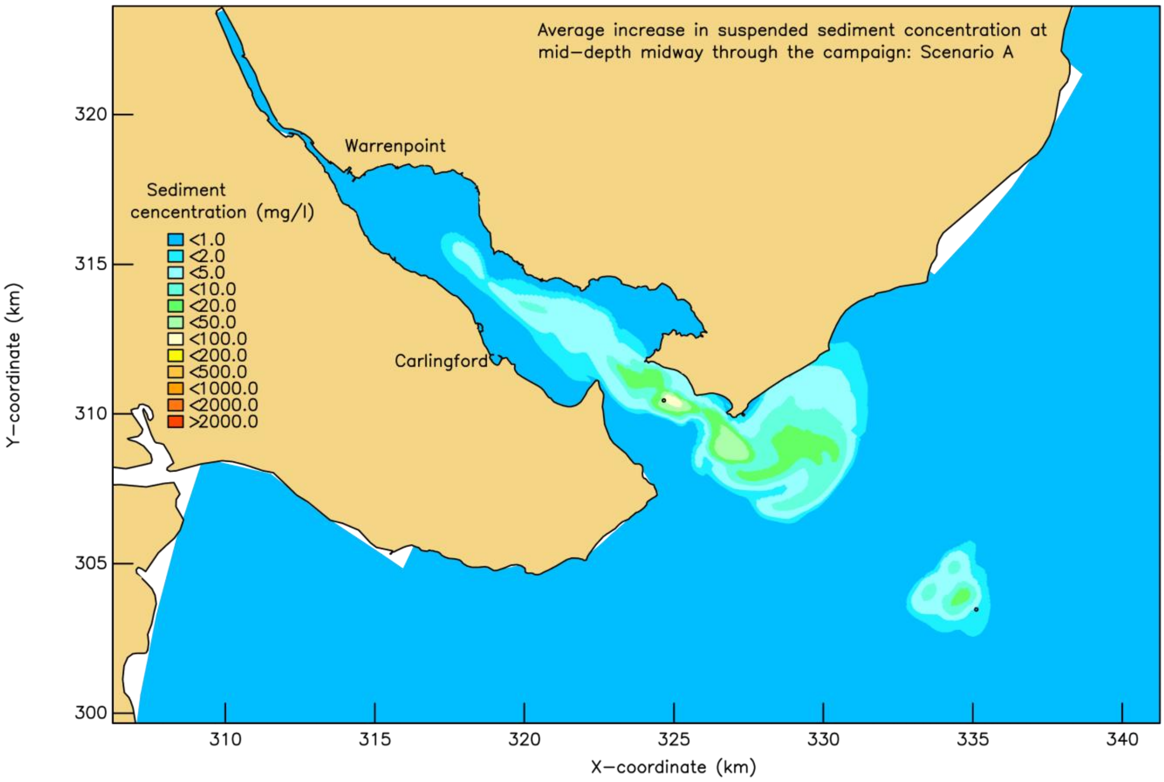

Figure A 10 – Scenario A: Average increase in suspended sediment concentration above the background at mid-depth over the first half of the campaign.

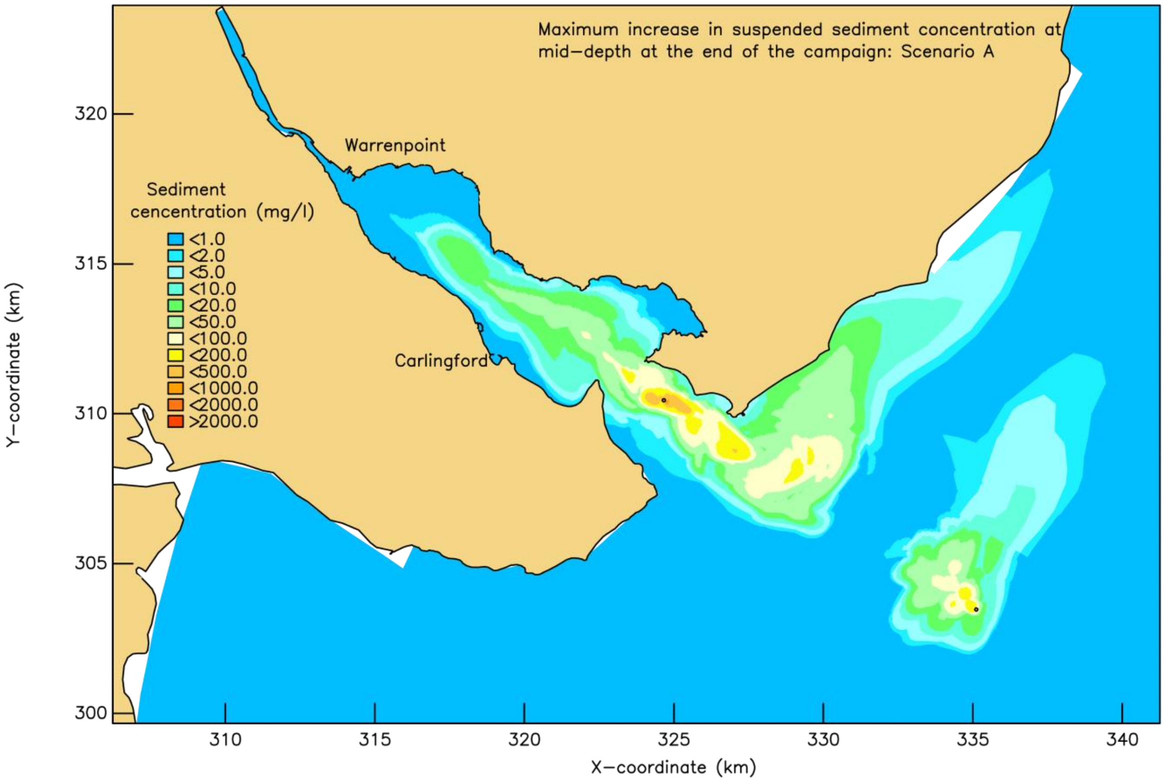

Figure A 11 – Scenario A: Maximum increase in suspended sediment concentration above the background at mid-depth over the campaign period.

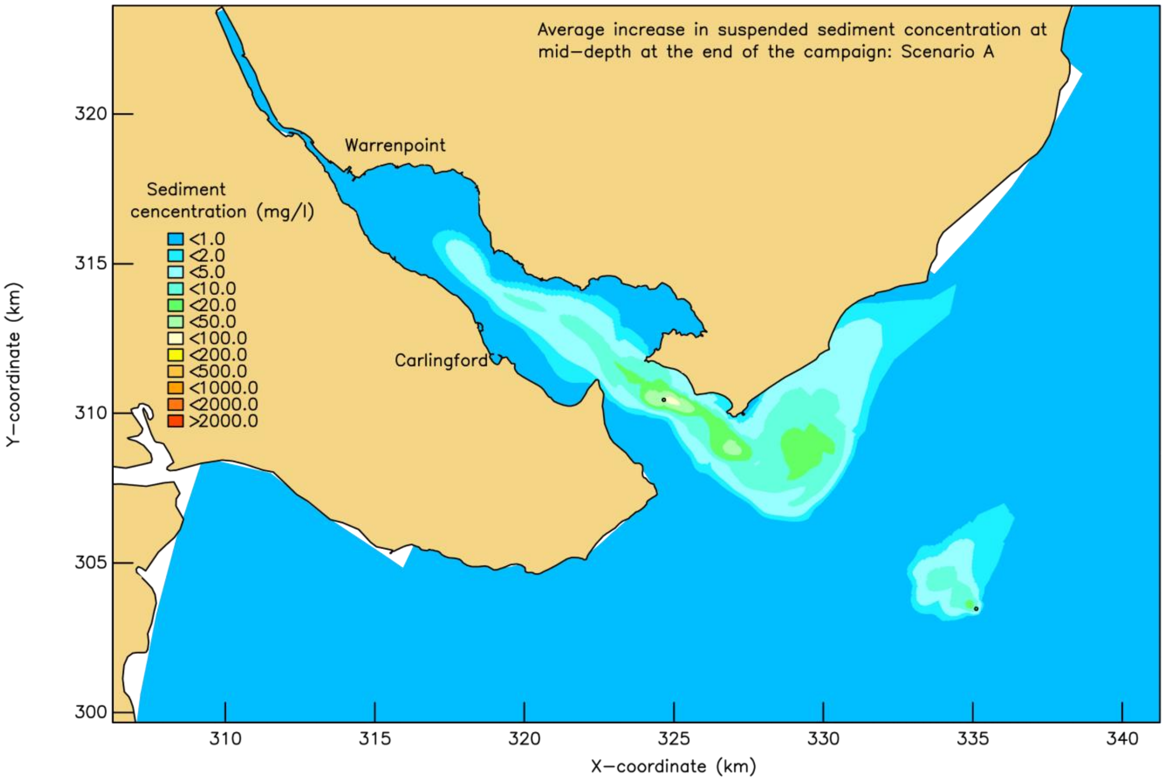

Figure A 12 – Scenario A: Average increase in suspended sediment concentration above the background at mid-depth over the campaign period.

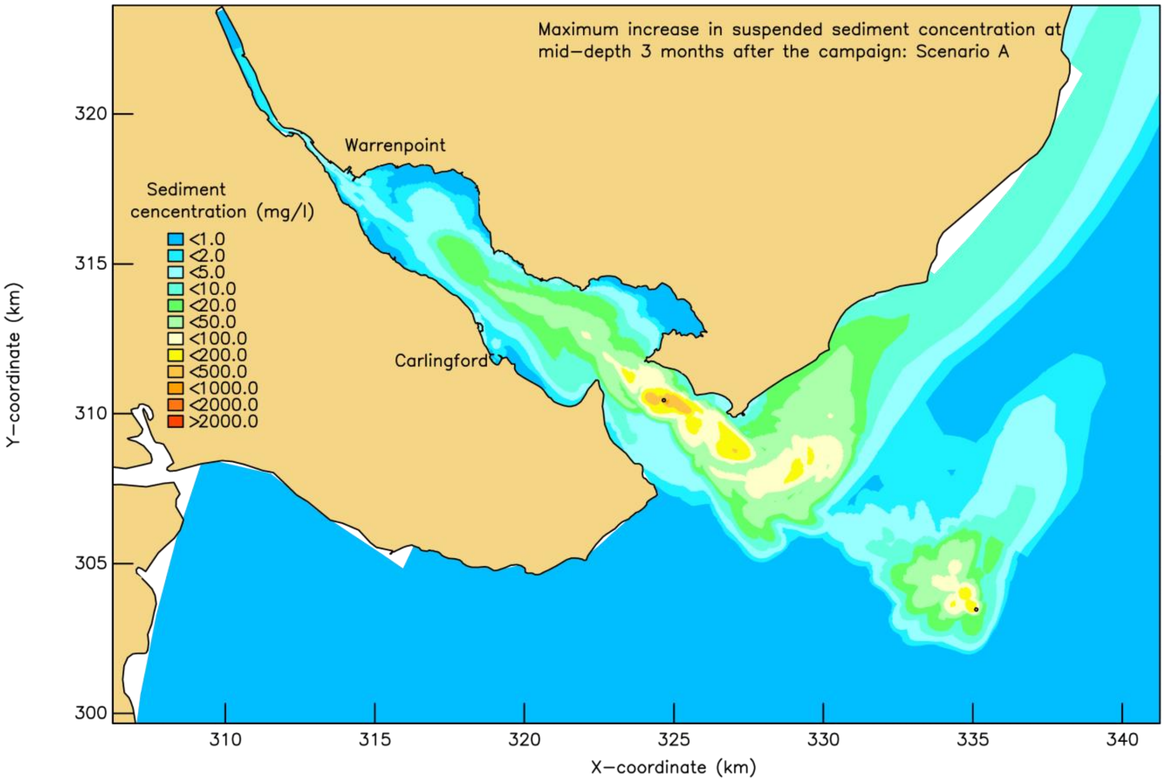

Figure A 13 – Scenario A: Maximum increase in suspended sediment concentration above the background at mid-depth over the campaign period and the three months thereafter.

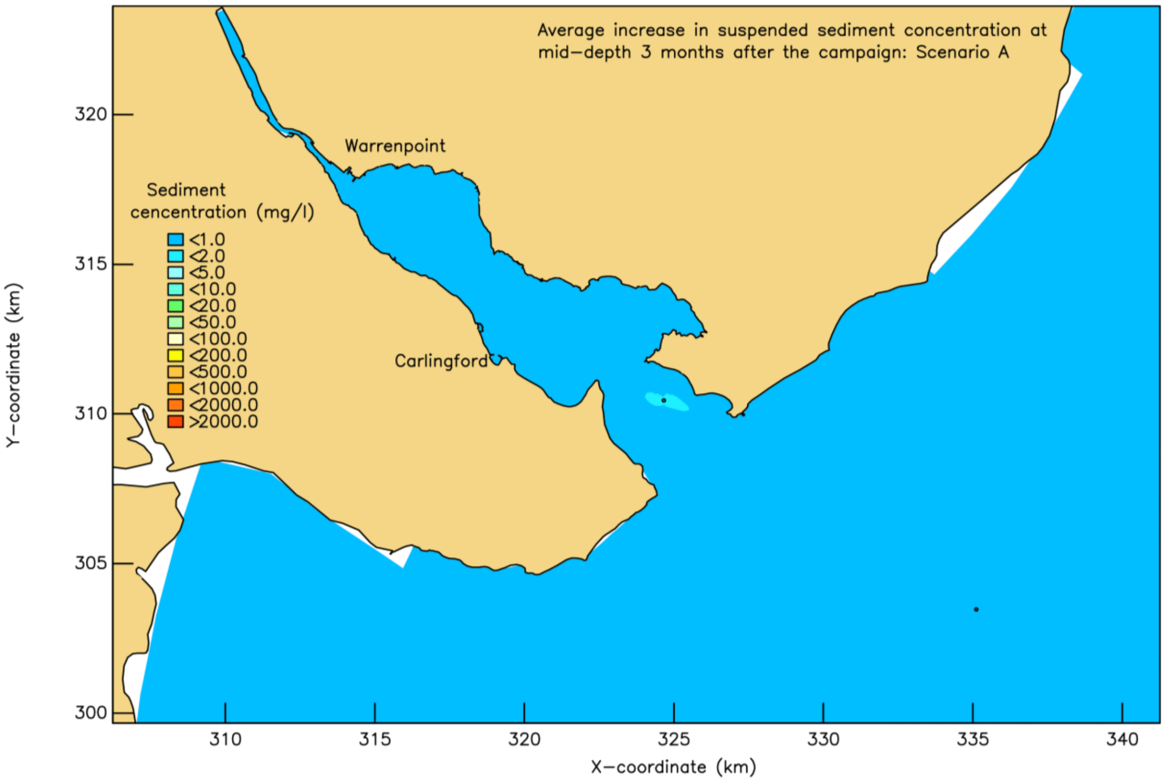

Figure A 14 – Scenario A: Average increase in suspended sediment concentration above the background at mid-depth over the campaign period and the three months thereafter.

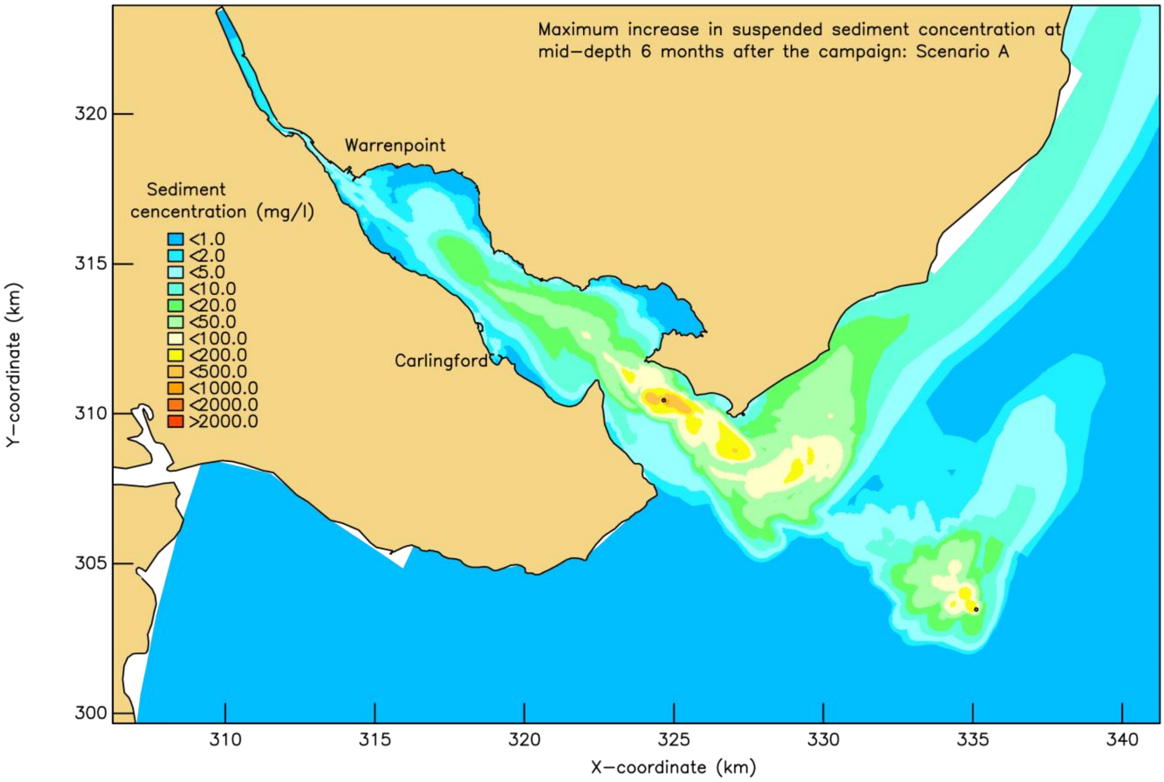

Figure A 15 – Scenario A: Maximum increase in suspended sediment concentration above the background at mid-depth over the campaign period and the six months thereafter.

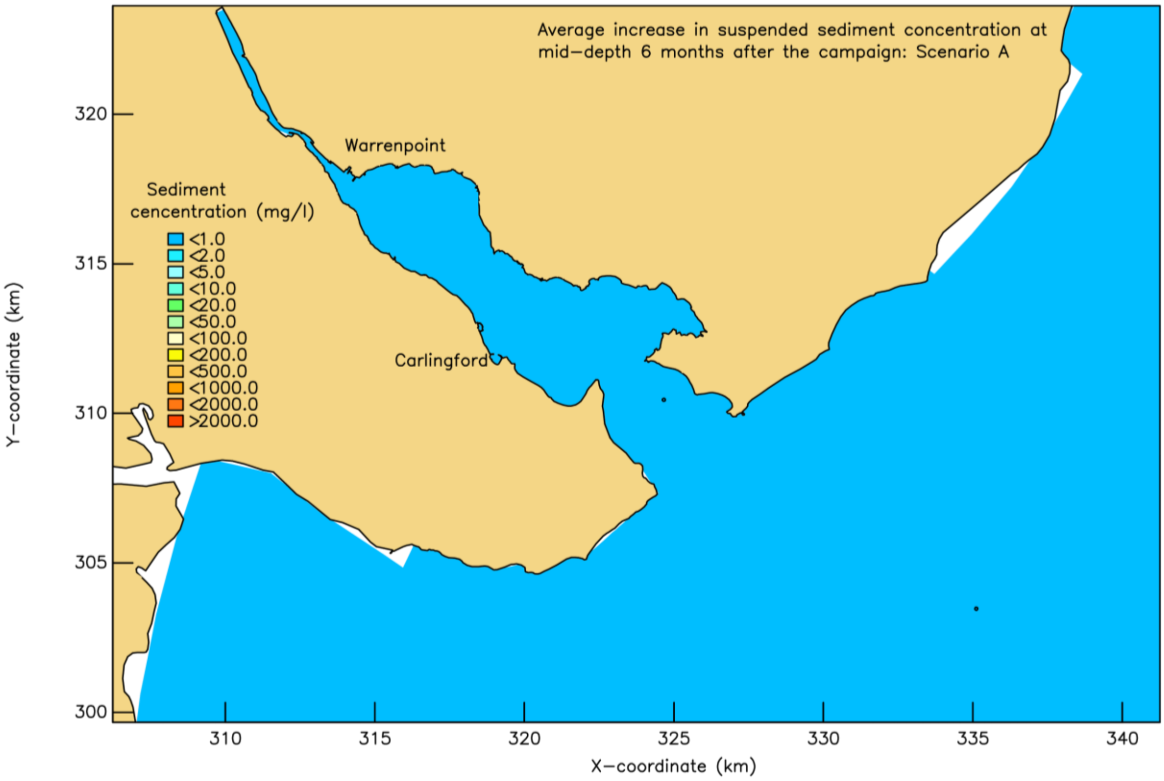

Figure A 16 – Scenario A: Average increase in suspended sediment concentration above the background at mid-depth over the campaign period and the six months thereafter.

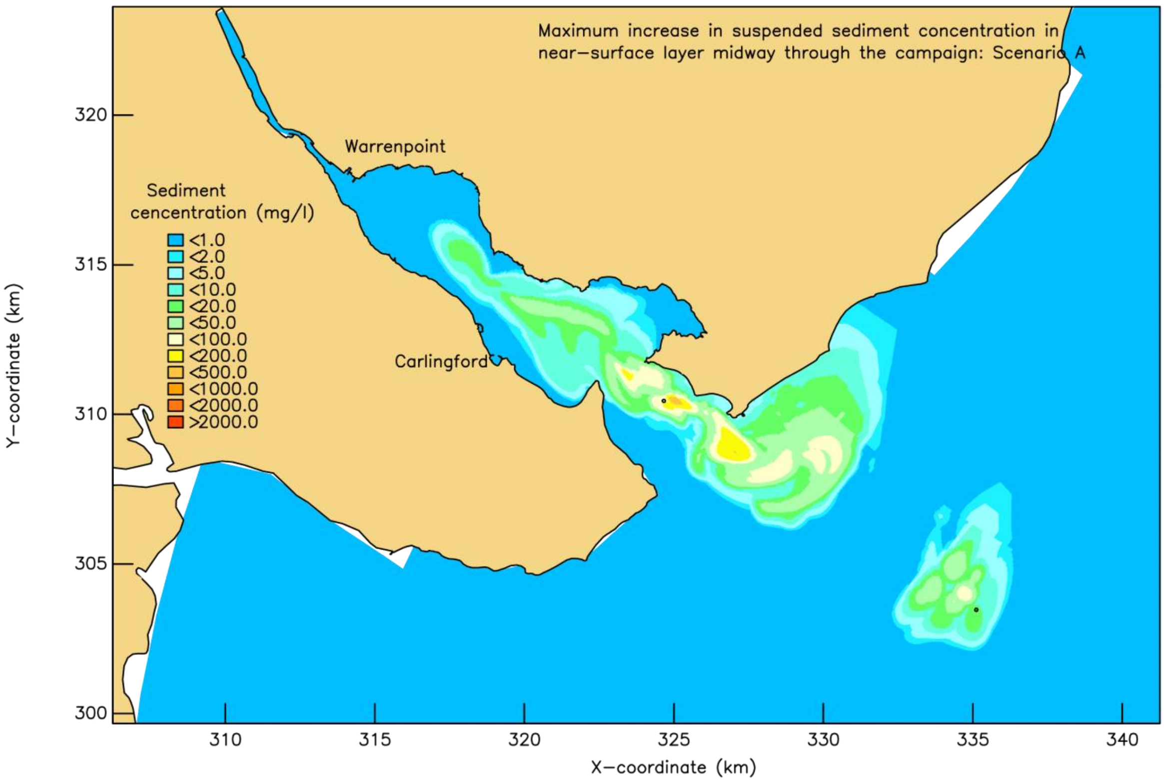

Figure A 17 – Scenario A: Maximum increase in suspended sediment concentration above the background in the near-surface layer over the first half of the campaign.

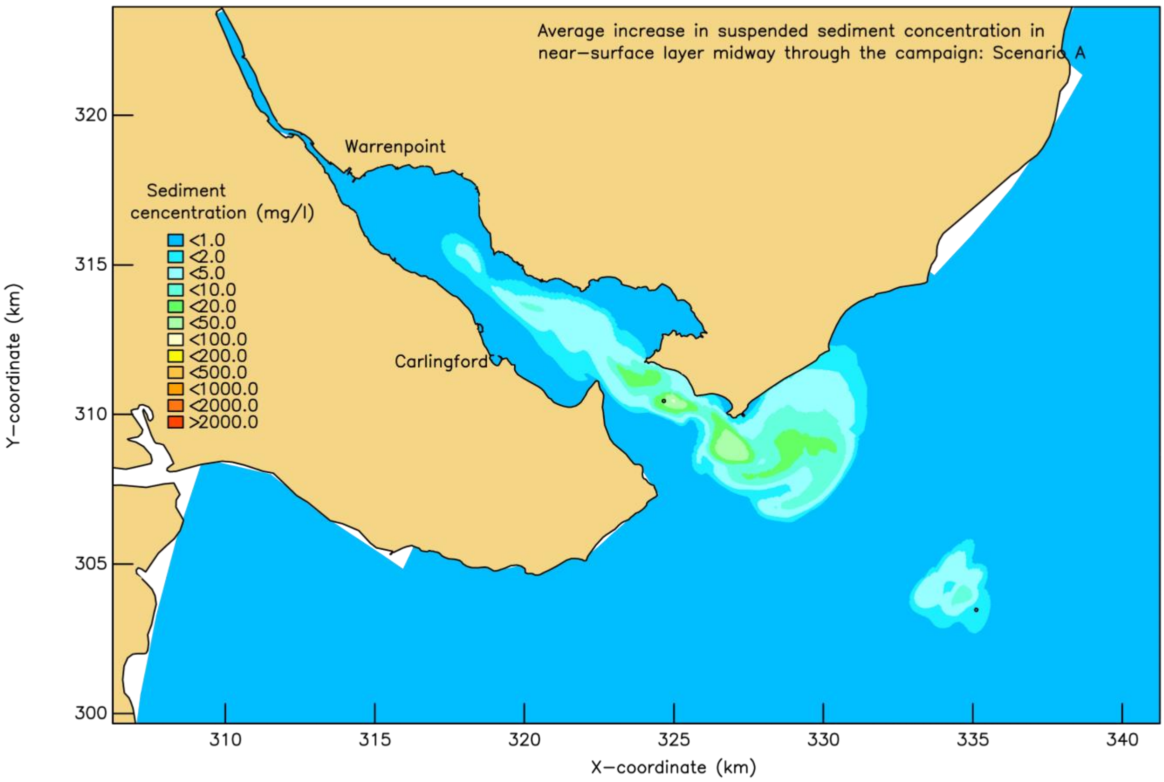

Figure A 18 – Scenario A: Average increase in suspended sediment concentration above the background in the near-surface layer over the first half of the campaign.

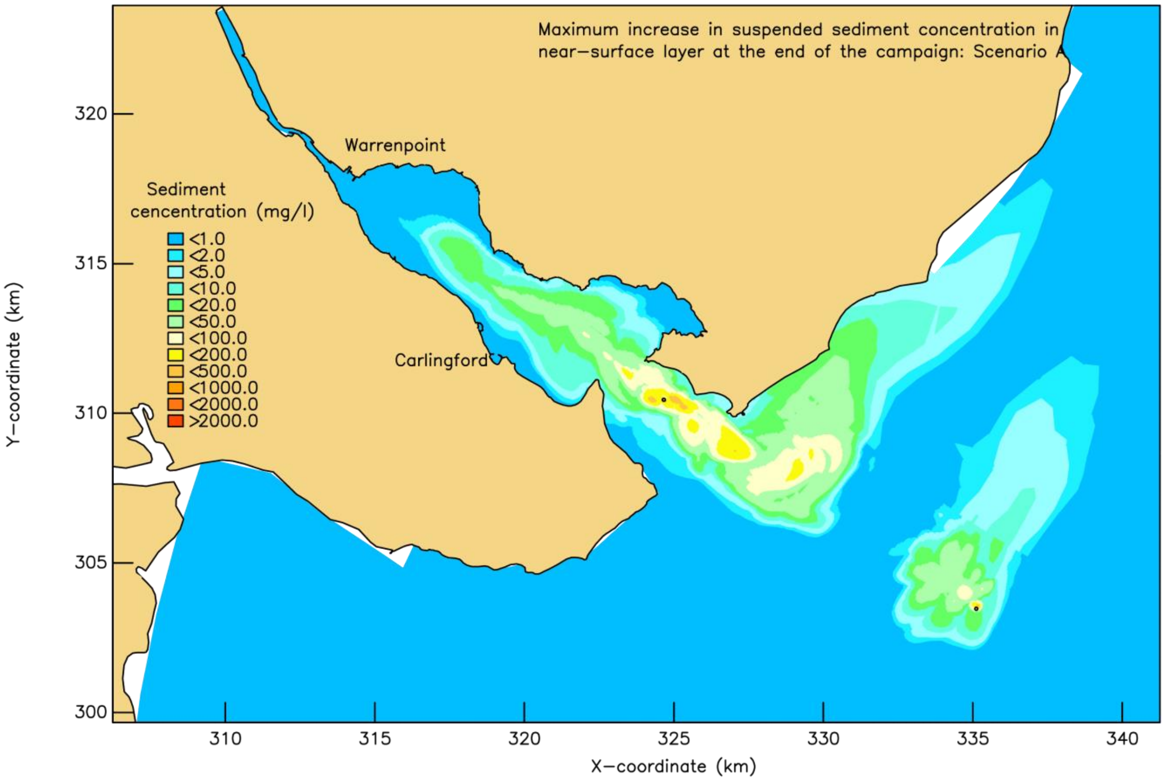

Figure A 19 – Scenario A: Maximum increase in suspended sediment concentration above the background in the near-surface layer over the campaign period.

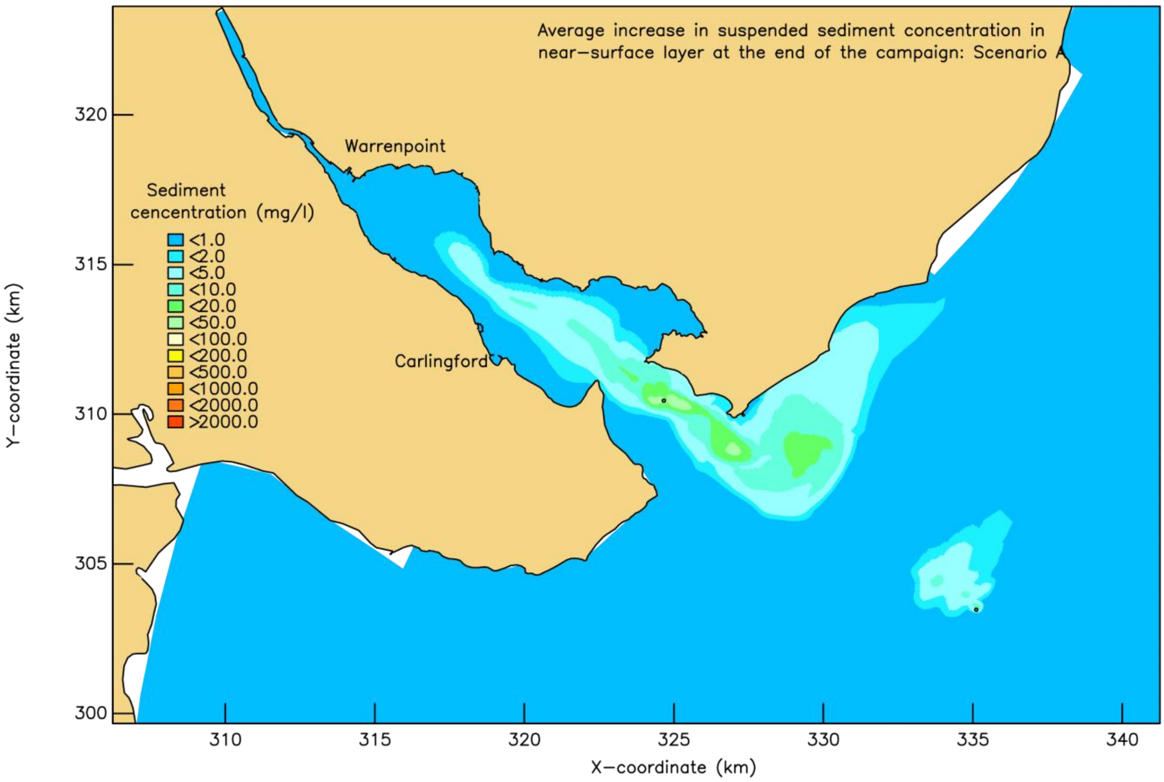

Figure A 20 – Scenario A: Average increase in suspended sediment concentration above the background in the near-surface layer over the campaign period.

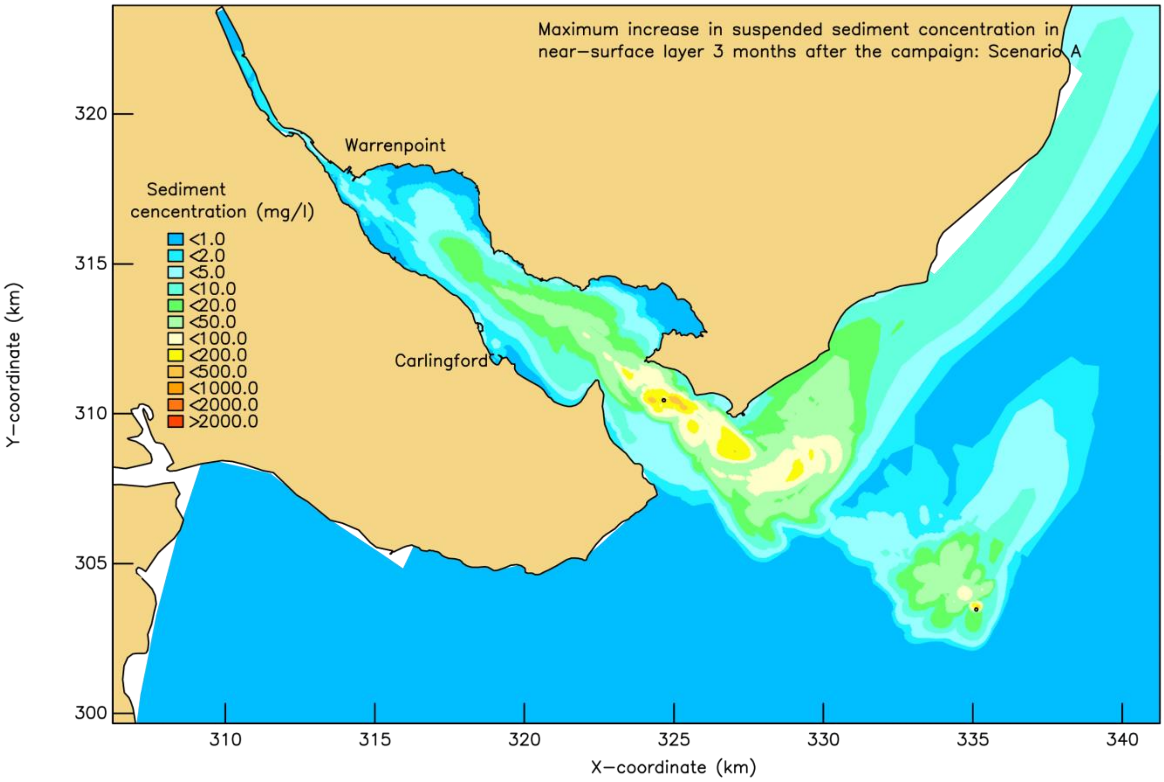

Figure A 21 – Scenario A: Maximum increase in suspended sediment concentration above the background in the near-surface layer over the campaign period and the three months thereafter.

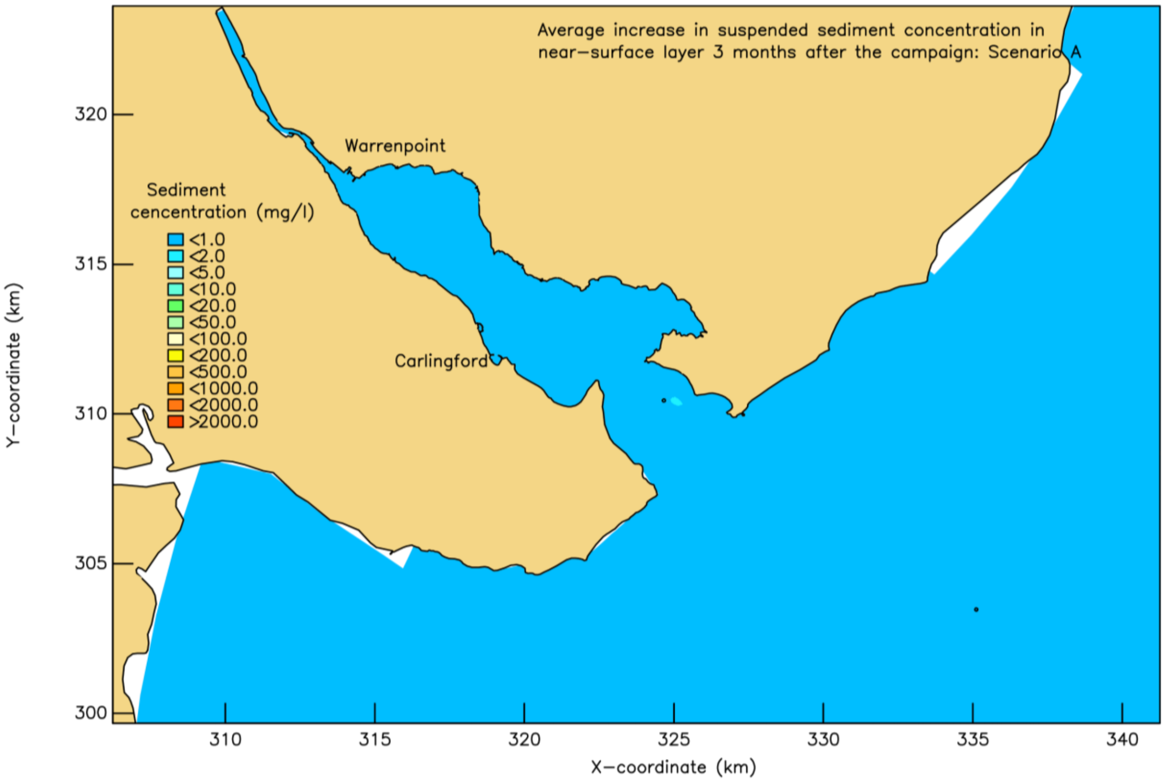

Figure A 22 – Scenario A: Average increase in suspended sediment concentration above the background in the near-surface layer over the campaign period and the three months thereafter.

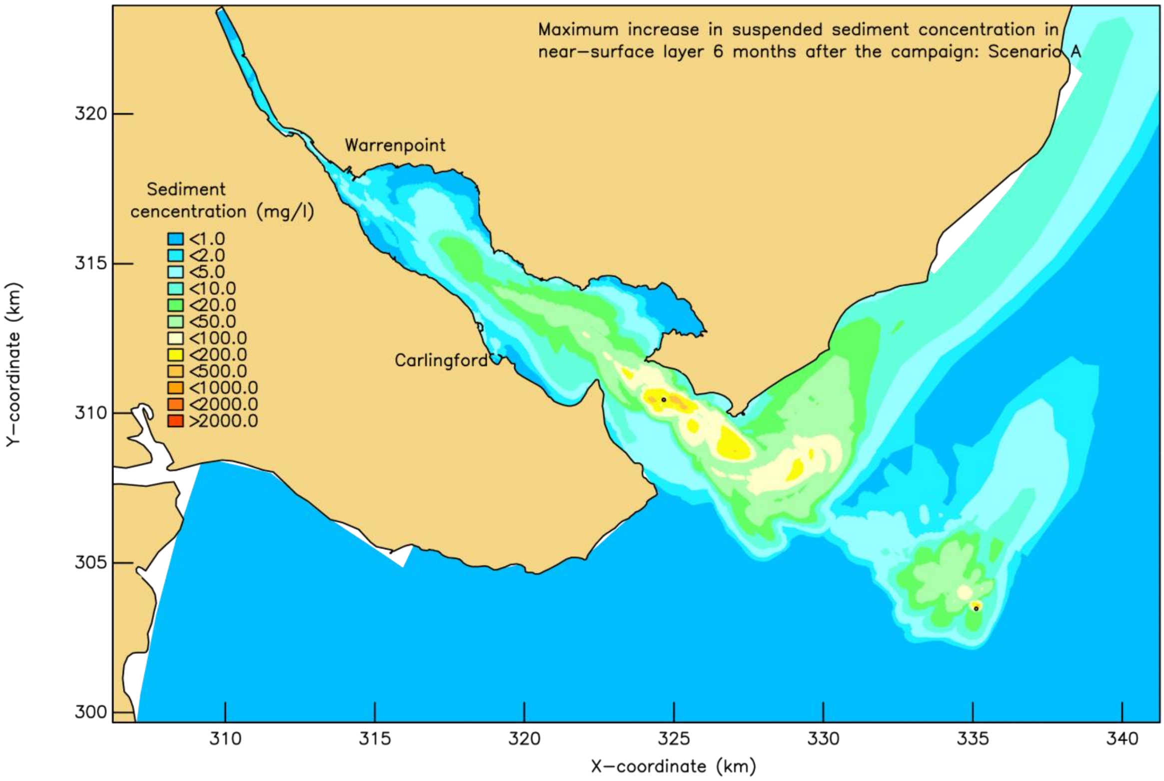

Figure A 23 – Scenario A: Maximum increase in suspended sediment concentration above the background in the near-surface layer over the campaign period and the six months thereafter.

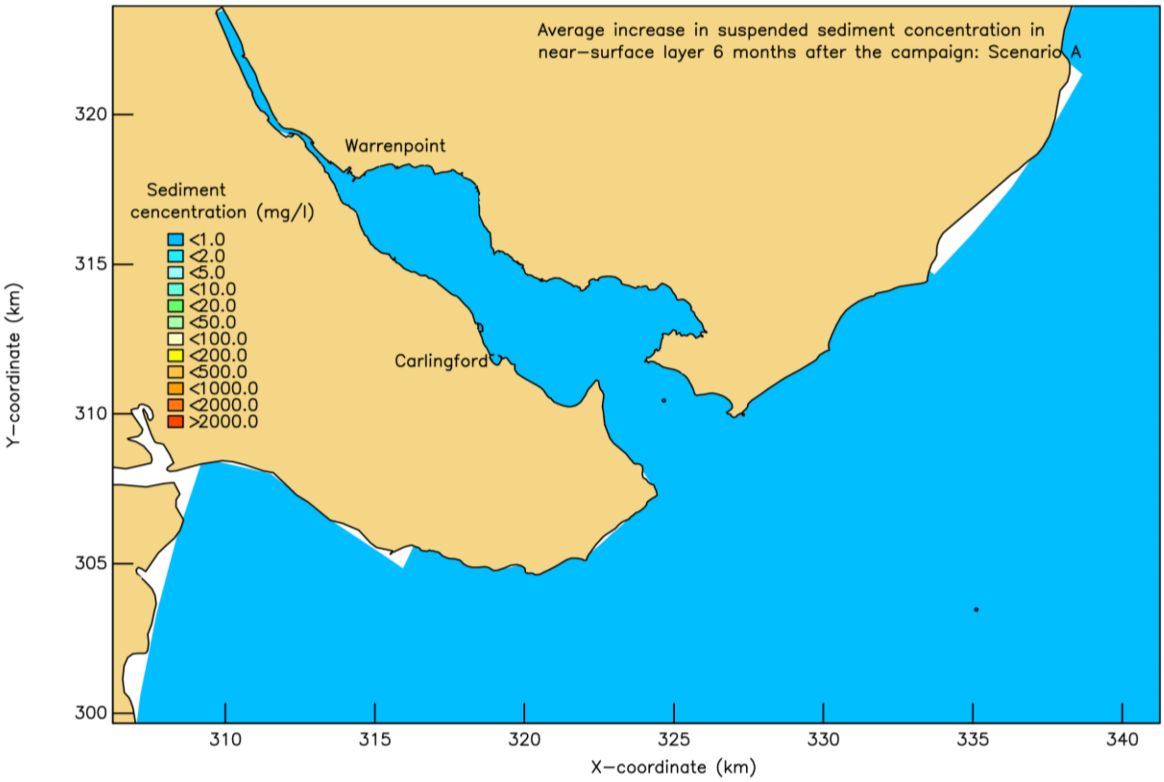

Figure A 24 – Scenario A: Average increase in suspended sediment concentration above the background in the near-surface layer over the campaign period and the six months thereafter.

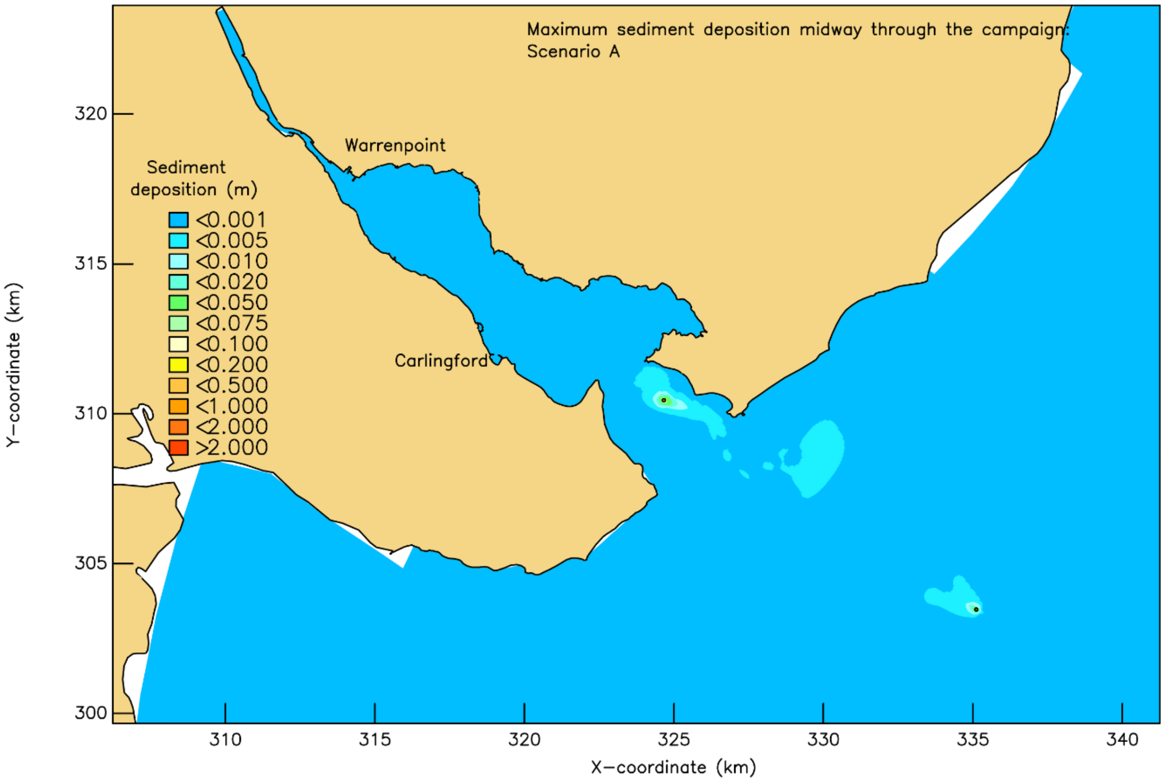

Figure A 25 – Scenario A: Maximum sediment deposition that occurred over the first half of the campaign period.

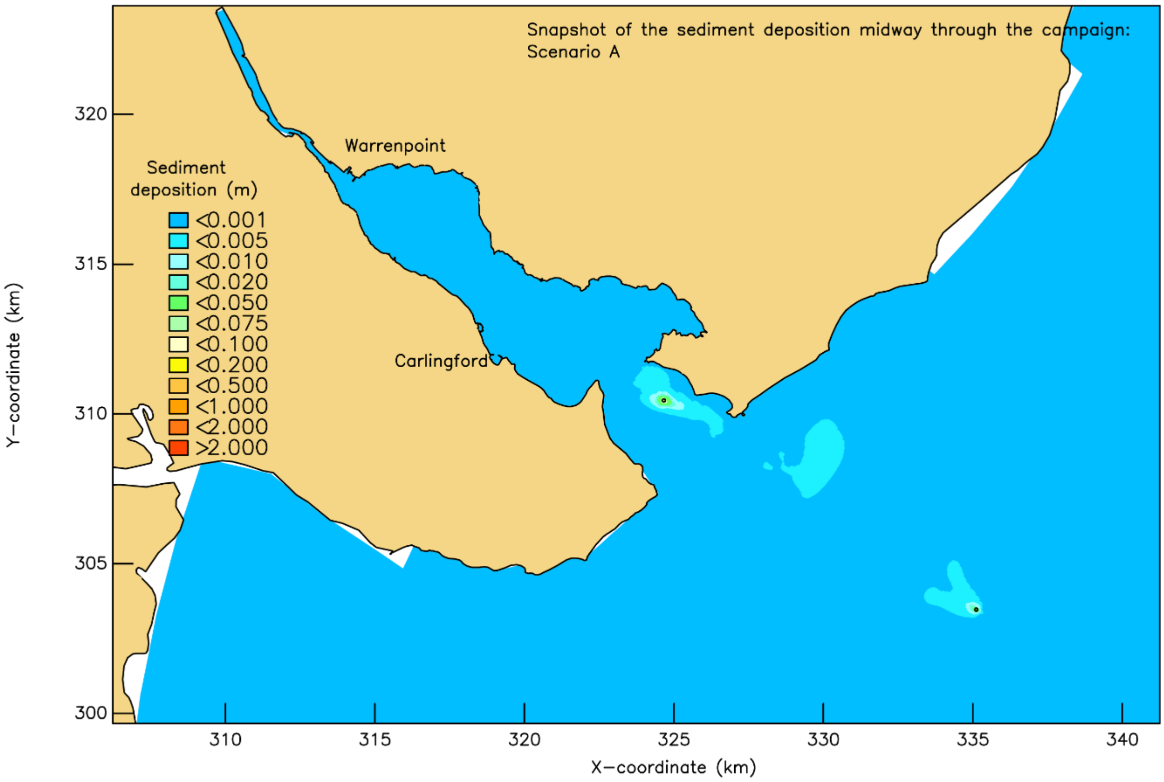

Figure A 26 – Scenario A: Instantaneous sediment deposition midway through the campaign.

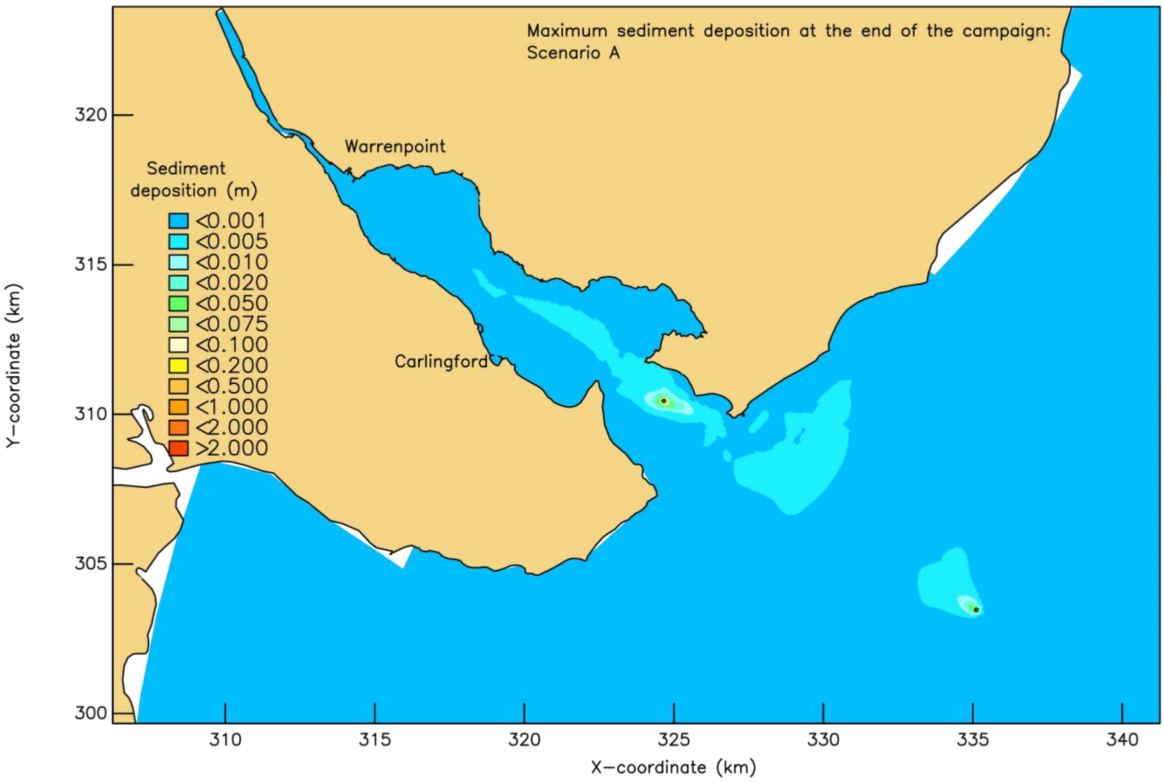

Figure A 27 – Scenario A: Maximum sediment deposition that occurred over the campaign period.

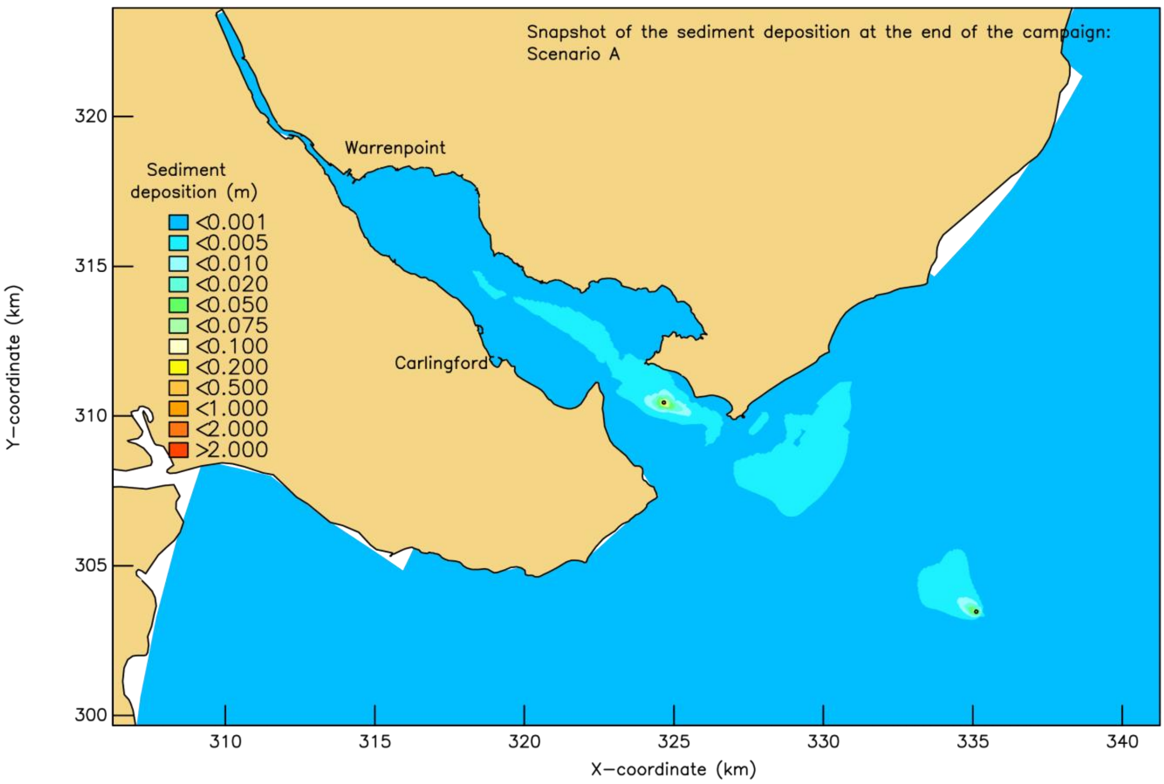

Figure A 28 – Scenario A: Instantaneous sediment deposition at the end of the campaign.

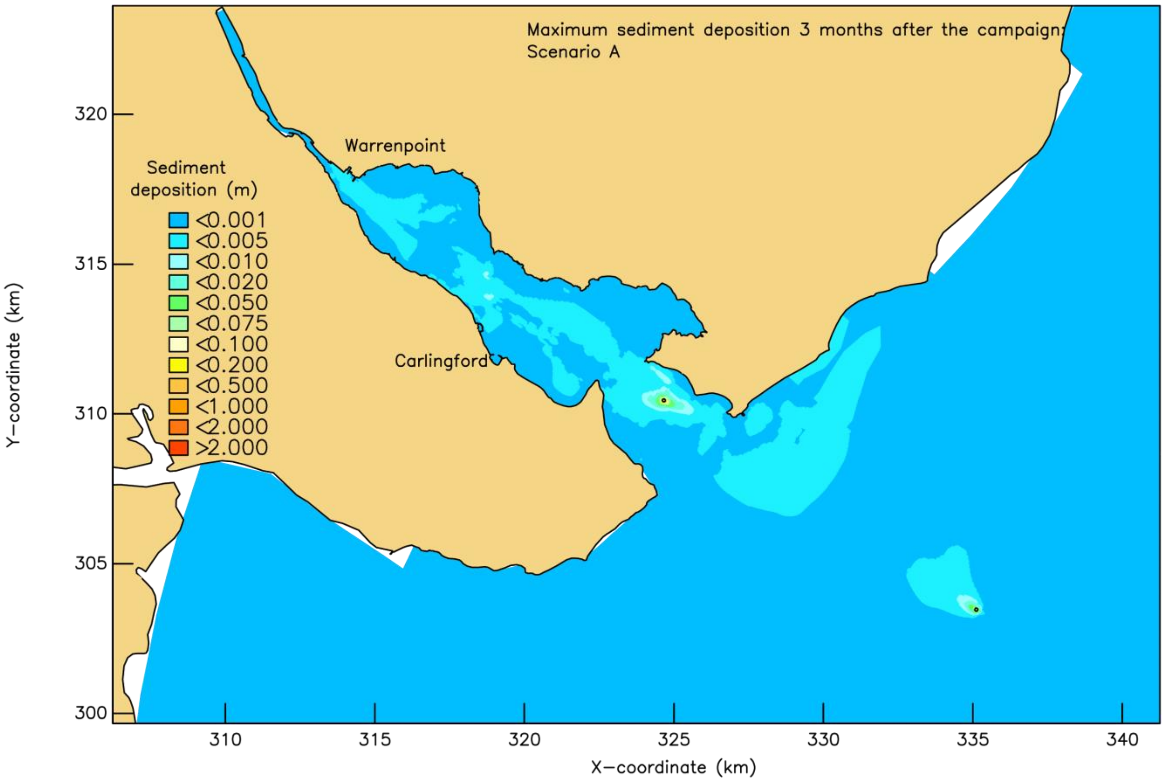

Figure A 29 – Scenario A: Maximum sediment deposition that occurred over the campaign period and the three months thereafter.

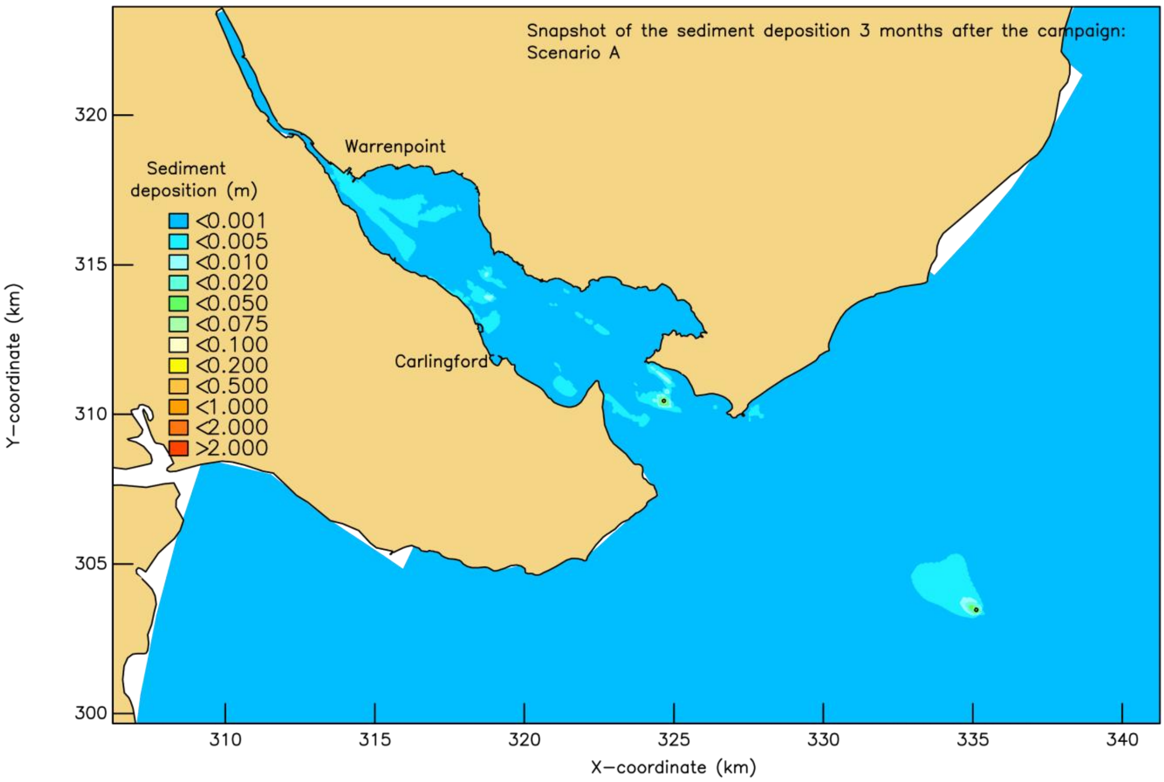

Figure A 30 – Scenario A: Instantaneous sediment deposition three months after the campaign ended.

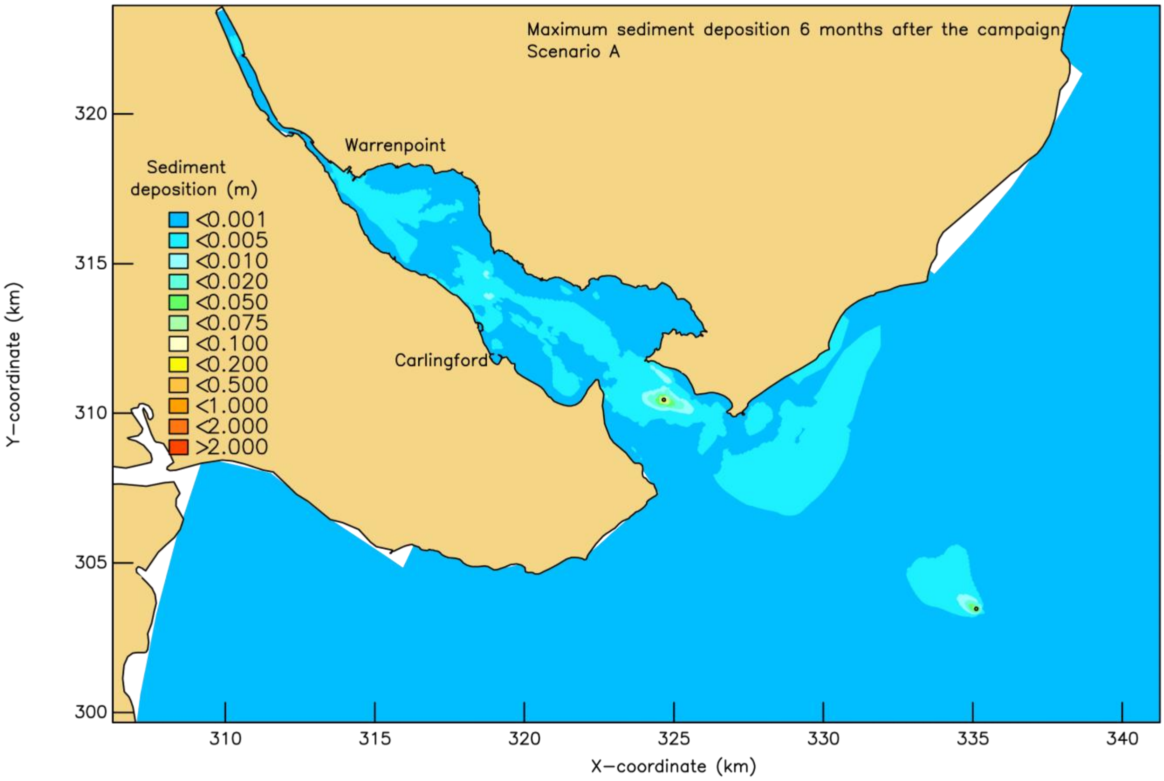

Figure A 31 – Scenario A: Maximum sediment deposition that occurred over the campaign period and the six months thereafter.

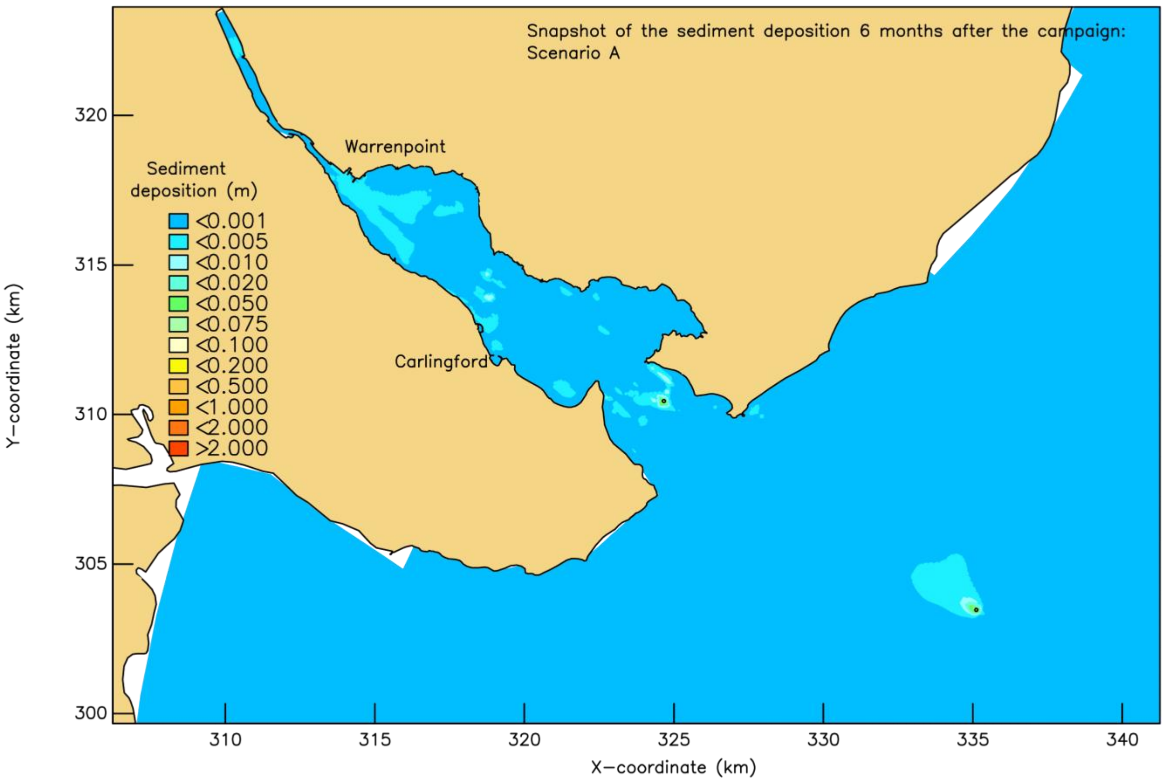

Figure A 32 – Scenario A: Instantaneous sediment deposition six months after the campaign ended.

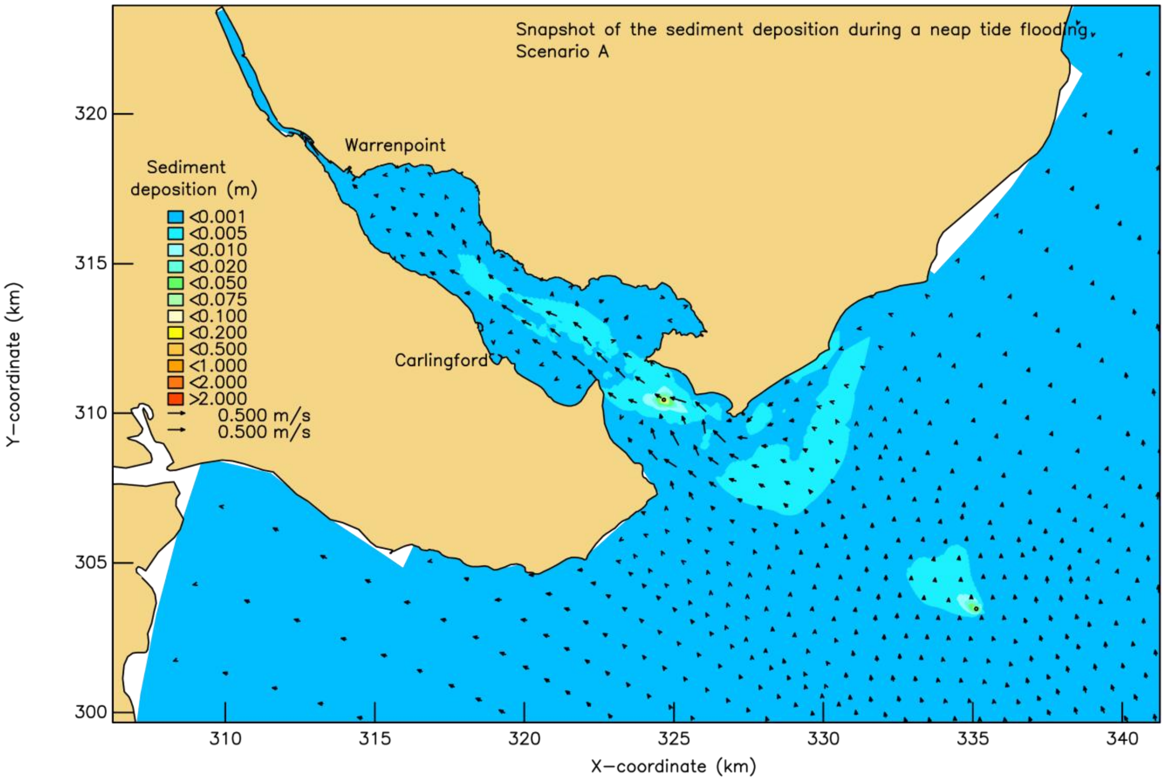

Figure A 33 – Scenario A: Snapshot of the sediment deposition during a neap tide flooding.

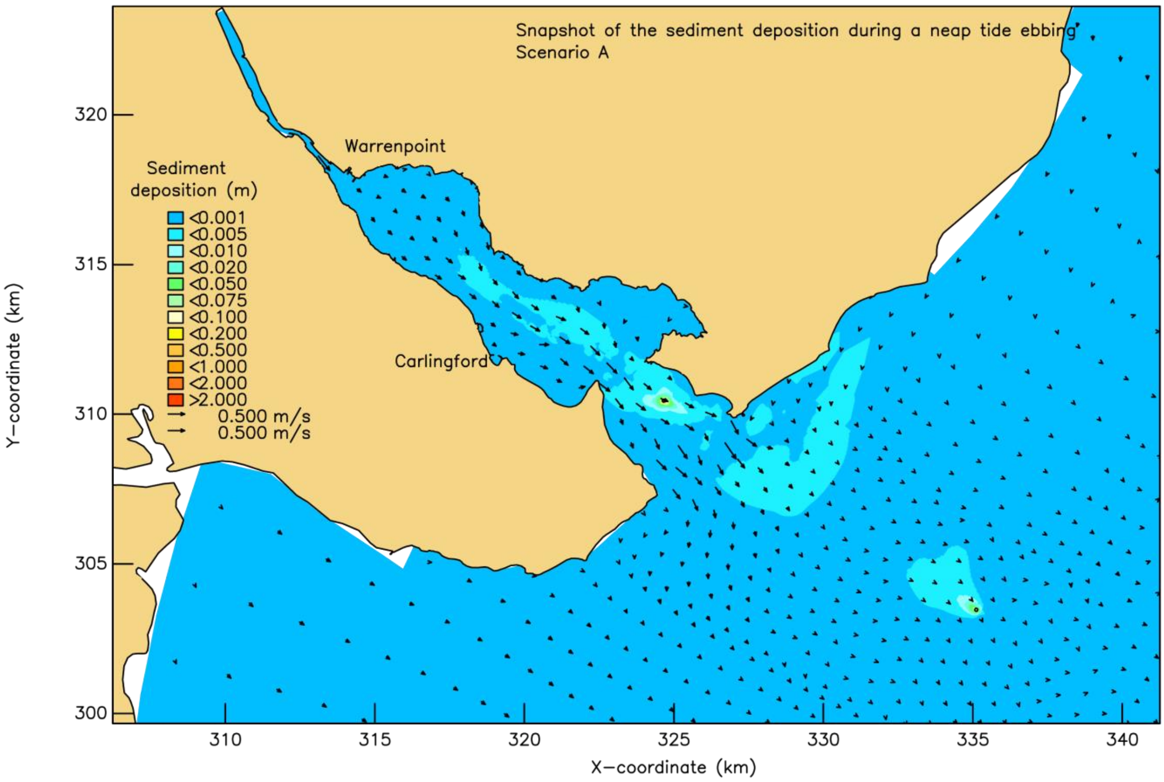

Figure A 34 – Scenario A: Snapshot of the sediment deposition during a neap tide ebbing.

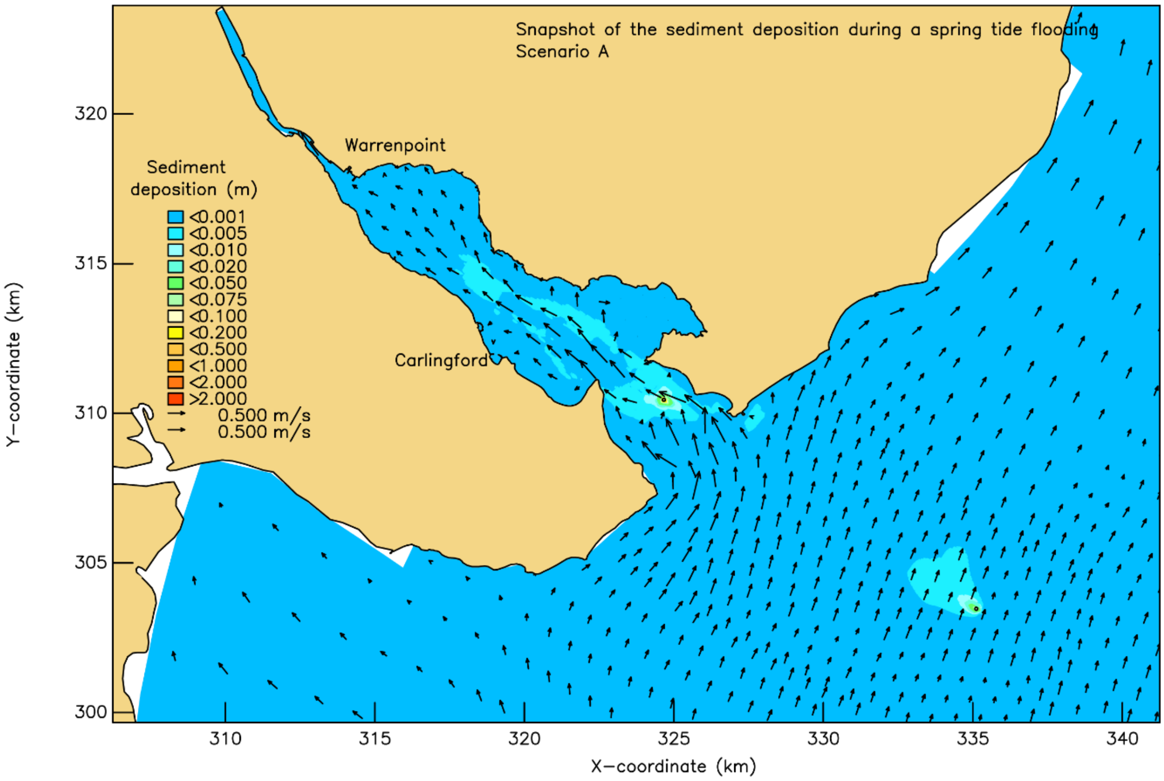

Figure A 35 – Scenario A: Snapshot of the sediment deposition during a spring tide flooding.

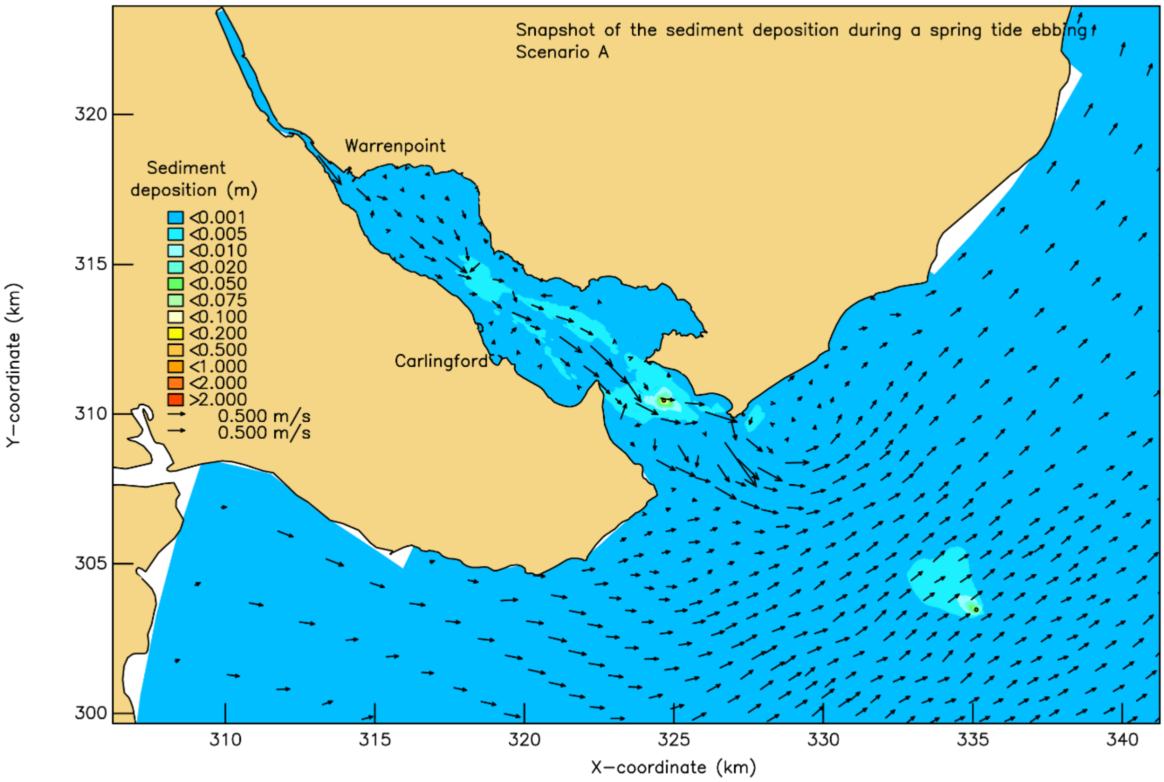

Figure A 36 – Scenario A: Snapshot of the sediment deposition during a spring tide ebbing.

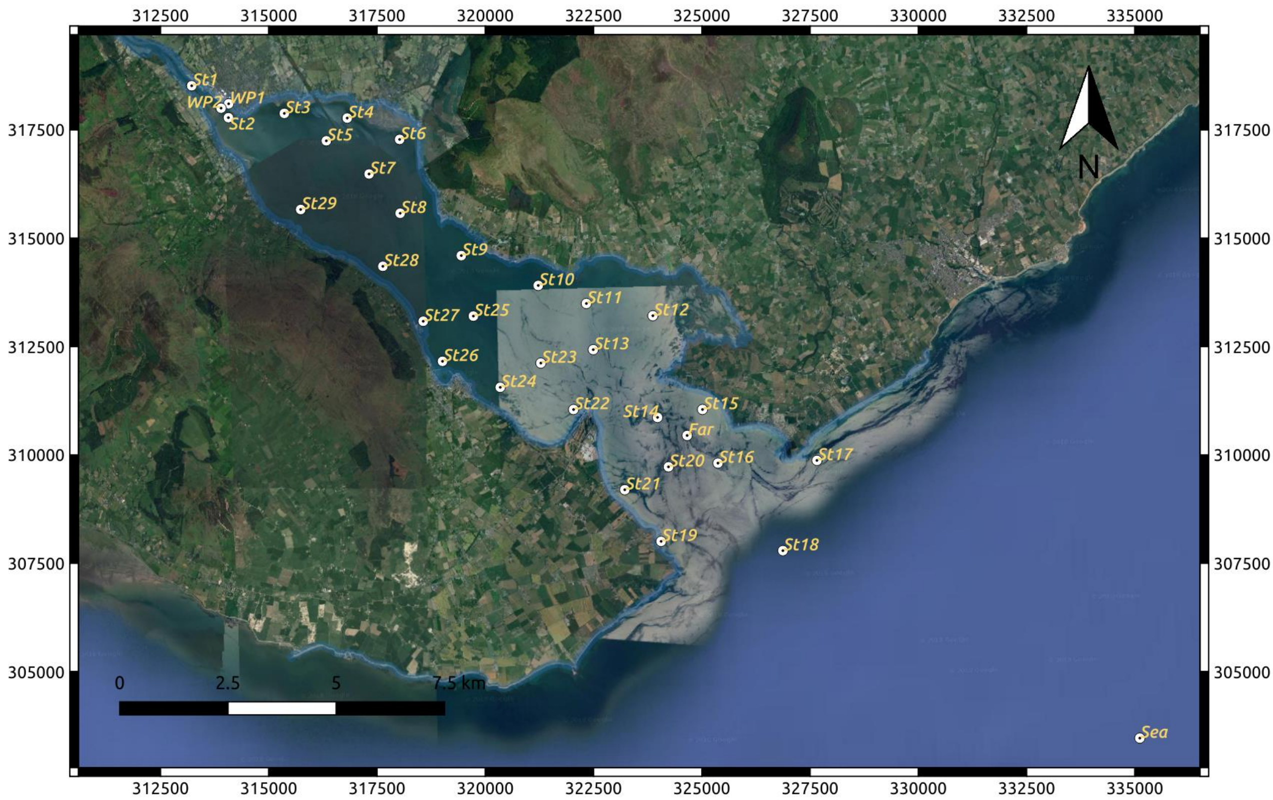

Figure A 37 – The locations of the output stations for the time series graphs.

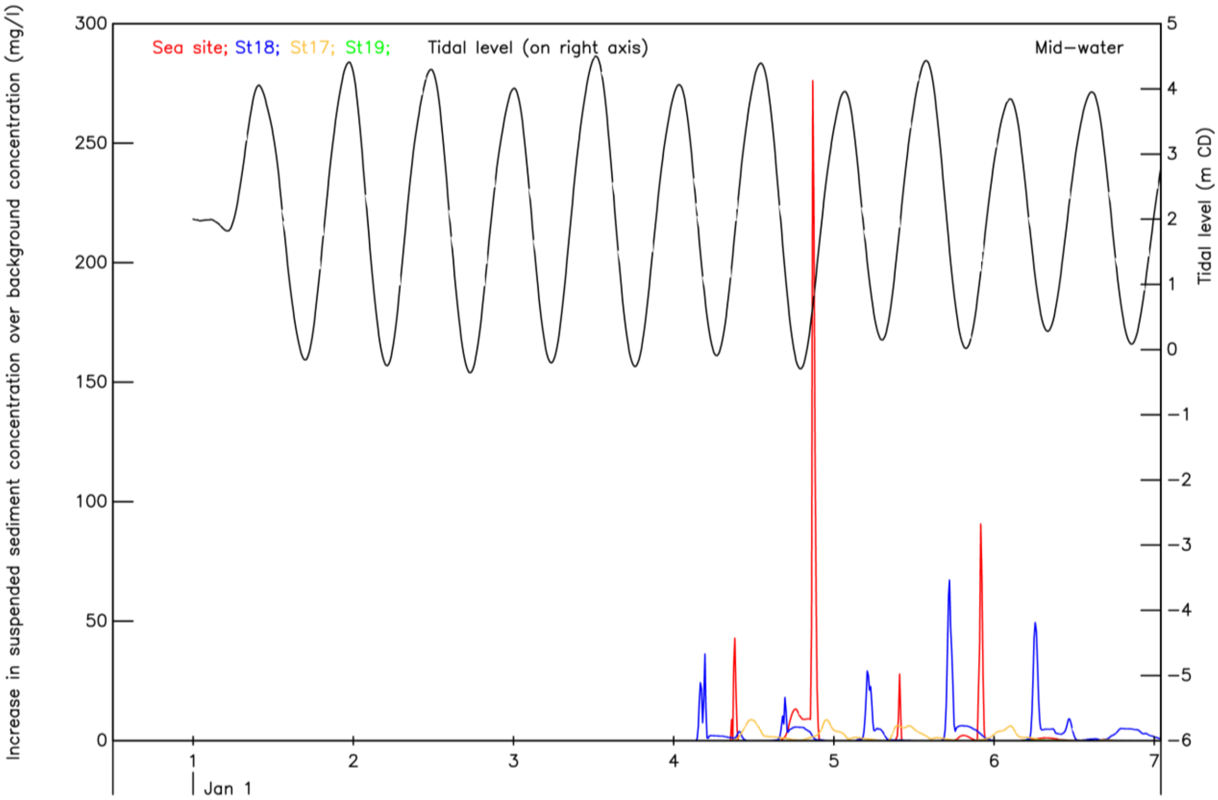

Figure A 38 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth during the campaign period at stations Sea site, St18, St17 and St19.

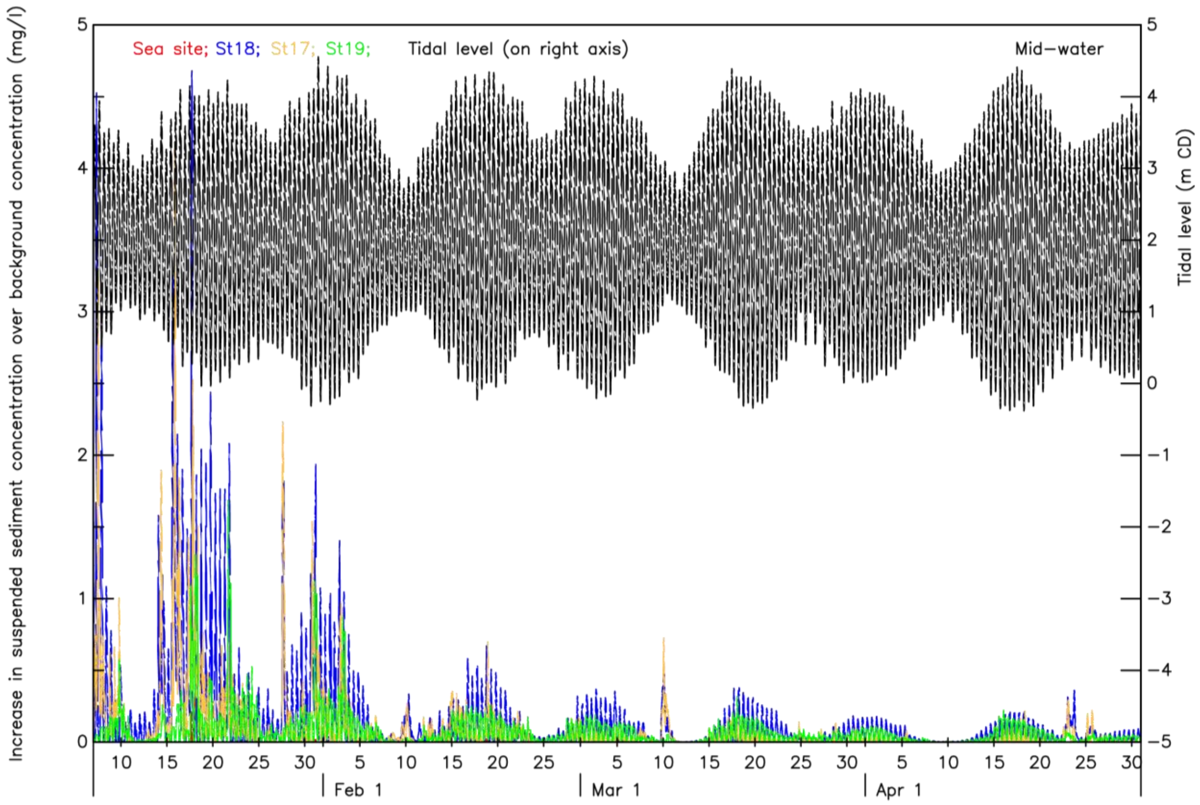

Figure A 39 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the three months following the campaign period at stations: Sea site, St18, St17 and St19.

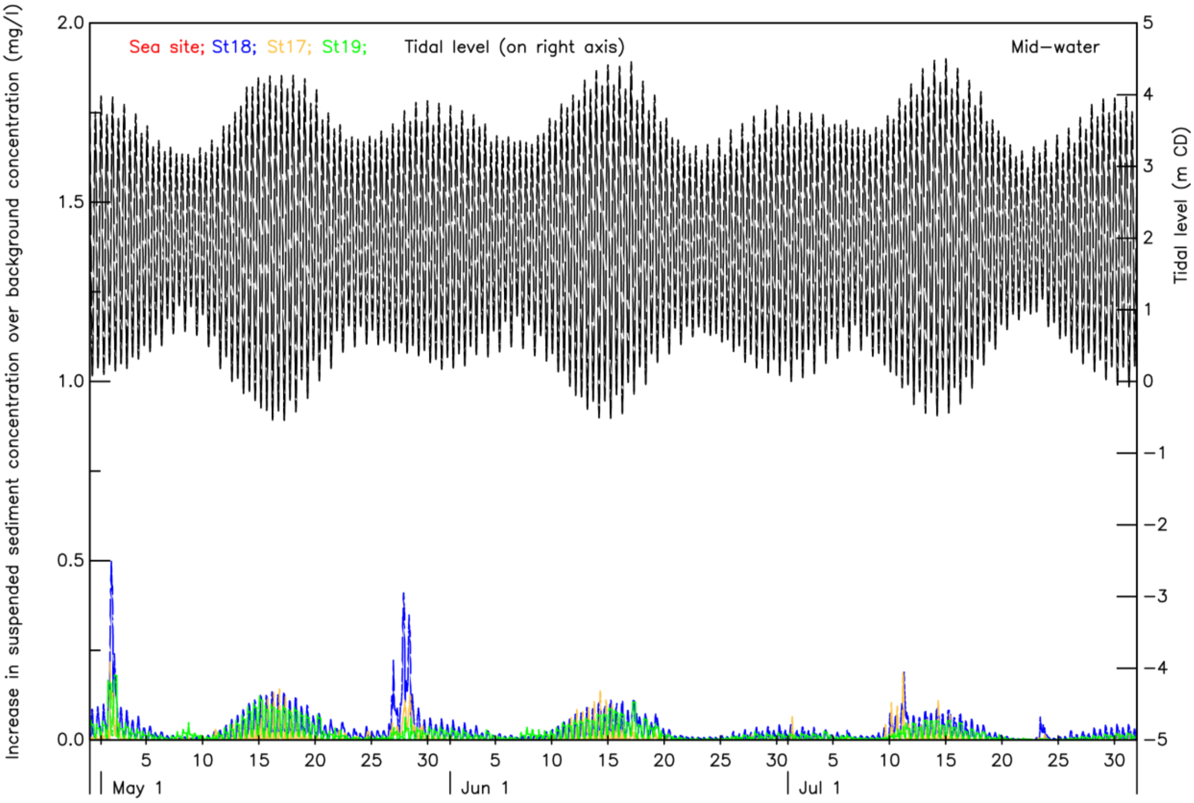

Figure A 40 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the four to six months following the campaign period at stations: Sea site, St18, St17 and St19.

Table A.1: **Scenario A: Statistical indicators for elevated suspended concentrations at mid-depth at stations Sea site, St18, St17 and St19.**

	Suspended sediment concentration at mid-depth			
	Sea site (mg/l)	**St18 (mg/l)**	**St17 (mg/l)**	**S19 (mg/l)**
Peak	276.20	67.20	8.83	1.68
99th percentile	0.02	1.93	1.38	0.37
95th percentile	0.00	0.41	0.27	0.18
50th percentile	0.00	0.02	0.00	0.02
Mean	0.05	0.14	0.08	0.05

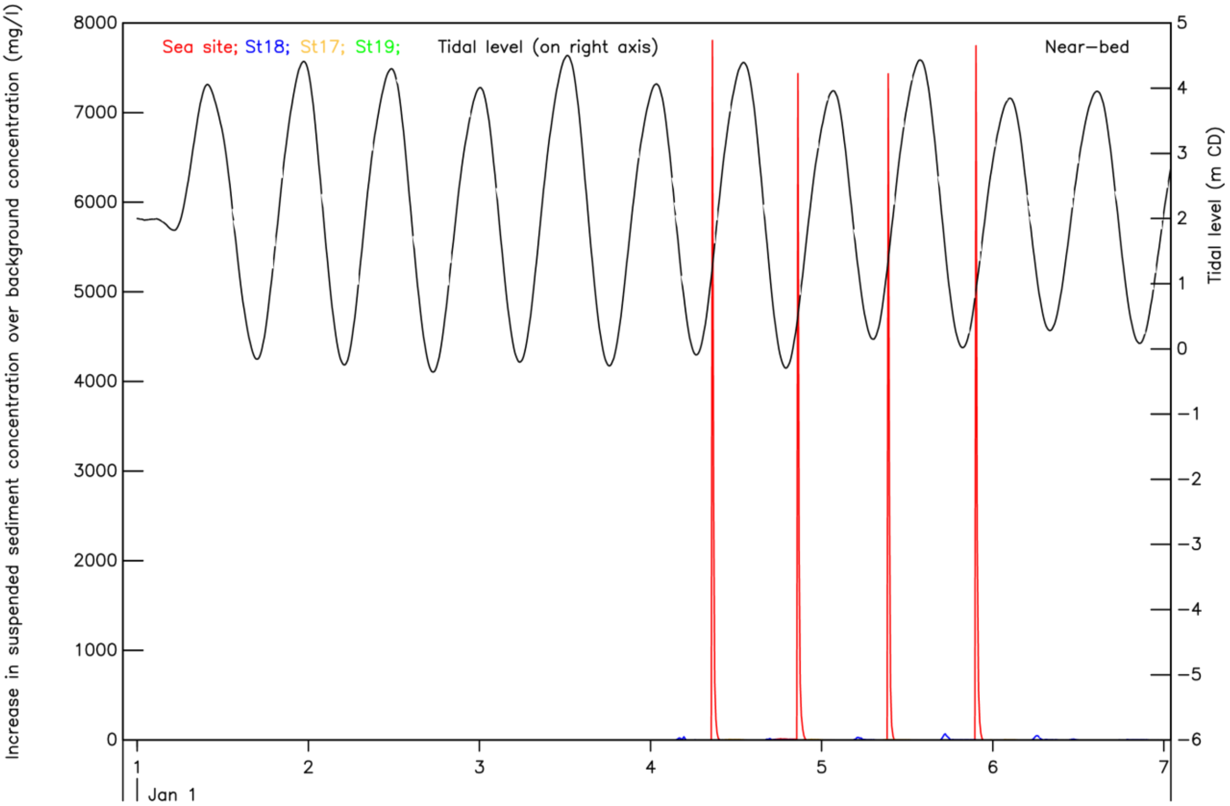

Figure A 41 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed during the campaign period at stations: Sea site, St18, St17 and St19.

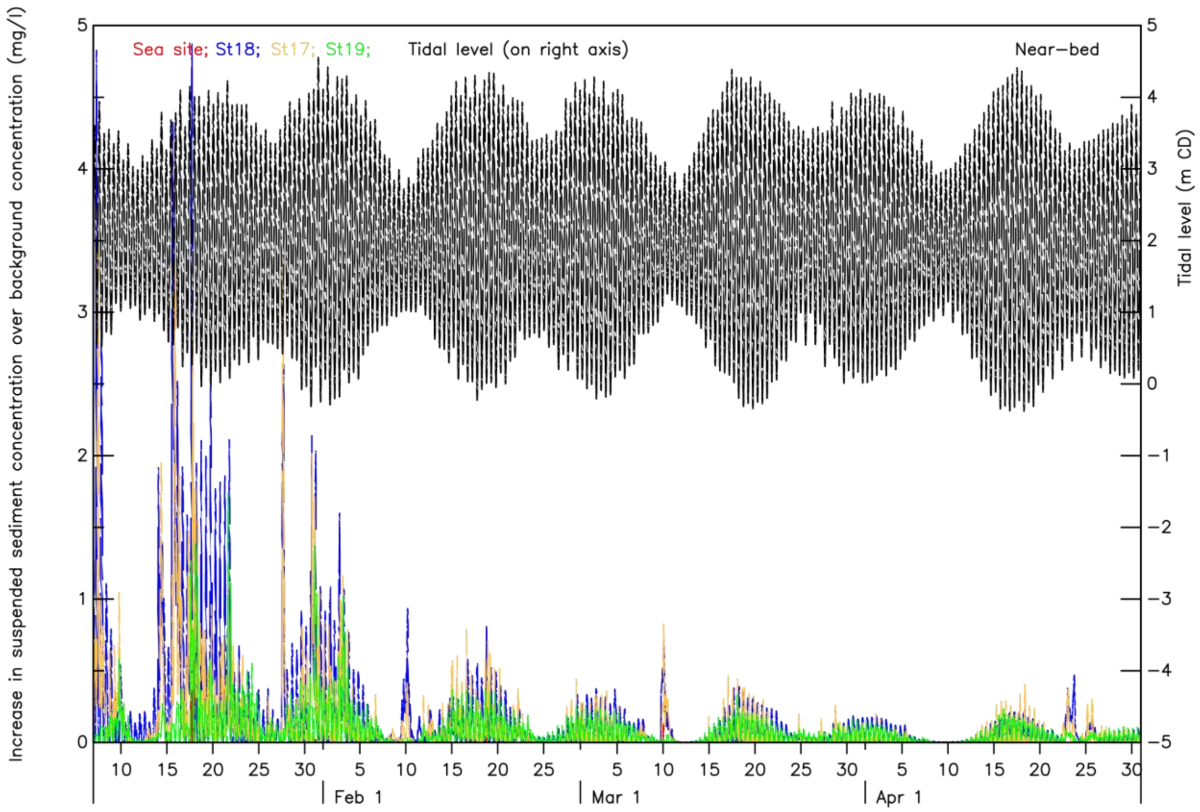

Figure A 42 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the three months following the campaign period at stations: Sea site, St18, St17 and St19.

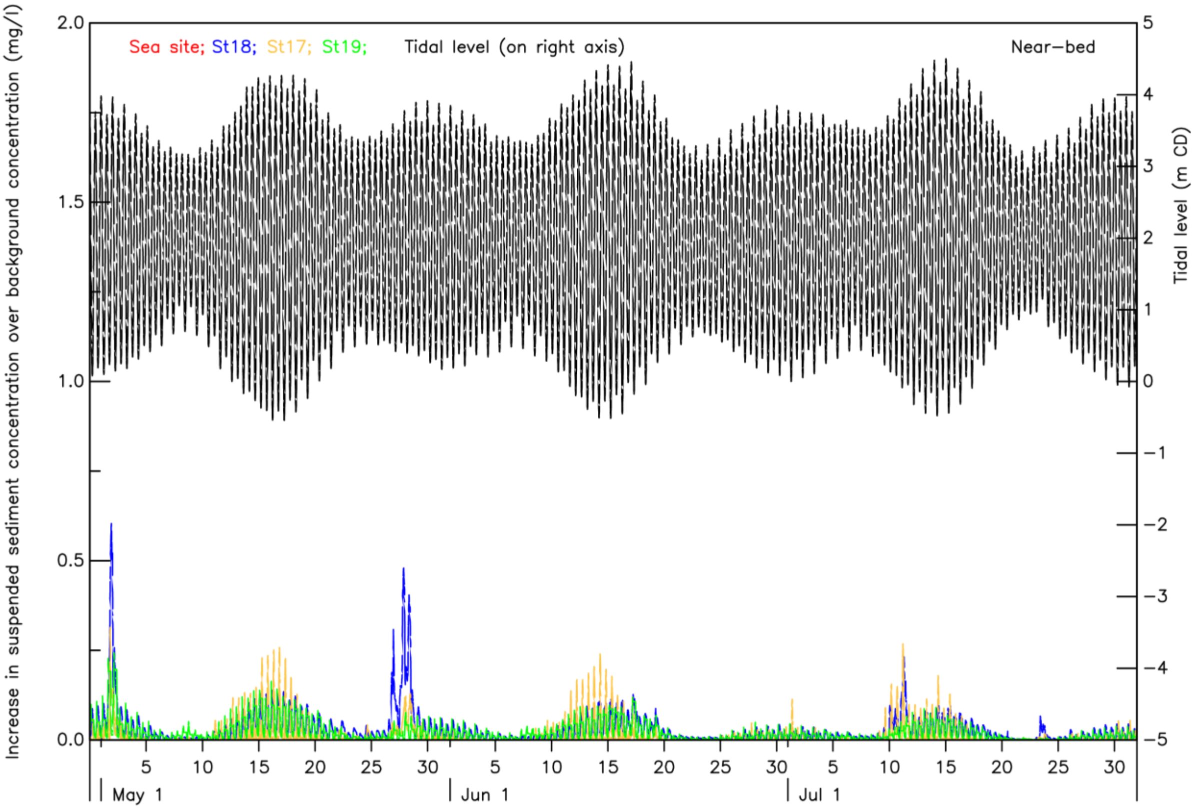

Figure A 43 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the four to six months following the campaign period at stations: Sea site, St18, St17 and St19.

Table A.2: **Scenario A: Statistical indicators for elevated suspended concentrations at the bed at stations Sea site, St18, St17 and St19.**

	Suspended sediment concentration at the bed			
	Sea site (mg/l)	**St18 (mg/l)**	**St17 (mg/l)**	**St19 (mg/l)**
Peak	7805.24	68.75	9.09	1.73
99th percentile	0.04	2.27	1.47	0.44
95th percentile	0.00	0.49	0.36	0.20
50th percentile	0.00	0.02	0.00	0.02
Mean	1.48	0.16	0.09	0.06

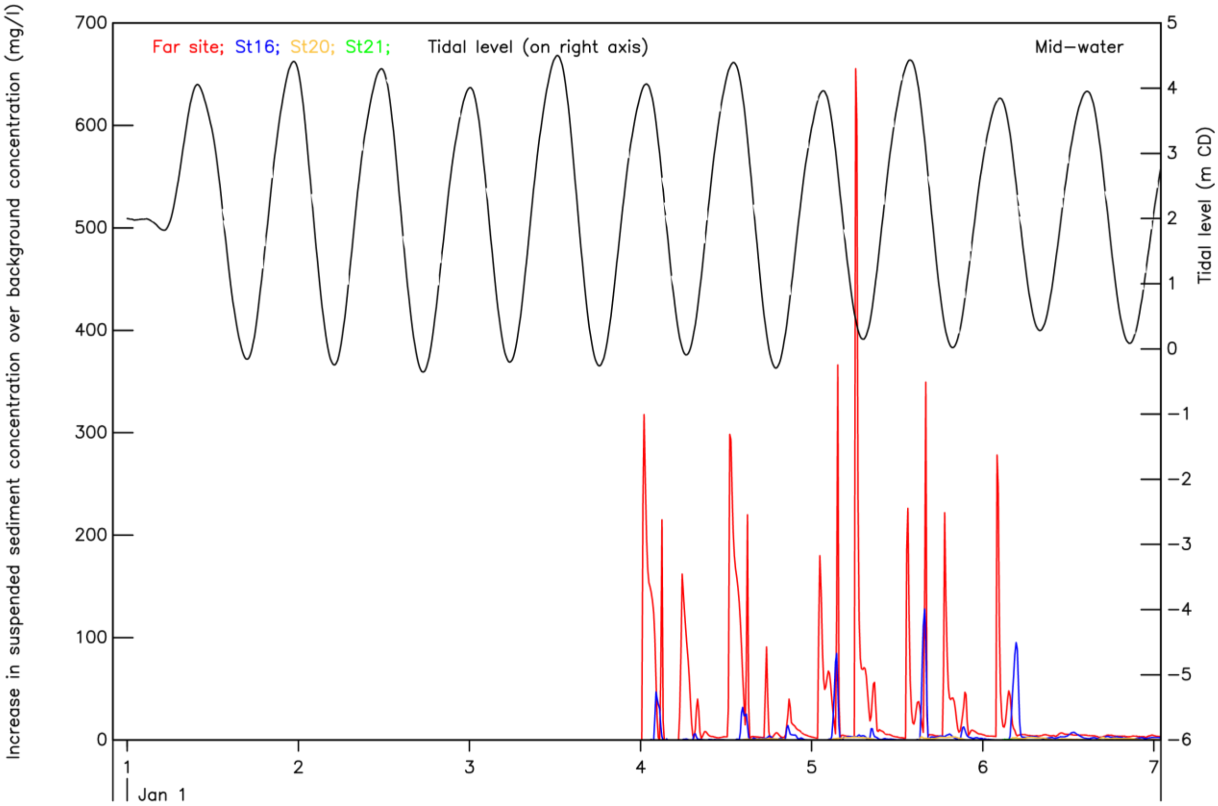

Figure A 44 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth during the campaign period at stations: Far site, St16, St20 and St21.

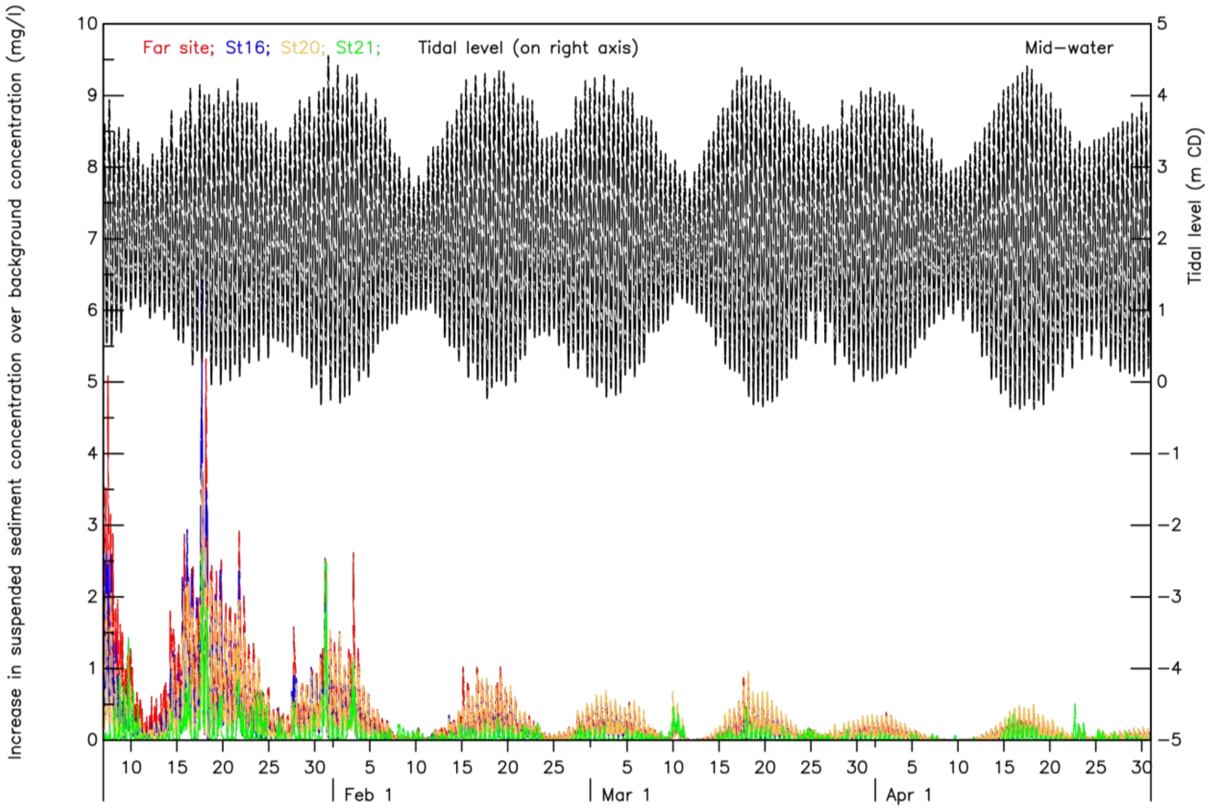

Figure A 45 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the three months following the campaign period at stations: Far site, St16, St20 and St21.

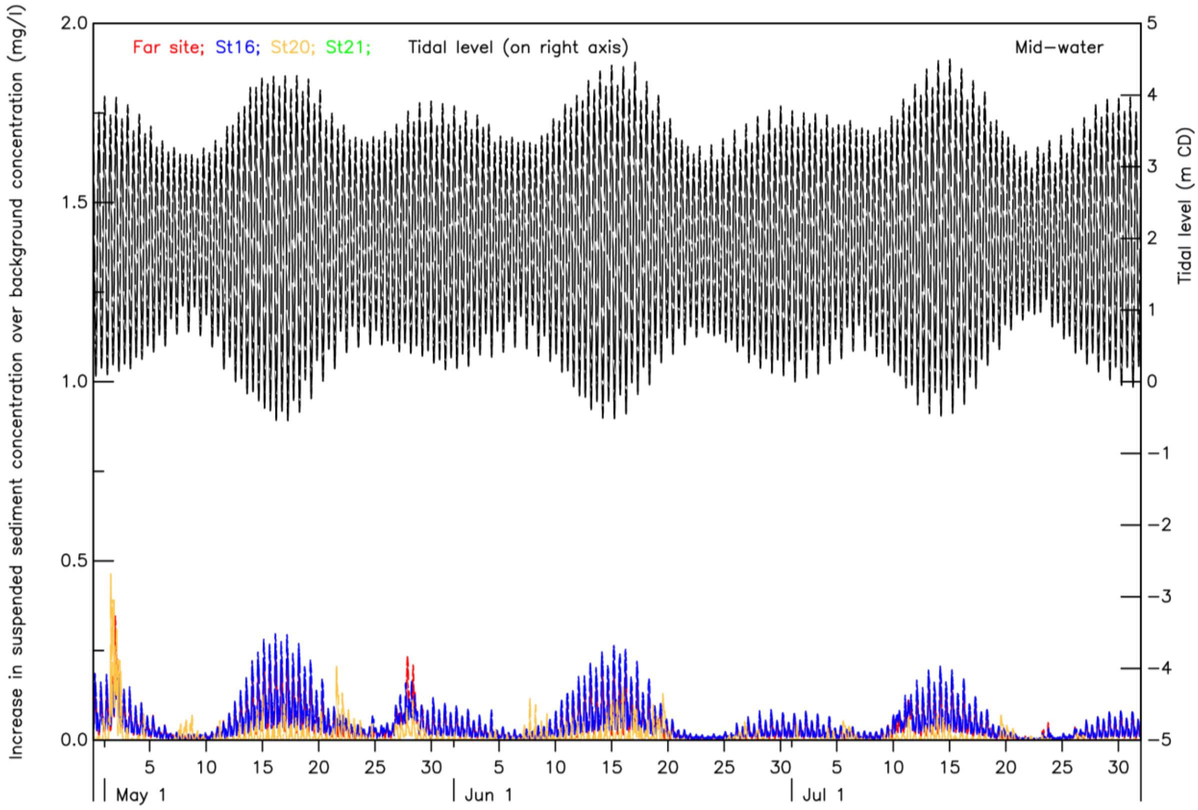

Figure A 46 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the four to six months following the campaign period at stations: Far site, St16, St20 and St21.

Table A.3: **Scenario A: Statistical indicators for elevated suspended concentrations at mid-depth at stations Far site, St16, St20 and St21.**

	Suspended sediment concentration at mid-depth			
	Far site (mg/l)	**St16 (mg/l)**	**St20 (mg/l)**	**St21 (mg/l)**
Peak	655.51	128.03	3.79	2.63
99^{th} percentile	4.15	2.30	1.64	0.62
95^{th} percentile	1.18	0.66	0.63	0.19
50^{th} percentile	0.06	0.04	0.05	0.01
Mean	0.68	0.21	0.15	0.05

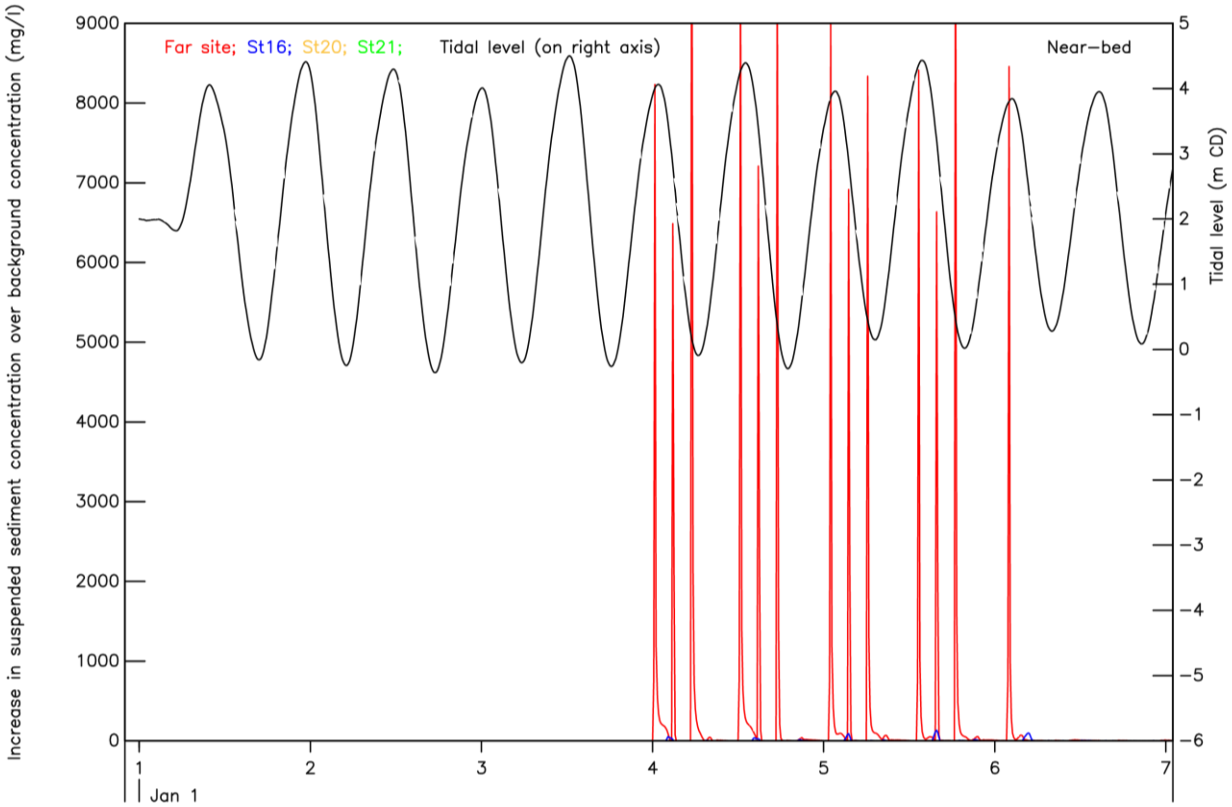

Figure A 47 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) above the bed during the campaign period at stations: Far site, St16, St20 and St21.

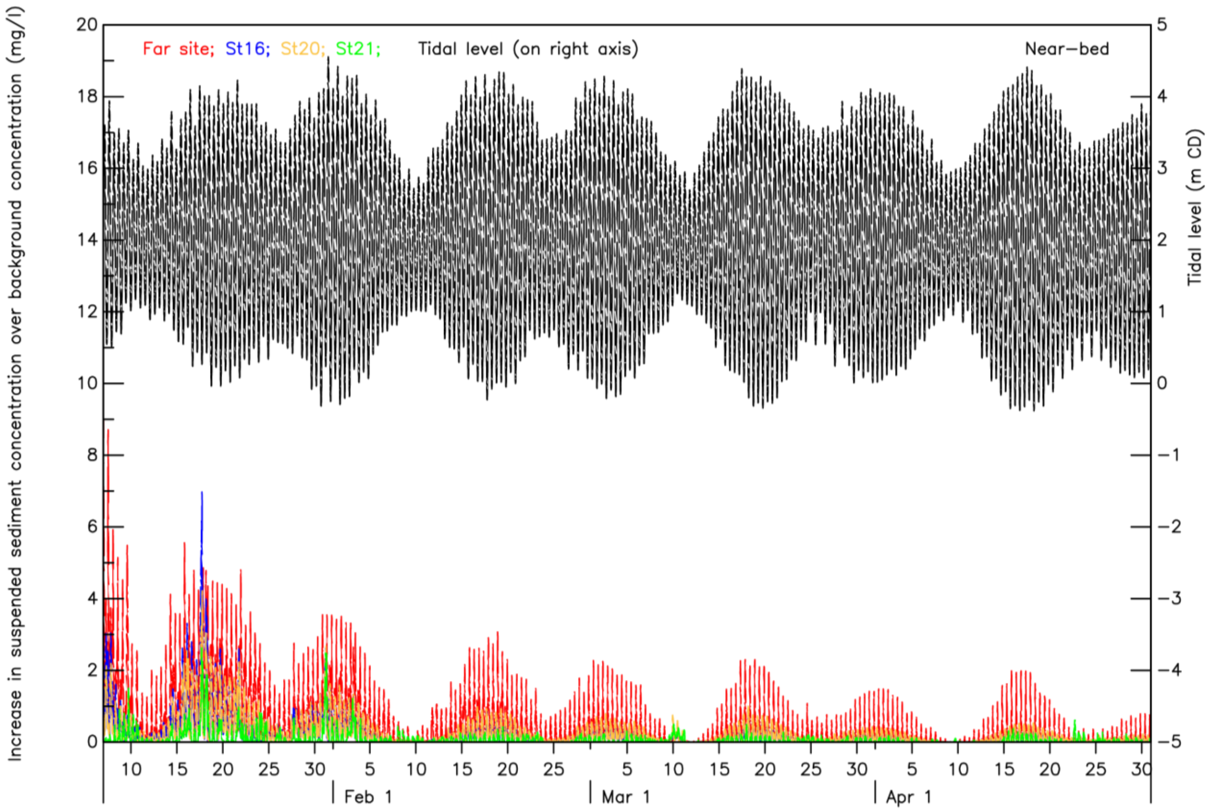

Figure A 48 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the three months following the campaign period at stations Far site, St16, St20 and St21.

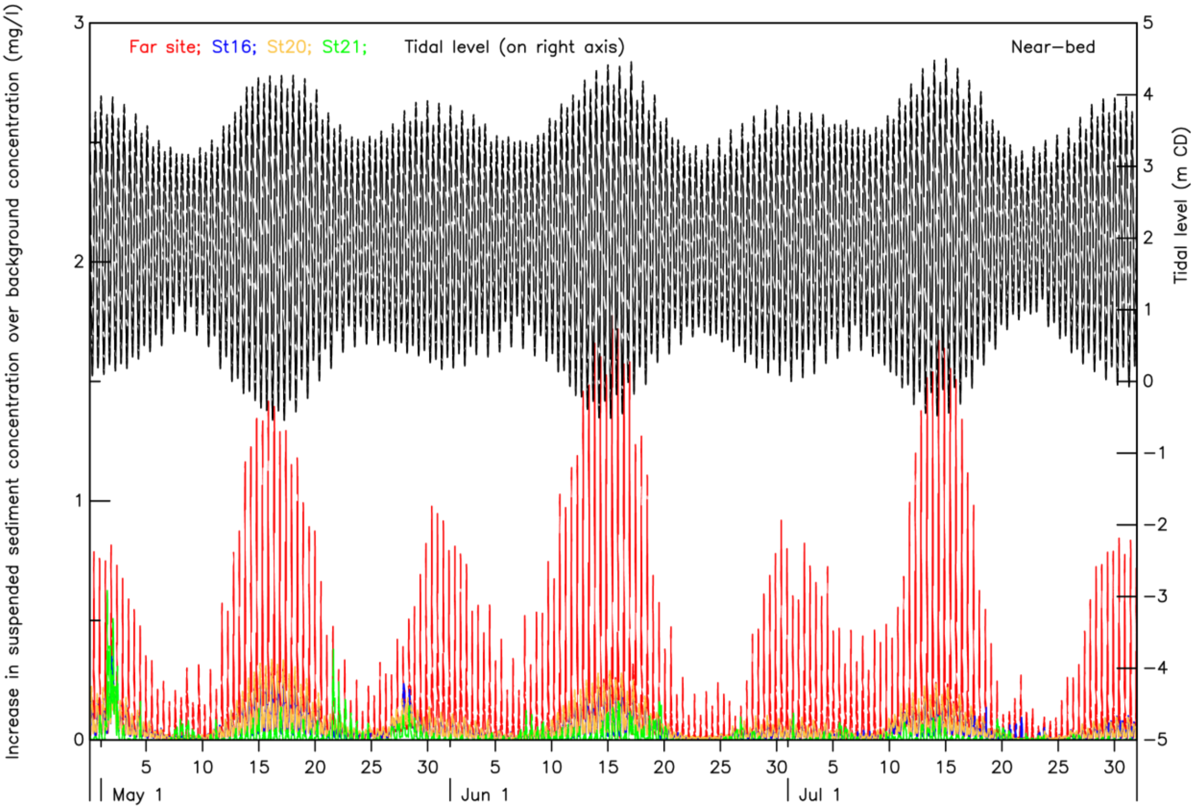

Figure A 49 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the four to six months following the campaign period at stations: Far site, St16, St20 and St21.

Table A.4: **Scenario A: Statistical indicators for elevated suspended concentrations at the bed at Far site, St16, St20 and St21.**

	Suspended sediment concentration at the bed			
	Far site (mg/l)	**St16 (mg/l)**	**St20 (mg/l)**	**St21 (mg/l)**
Peak	11731.0	133.09	4.22	2.63
99th percentile	5.37	2.55	1.79	0.67
95th percentile	1.93	0.71	0.69	0.24
50th percentile	0.1	0.05	0.06	0.01
Mean	5.37	0.23	0.17	0.05

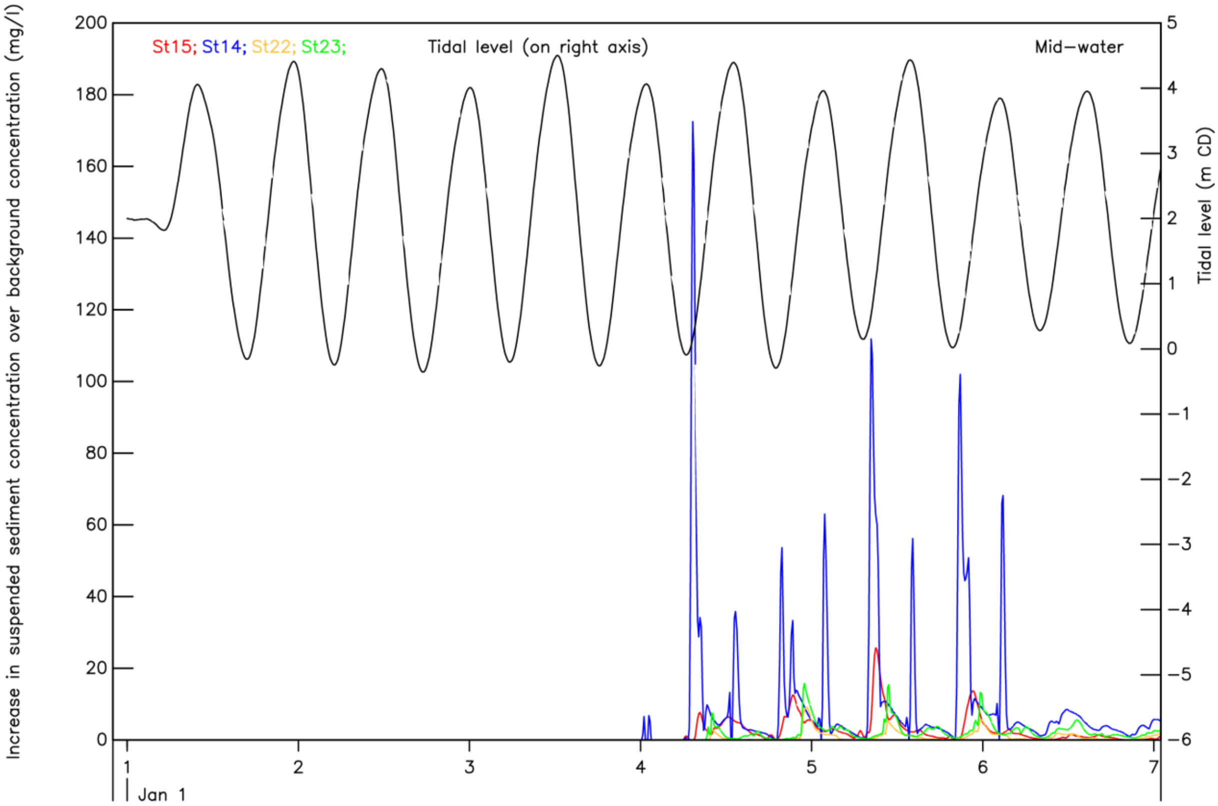

Figure A 50 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth during the campaign period at stations: St15, St14, St22 and St23.

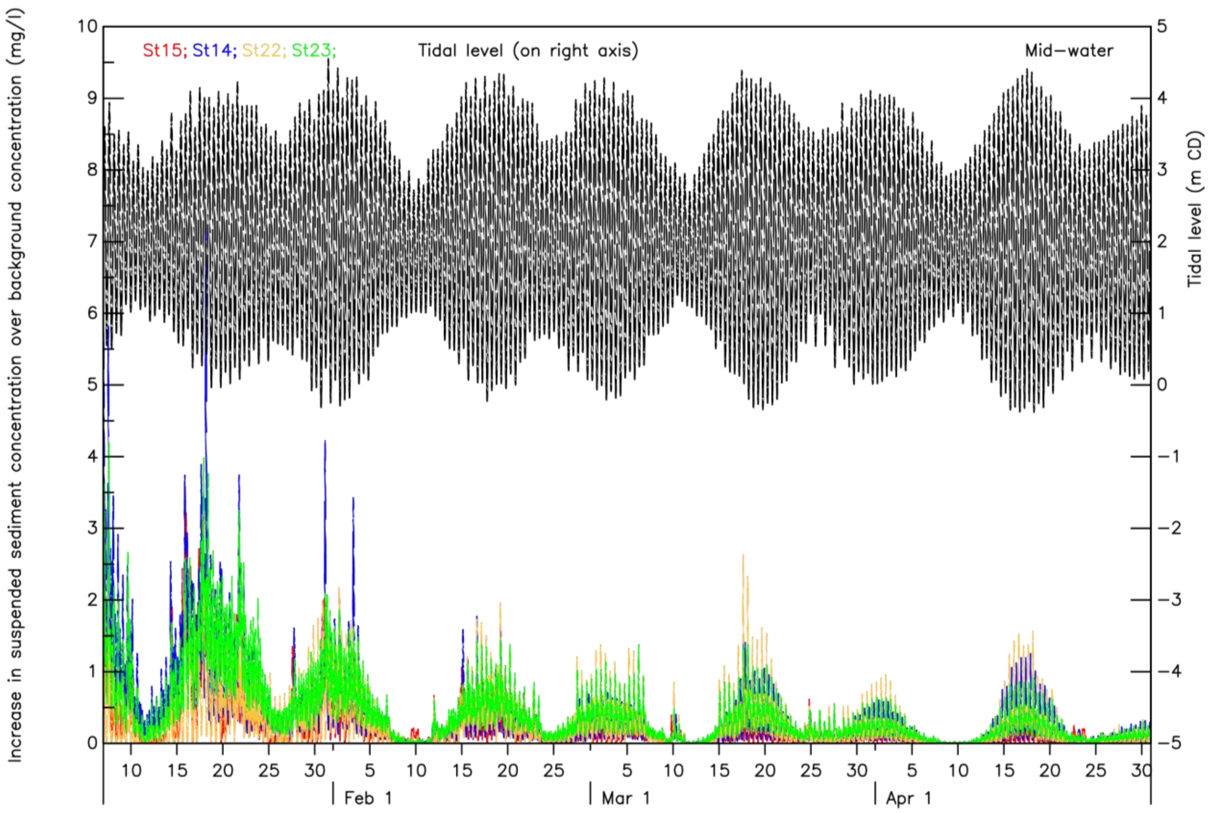

Figure A 51 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the three months following the campaign period at stations: St15, St14, St22 and St23.

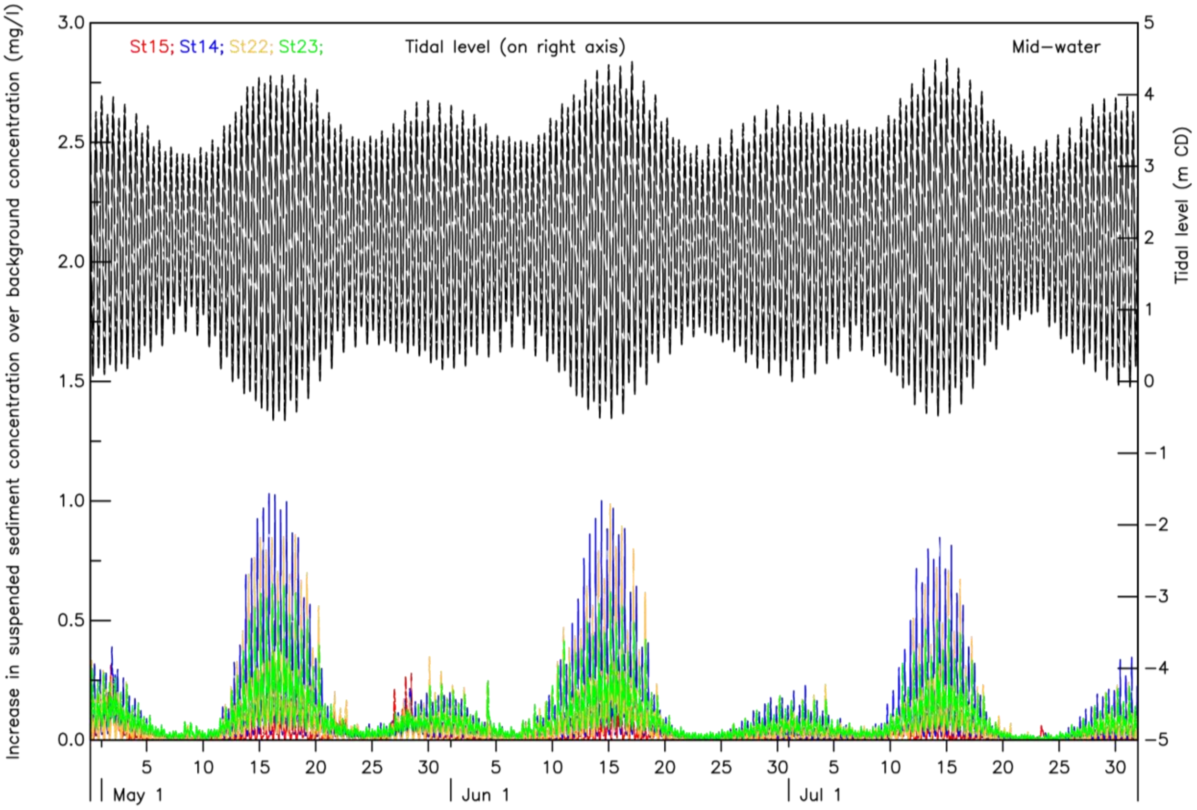

Figure A 52 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the four to six months following the campaign period at stations St15, St14, St22 and St23.

Table A.5: **Scenario A: Statistical indicators for elevated suspended concentrations at mid-depth at stations St15, St14, St22 and St23.**

	Suspended sediment concentration at mid-depth			
	St15 (mg/l)	**St14 (mg/l)**	**St22 (mg/l)**	**St23 (mg/l)**
Peak	25.75	172.53	9.18	15.83
99th percentile	2.10	3.74	1.63	2.41
95th percentile	0.66	1.32	0.86	1.24
50th percentile	0.03	0.07	0.07	0.11
Mean	0.16	0.39	0.20	0.30

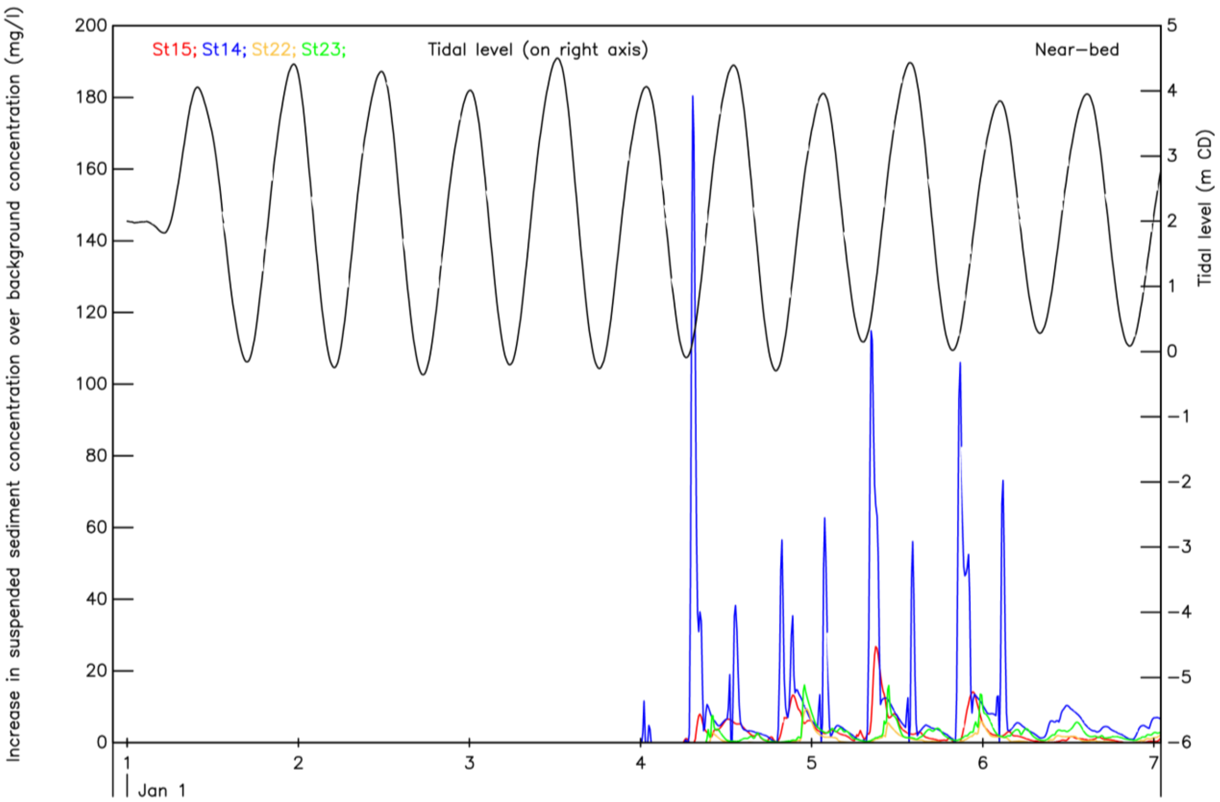

Figure A 53 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed during the campaign period at stations: St15, St14, St22 and St23.

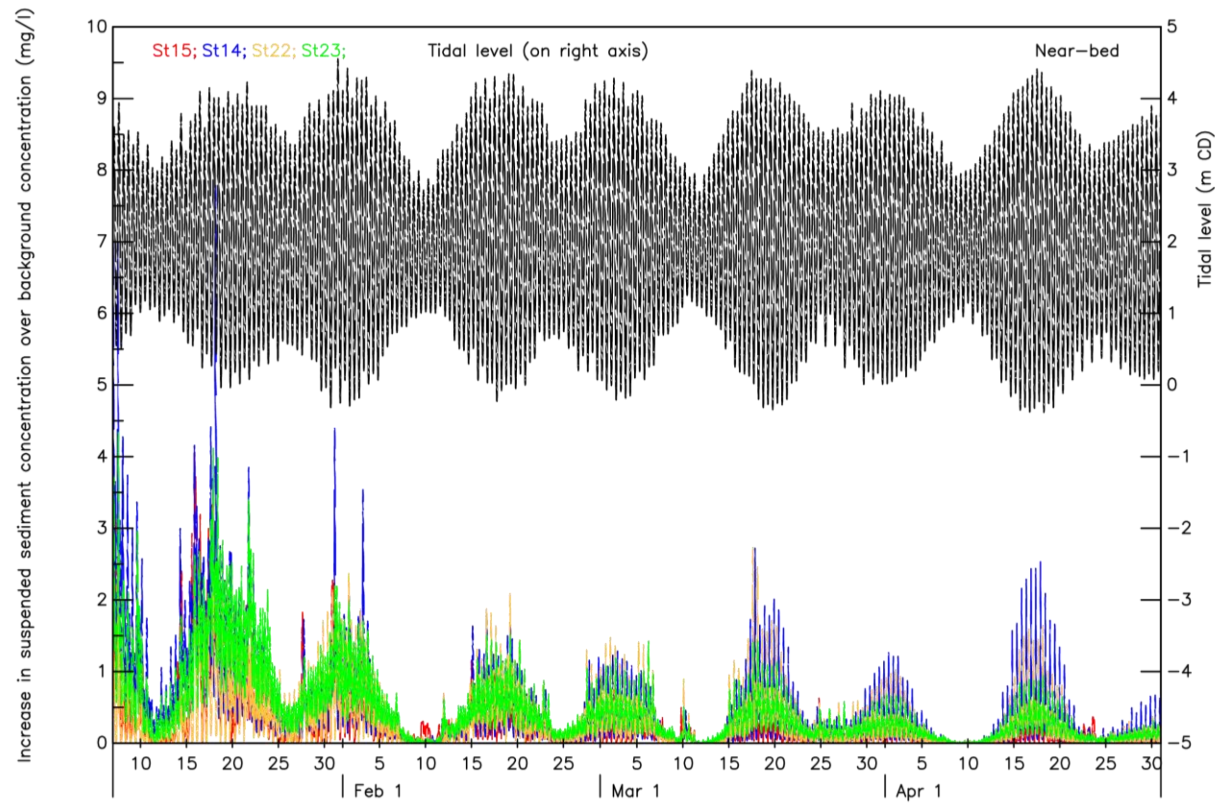

Figure A 54 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the three months following the campaign period at stations: St15, St14, St22 and St23.

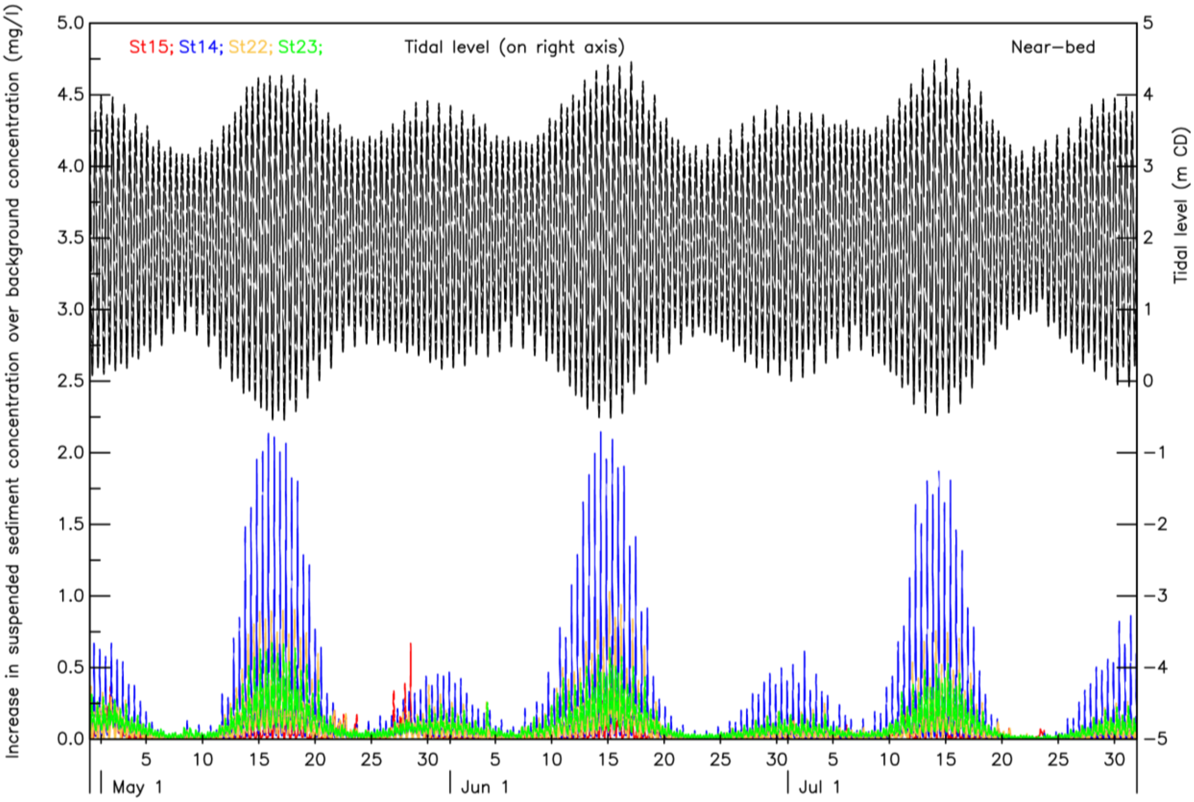

Figure A 55 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the four to six months following the campaign period at stations: St15, St14, St22 and St23.

Table A.6: **Scenario A: Statistical indicators for elevated suspended concentrations at the bed at stations St15, St14, St22 and St23.**

	Suspended sediment concentration at the bed			
	St15 (mg/l)	**St14 (mg/l)**	**St22 (mg/l)**	**St23 (mg/l)**
Peak	26.79	180.41	9.45	16.08
99^{th} percentile	2.40	4.17	1.76	2.57
95^{th} percentile	0.76	1.58	0.96	1.35
50^{th} percentile	0.03	0.09	0.08	0.12
Mean	0.19	0.46	0.22	0.32

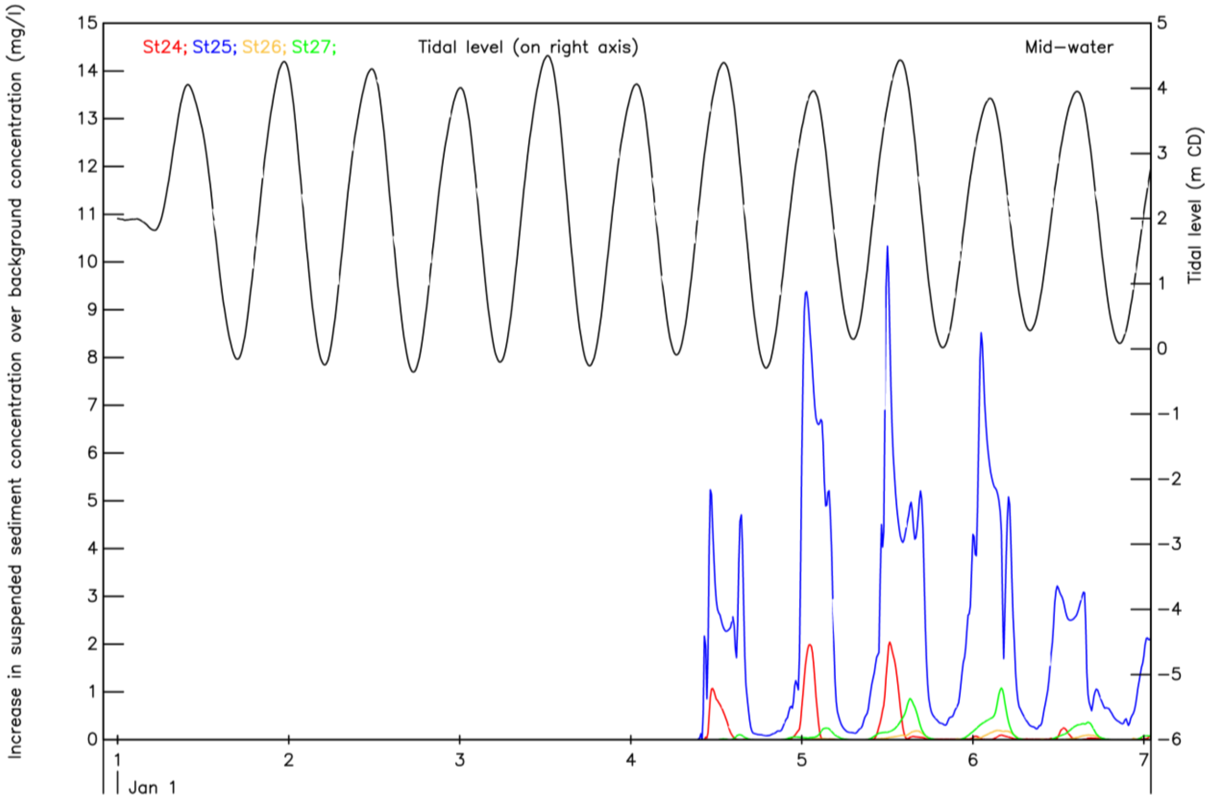

Figure A 56 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth during the campaign period at stations: St24, St25, St26 and St27.

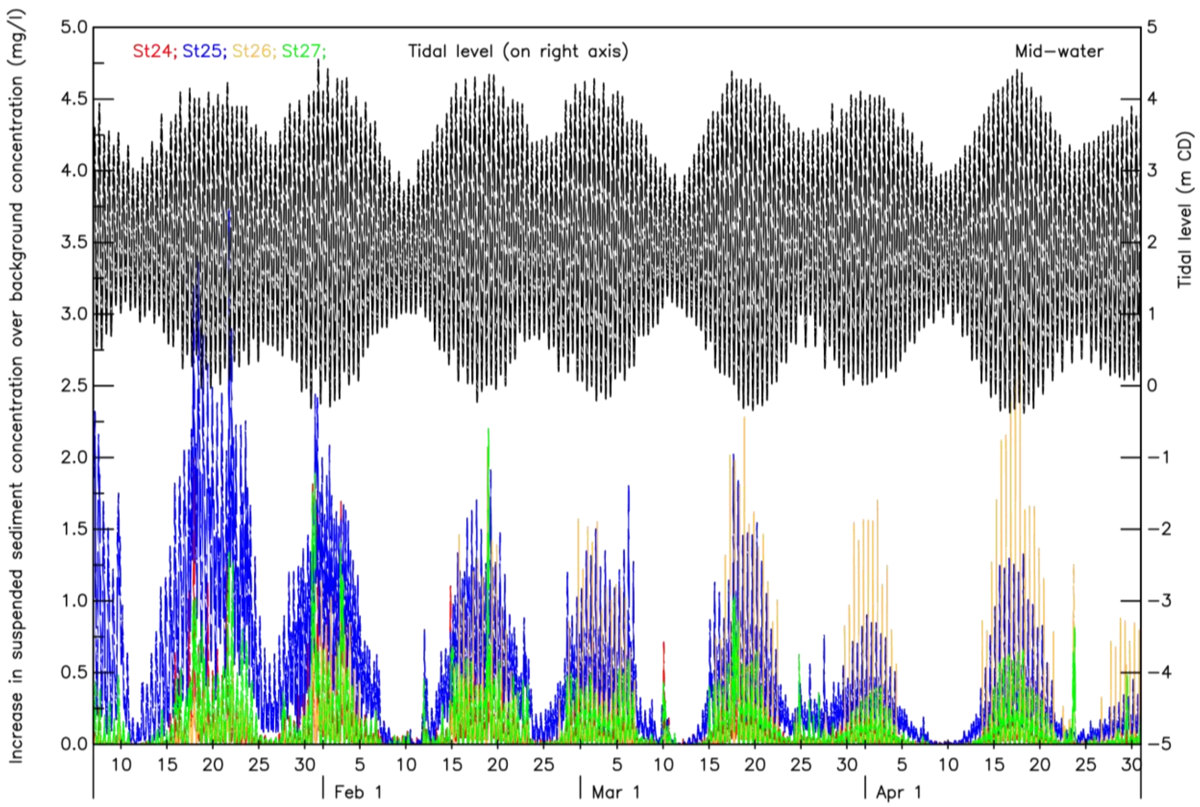

Figure A 57 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the three months following the campaign period at stations: St24, St25, St26 and St27.

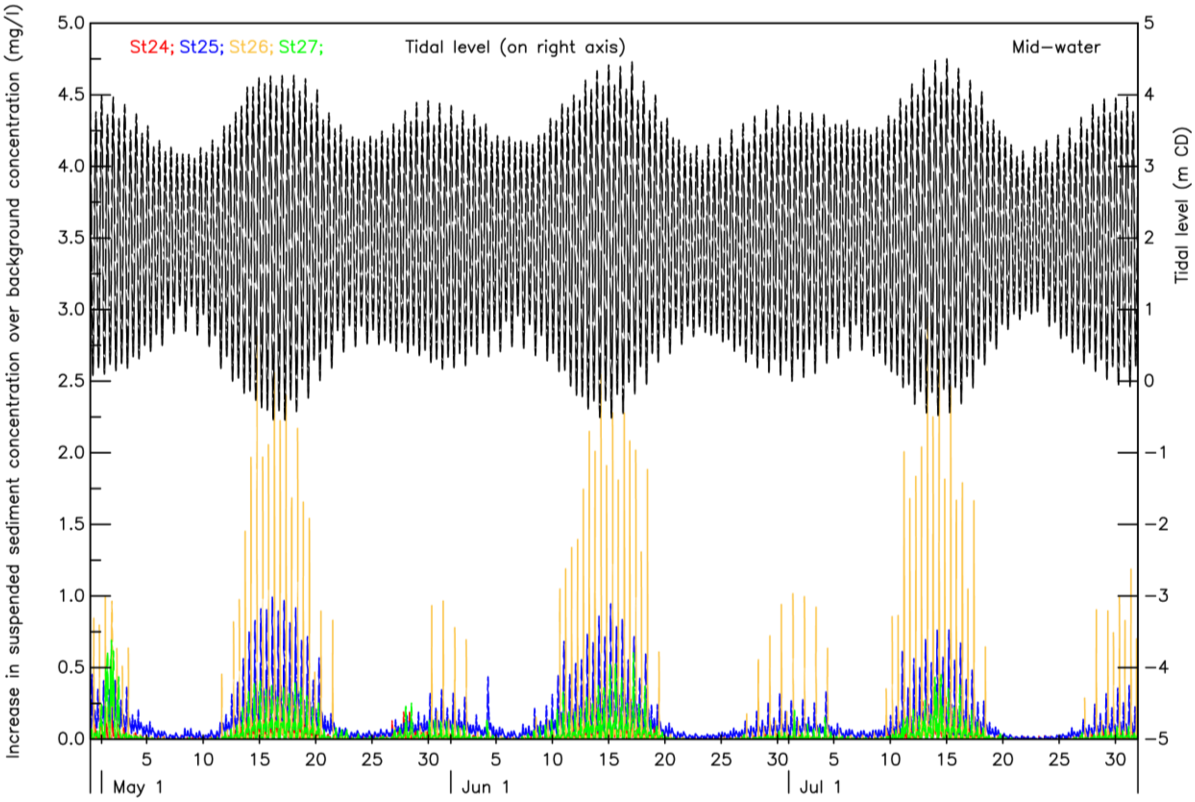

Figure A 58 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the four to six months following the campaign period at stations: St24, St25, St26 and St27.

Table A.7: **Scenario A: Statistical indicators for elevated suspended concentrations at mid-depth at stations St24, St25, St26 and St27.**

	Suspended sediment concentration at mid-depth			
	St24 (mg/l)	**St25 (mg/l)**	**St26 (mg/l)**	**St27 (mg/l)**
Peak	2.04	10.33	2.94	2.20
99th percentile	0.60	2.25	0.85	0.70
95th percentile	0.22	1.25	0.21	0.39
50th percentile	0.01	0.13	0.00	0.02
Mean	0.05	0.32	0.05	0.08

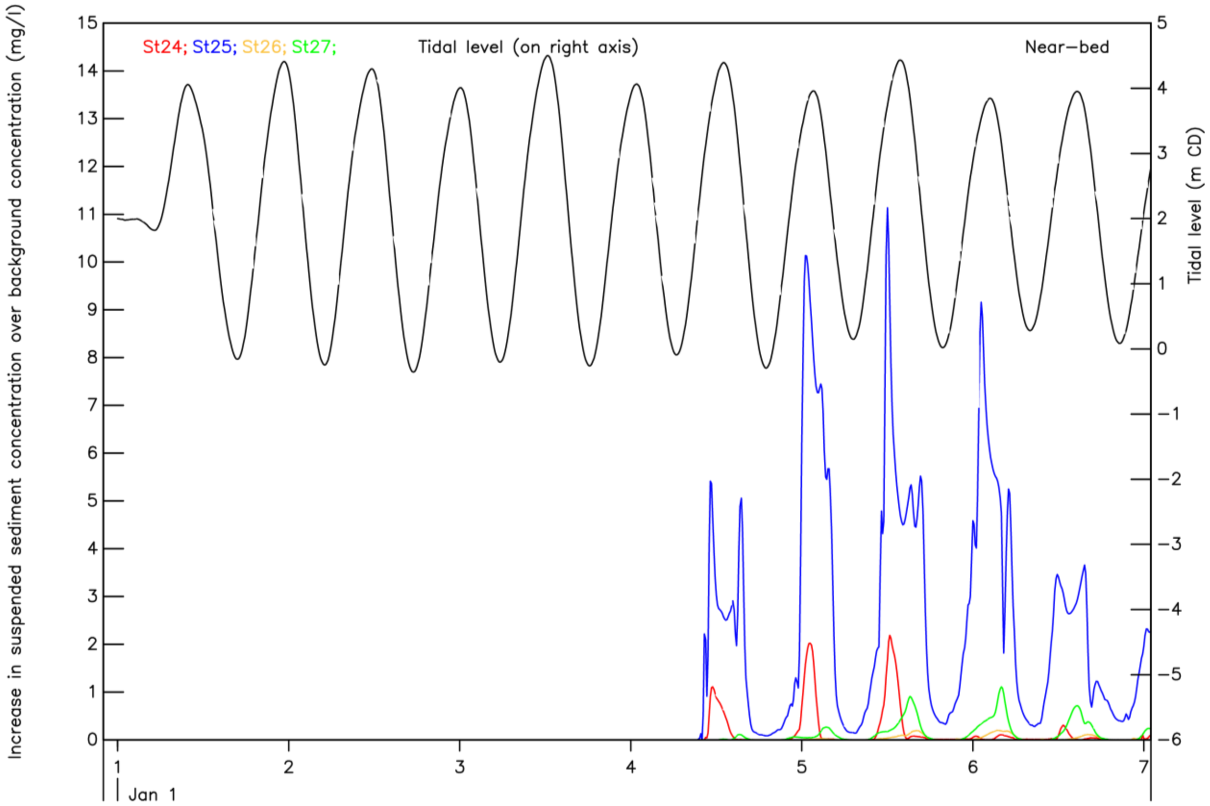

Figure A 59 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed during the campaign period at stations: St24, St25, St26 and St27.

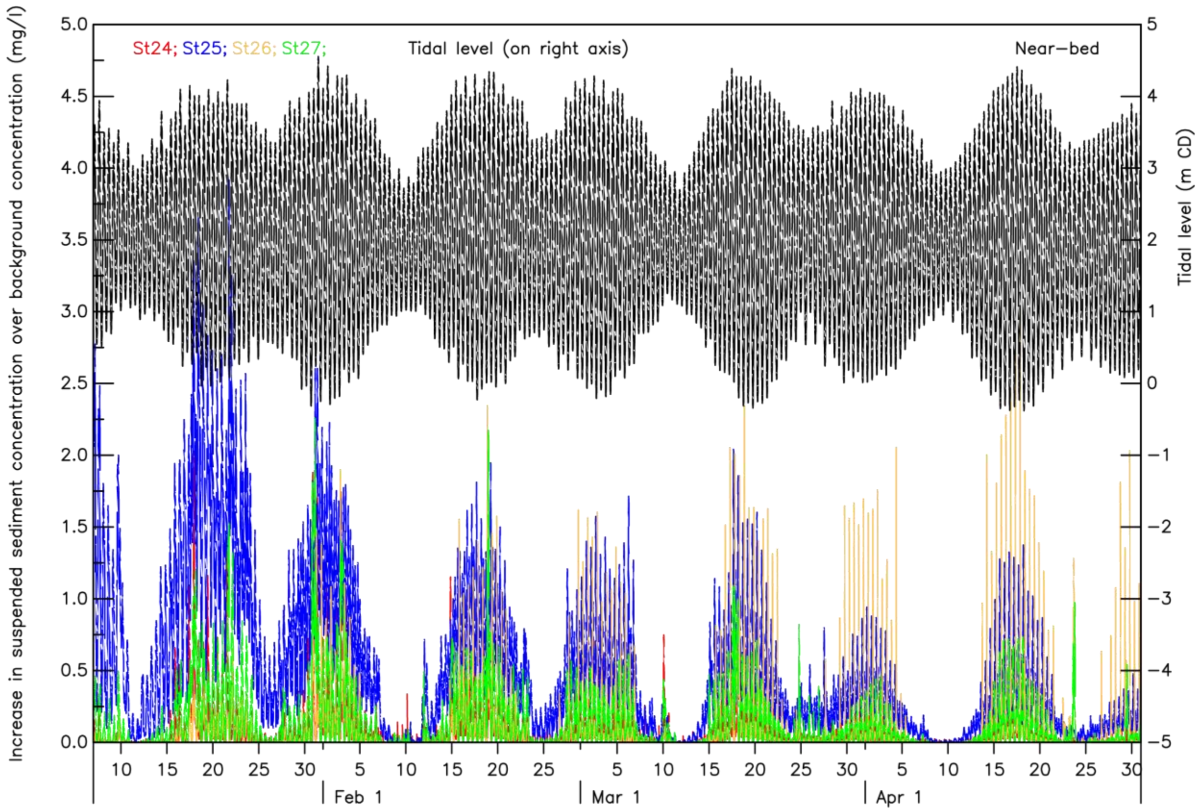

Figure A 60 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the three months following the campaign period at stations: St24, St25, St26 and St27.

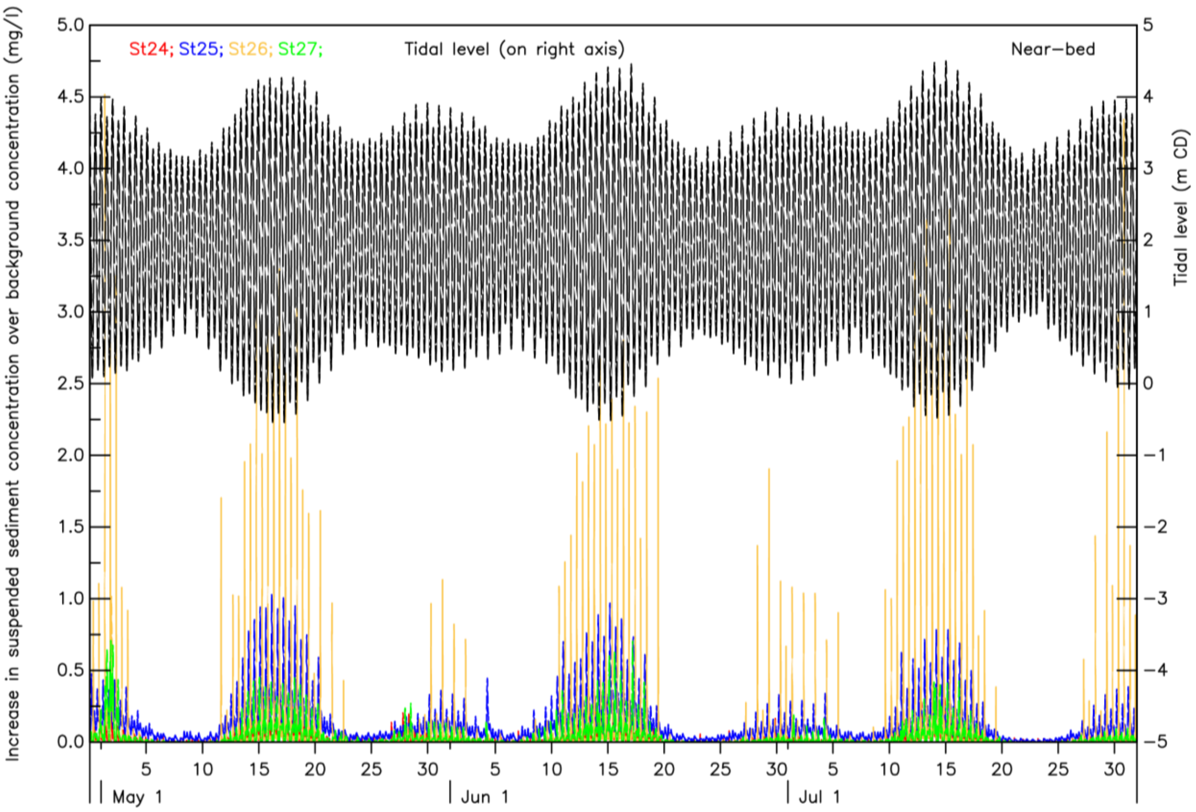

Figure A 61 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the four to six months following the campaign period at stations: St24, St25, St26 and St27.

Table A.8: **Scenario A: Statistical indicators for elevated suspended concentrations at the bed at stations St24, St25, St26 and St27.**

	Suspended sediment concentration at the bed			
	St24 (mg/l)	**St25 (mg/l)**	**St26 (mg/l)**	**St27 (mg/l)**
Peak	2.19	11.14	4.52	2.26
99th percentile	0.63	2.48	1.00	0.78
95th percentile	0.24	1.36	0.23	0.44
50th percentile	0.01	0.15	0.00	0.02
Mean	0.06	0.36	0.05	0.09

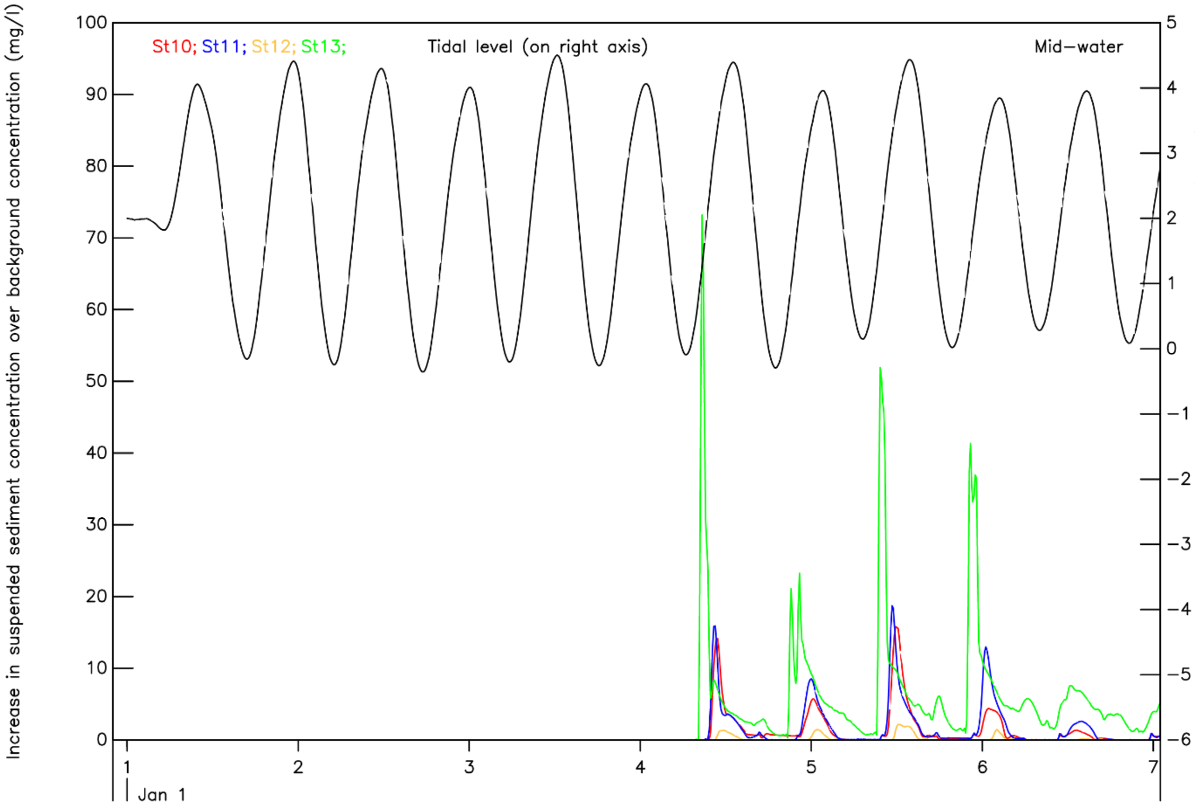

Figure A 62 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth during the campaign period at stations: St10, St11, St12 and St13.

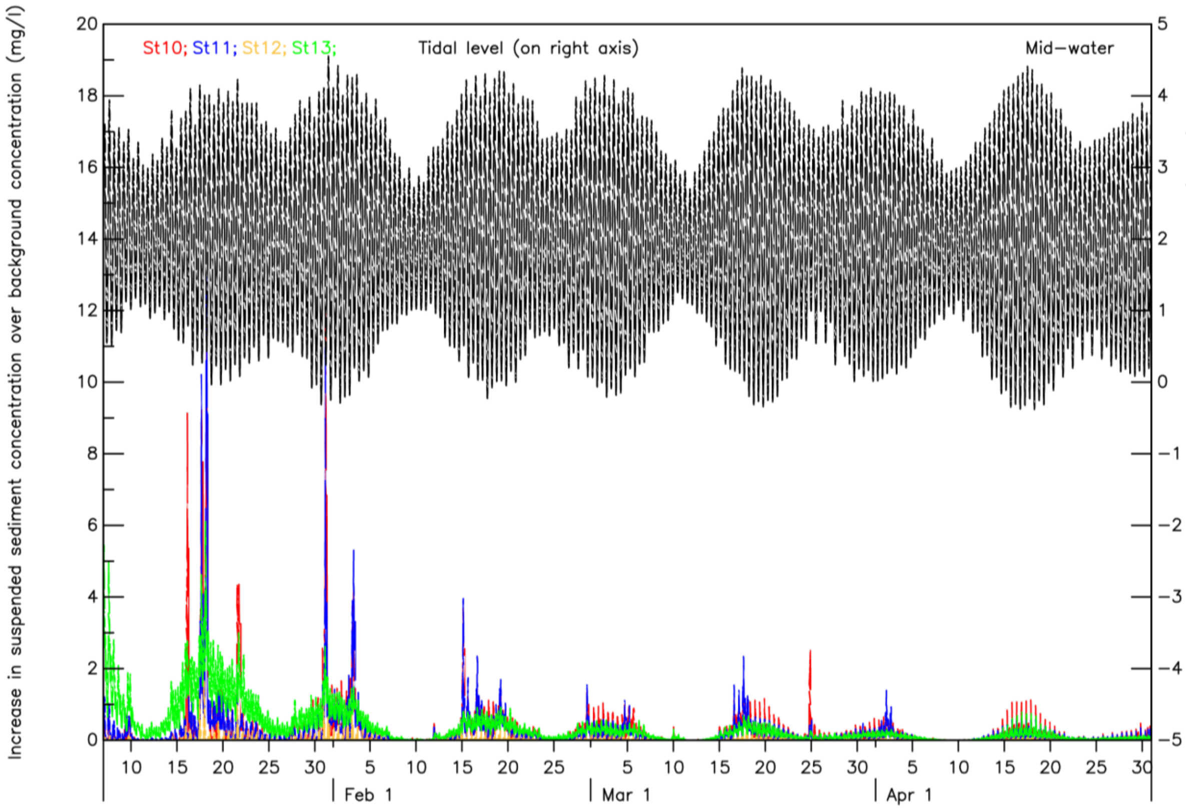

Figure A 63 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the three months following the campaign period at stations: St10, St11, St12 and St13.

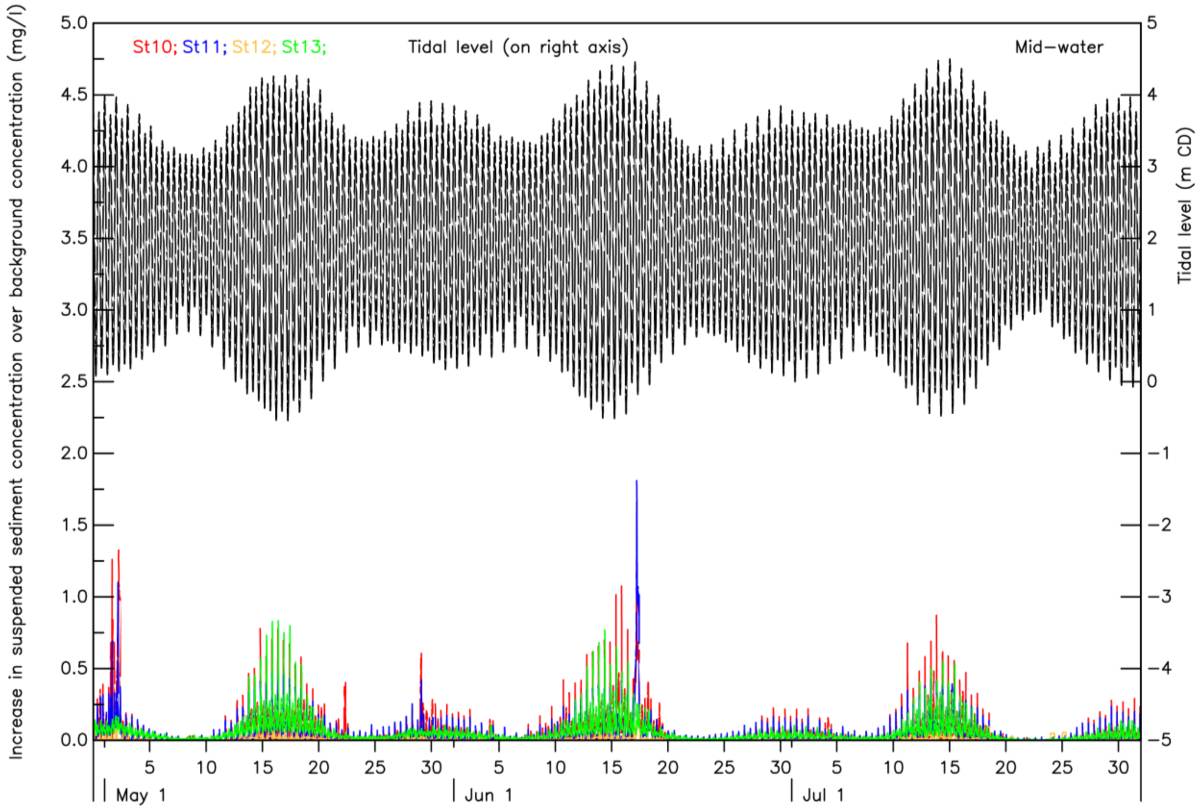

Figure A 64 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the four to six months following the campaign period at stations: St10, St11, St12 and St13.

Table A.9: **Scenario A: Statistical indicators for elevated suspended concentrations at mid-depth at stations St10, St11, St12 and St13.**

	Suspended sediment concentration at mid-depth			
	St10 (mg/l)	**St11 (mg/l)**	**St12 (mg/l)**	**St13 (mg/l)**
Peak	15.80	18.73	2.17	73.21
99th percentile	2.81	1.82	0.22	3.55
95th percentile	0.68	0.59	0.06	1.25
50th percentile	0.02	0.02	0.00	0.07
Mean	0.18	0.15	0.02	0.31

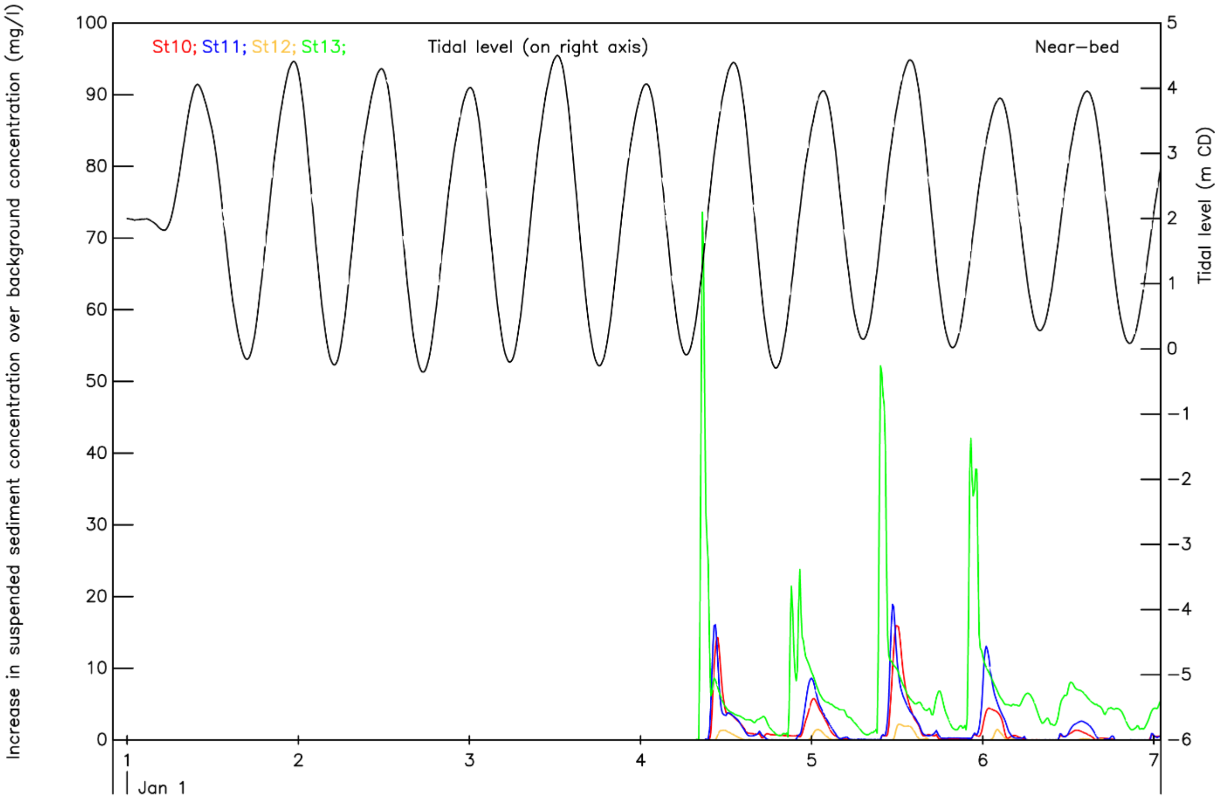

Figure A 65 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed during the campaign period at stations: St10, St11, St12 and St13.

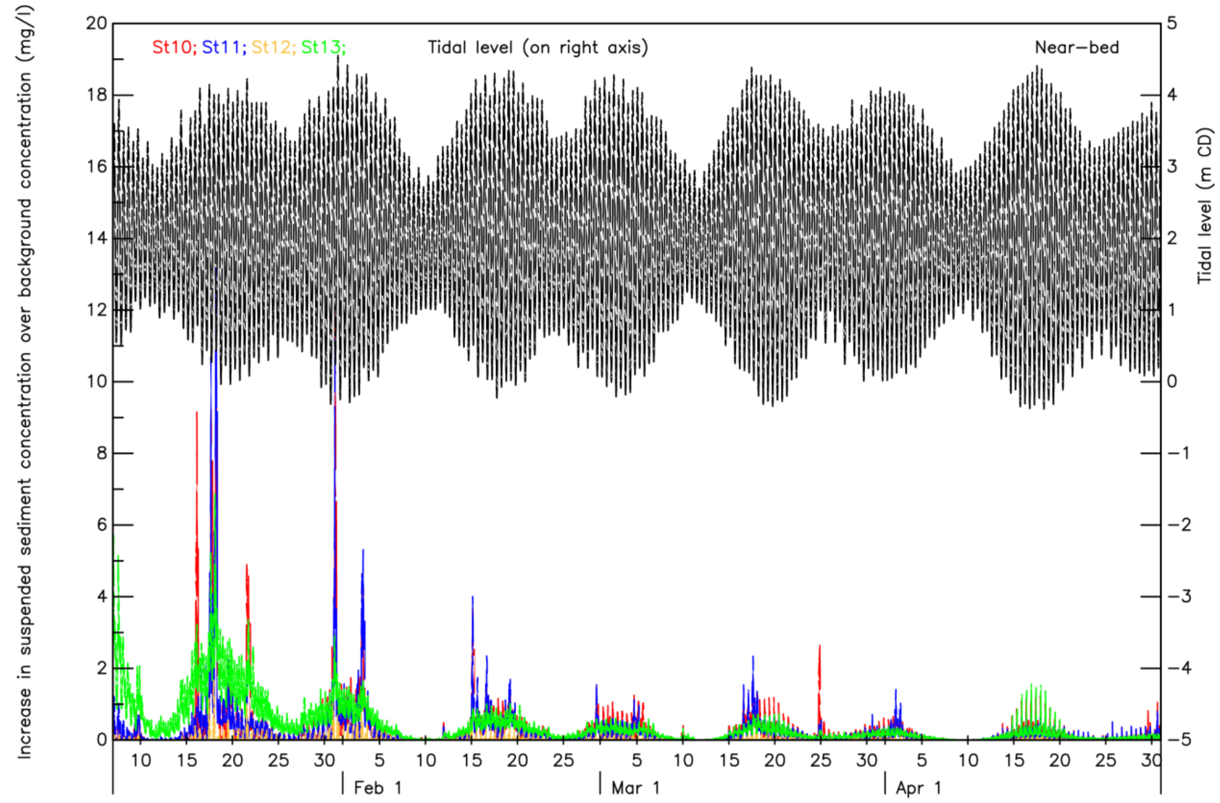

Figure A 66 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the three months following the campaign period at stations: St10, St11, St12 and St13.

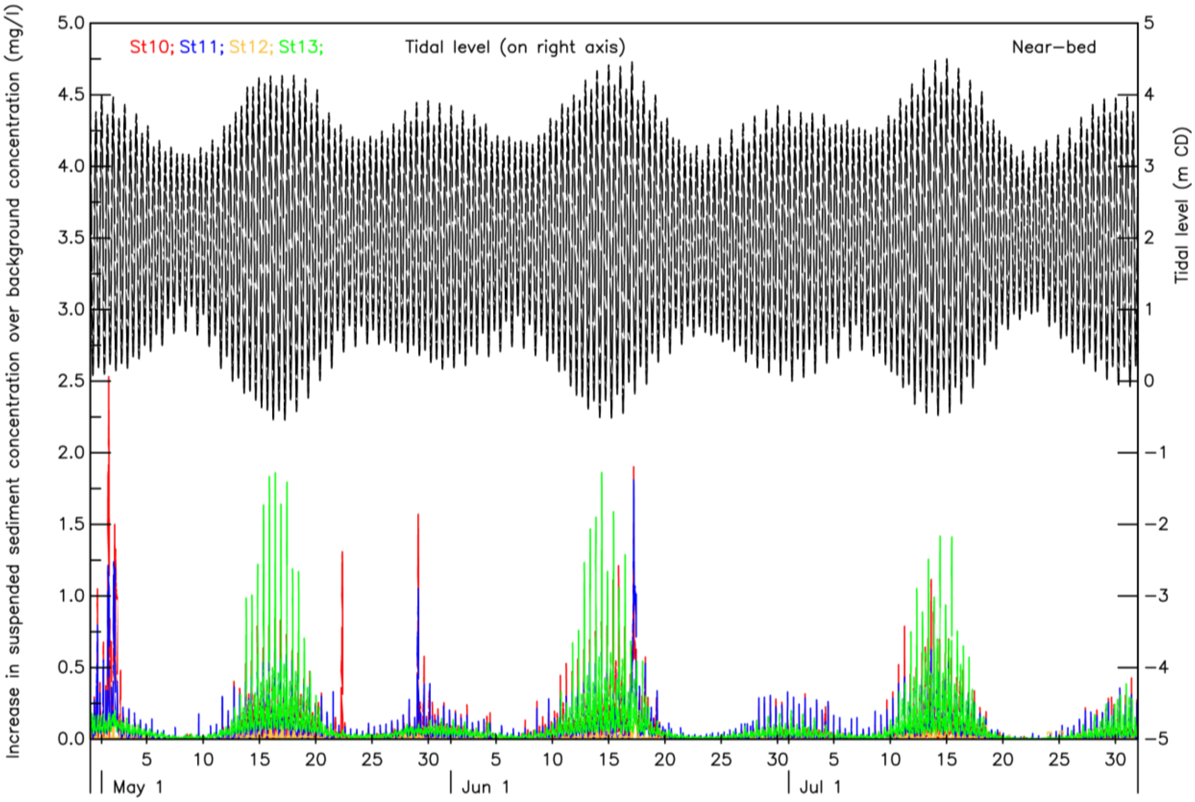

Figure A 67 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the four to six months following the campaign period at stations: St10, St11, St12 and St13.

Table A.10: **Scenario A: Statistical indicators for elevated suspended concentrations at the bed at stations St10, St11, St12 and St13.**

	Suspended sediment concentration at the bed			
	St10 (mg/l)	**St11 (mg/l)**	**St12 (mg/l)**	**St13 (mg/l)**
Peak	15.95	18.91	2.20	73.64
99th percentile	3.13	2.03	0.27	3.93
95th percentile	0.75	0.66	0.07	1.41
50th percentile	0.02	0.02	0.00	0.08
Mean	0.19	0.16	0.02	0.35

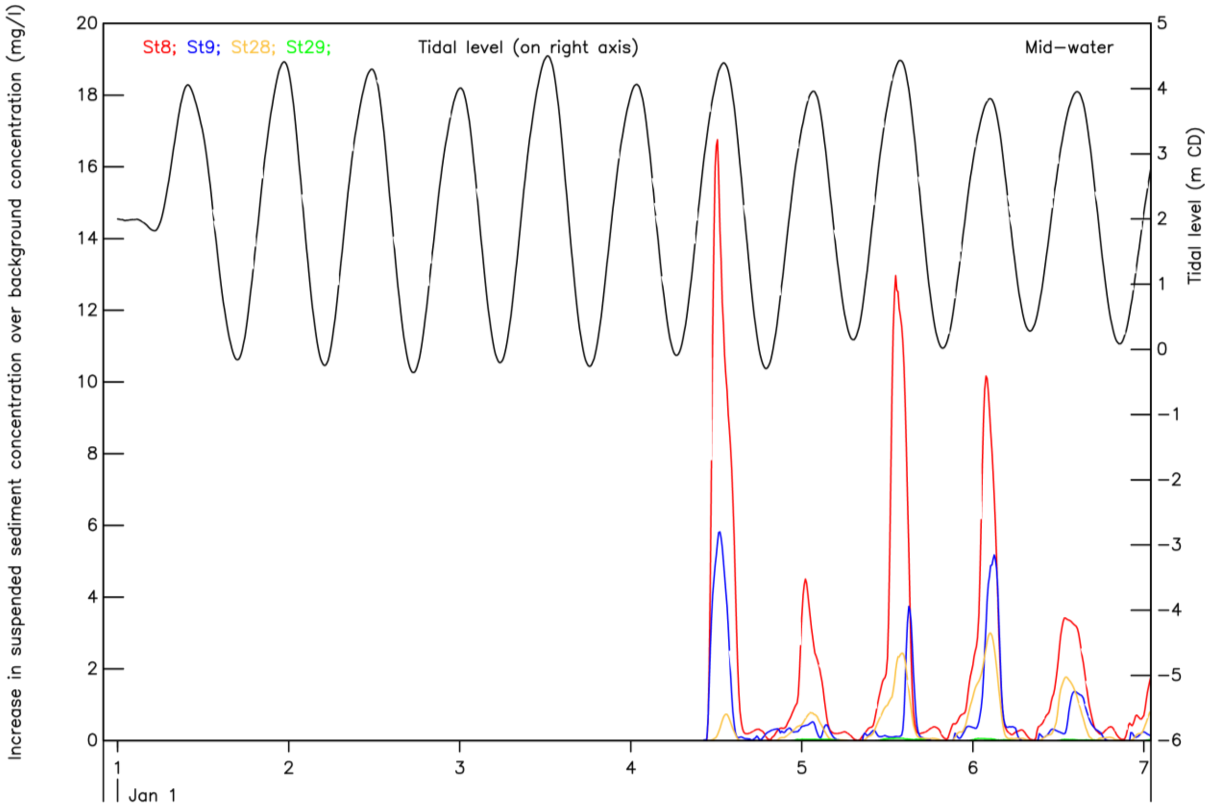

Figure A 68 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth during the campaign period at stations: St8, St9, St28 and St29.

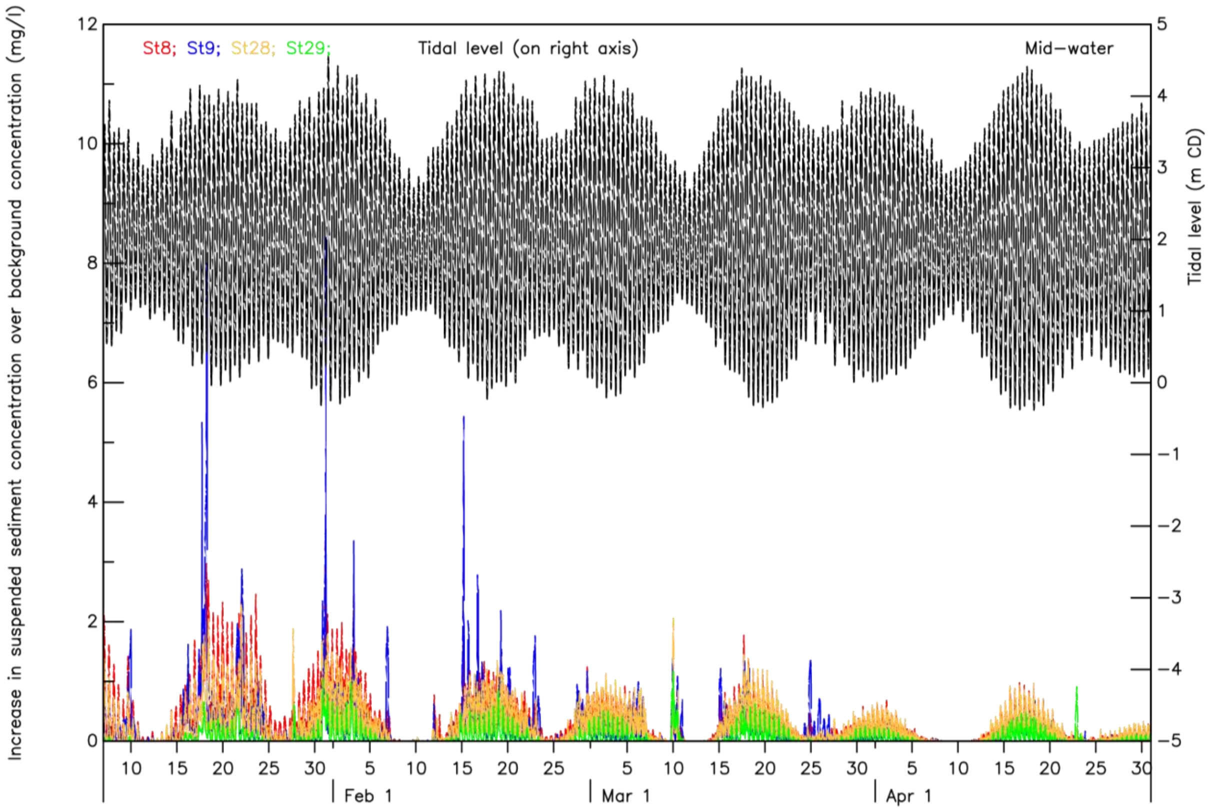

Figure A 69 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the three months following the campaign period at stations: St8, St9, St28 and St29.

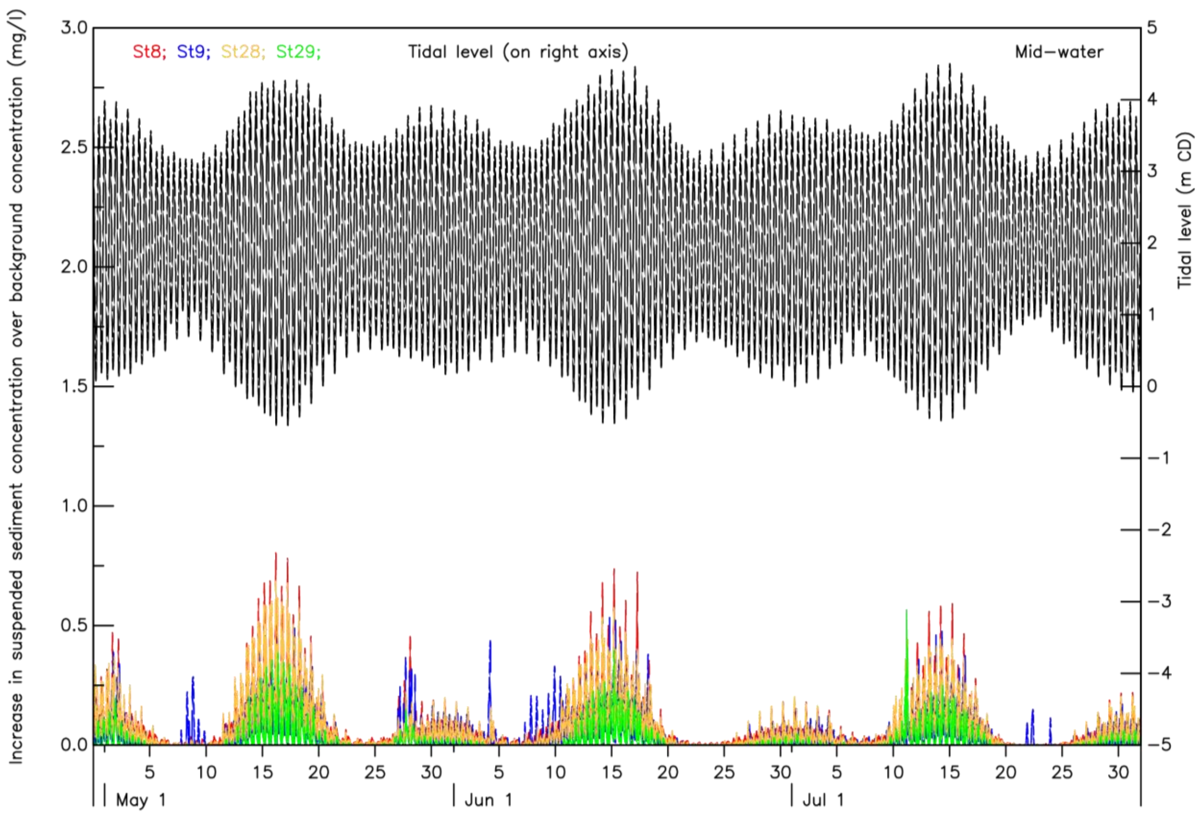

Figure A 70 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the four to six months following the campaign period at stations: St8, St9, St28 and St29.

Table A.11: **Scenario A: Statistical indicators for elevated suspended concentrations at mid-depth at stations St8, St9, St28 and St29.**

	Suspended sediment concentration at mid-depth			
	St8 (mg/l)	**St9 (mg/l)**	**St28 (mg/l)**	**St29 (mg/l)**
Peak	16.76	8.43	3.00	1.16
99th percentile	1.90	1.67	1.30	0.51
95th percentile	0.95	0.62	0.75	0.23
50th percentile	0.08	0.02	0.06	0.00
Mean	0.24	0.14	0.17	0.04

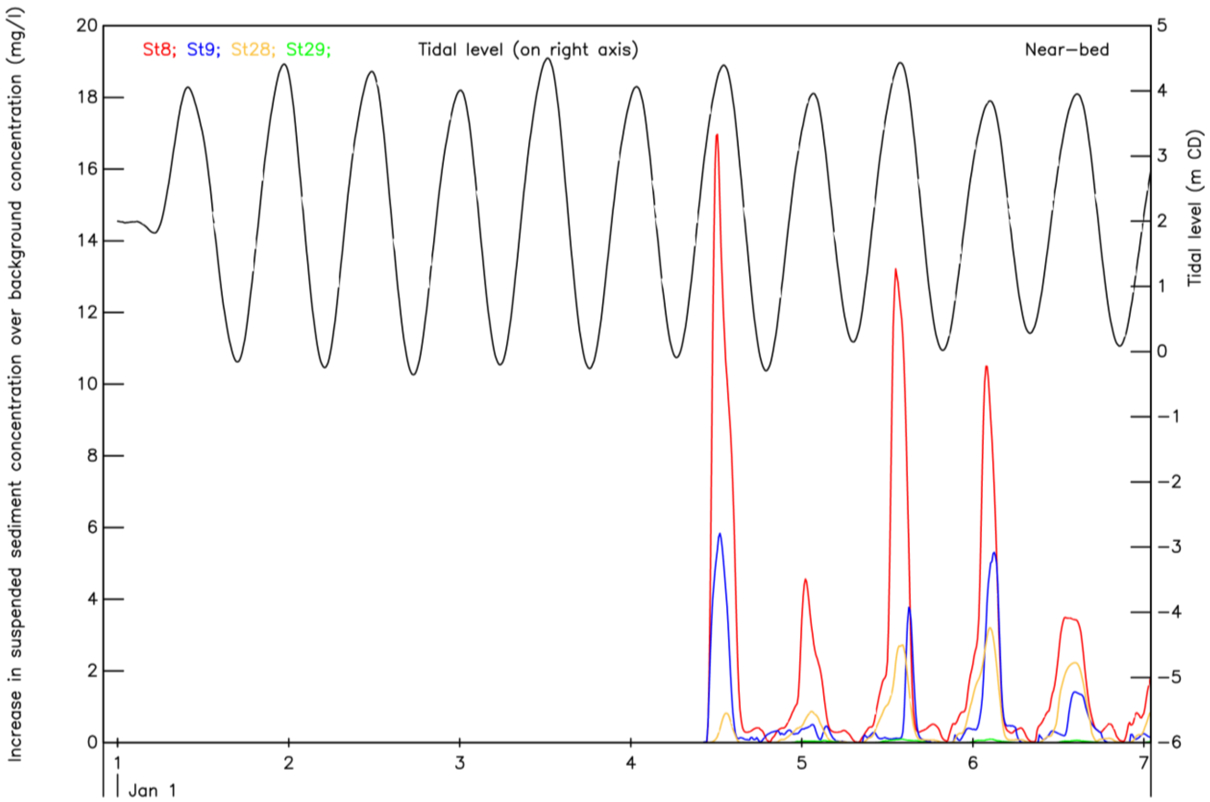

Figure A 71 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed during the campaign period at stations: St8, St9, St28 and St29.

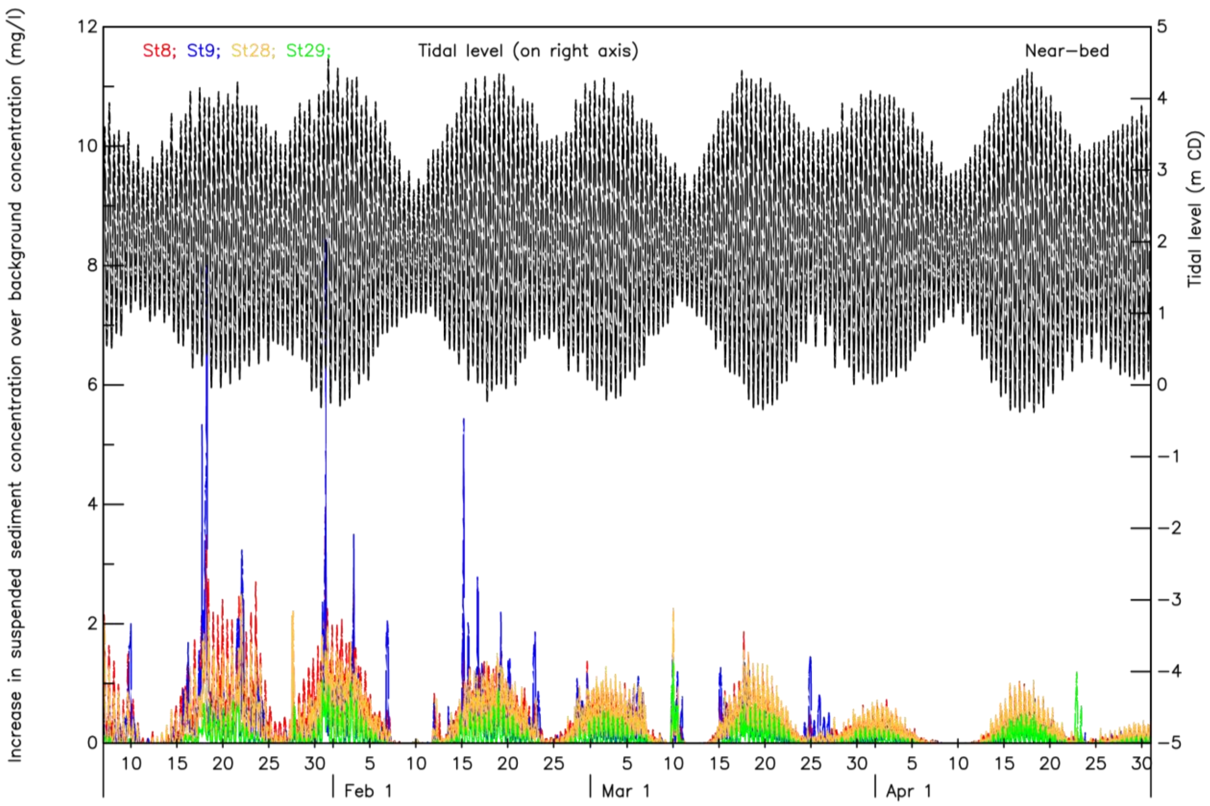

Figure A 72 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the three months following the campaign period at stations: St8, St9, St28 and St29.

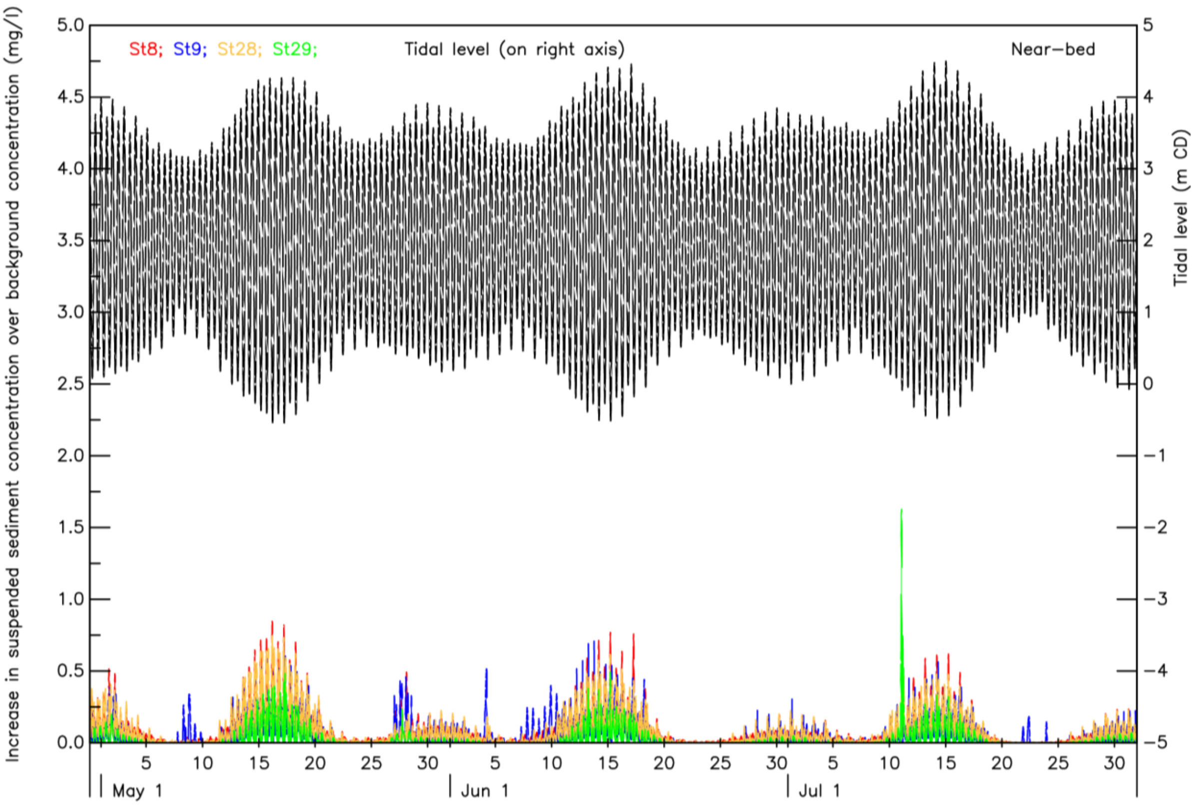

Figure A 73 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the four to six months following the campaign period at stations: St8, St9, St28 and St29.

Table A.12: **Scenario A: Statistical indicators for elevated suspended concentrations at the bed at stations St8, St9, St28 and St29.**

	Suspended sediment concentration at the bed			
	St8 (mg/l)	St9 (mg/l)	St28 (mg/l)	St29 (mg/l)
Peak	16.97	8.43	3.20	1.63
99th percentile	2.01	1.80	1.46	0.59
95th percentile	1.05	0.68	0.86	0.30
50th percentile	0.09	0.02	0.07	0.00
Mean	0.26	0.15	0.20	0.05

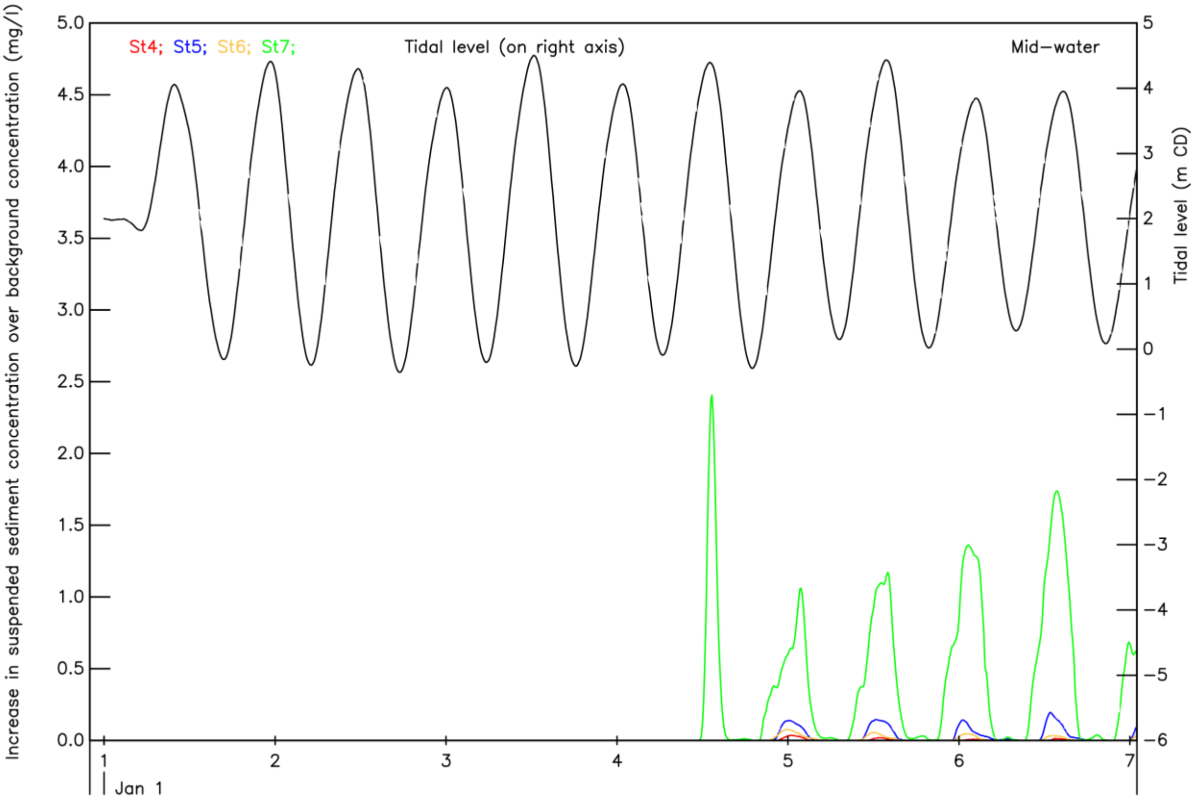

Figure A 74 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth during the campaign period at stations: St4, St5, St6 and St7.

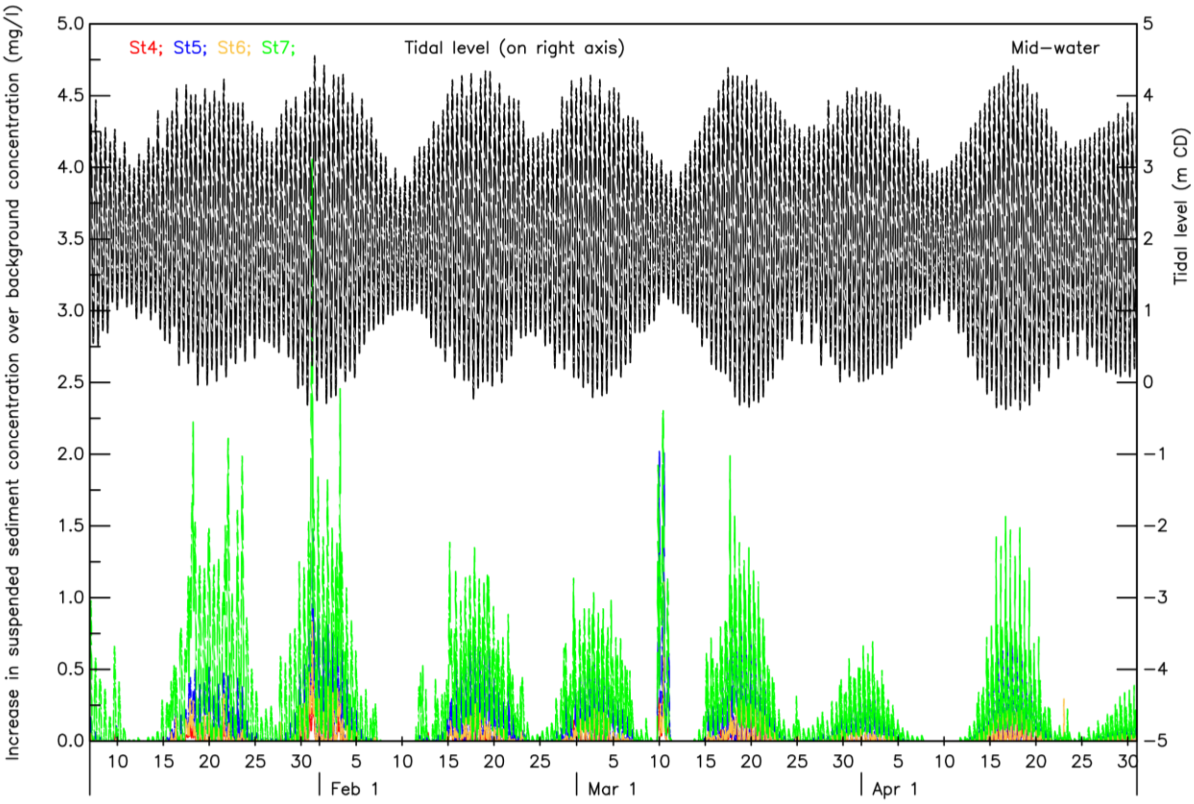

Figure A 75 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the three months following the campaign period at stations: St4, St5, St6 and St7.

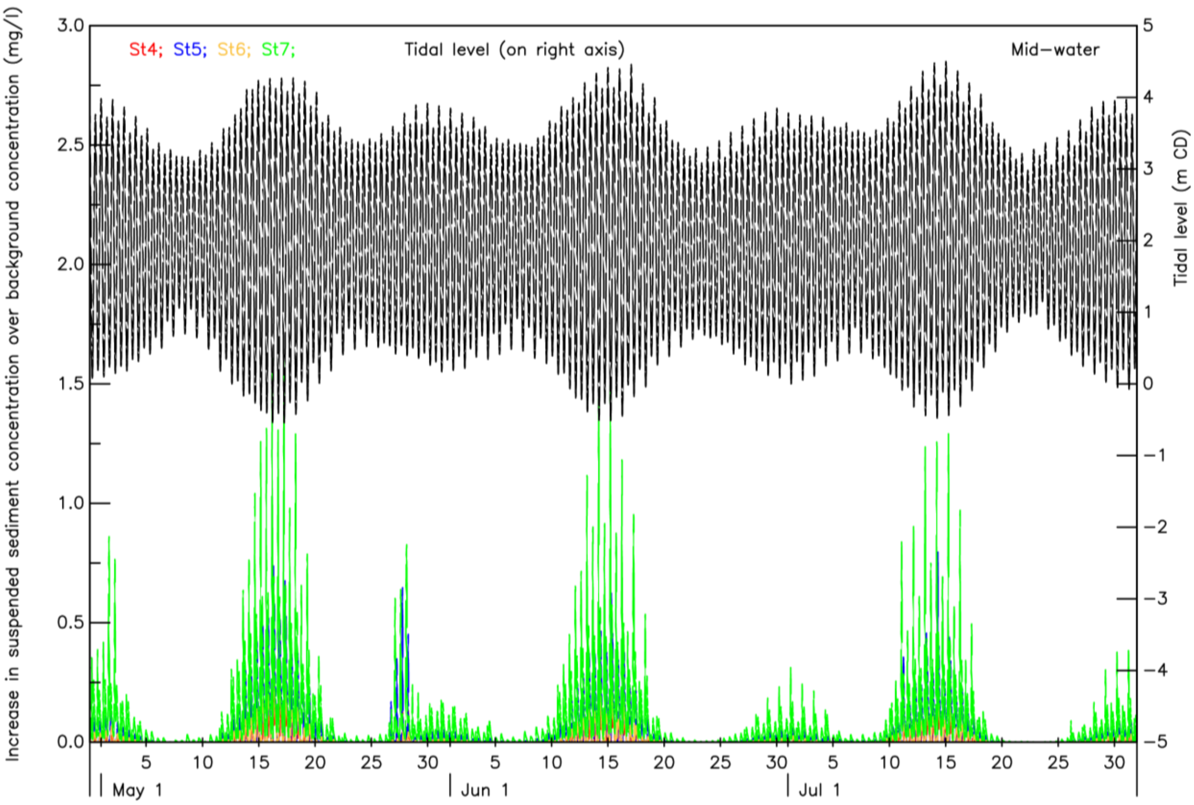

Figure A 76 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the four to six months following the campaign period at stations: St4, St5, St6 and St7.

Table A.13: **Scenario A: Statistical indicators for elevated suspended concentrations at mid-depth at stations St4, St5, St6 and St7.**

	Suspended sediment concentration at the bed			
	St4 (mg/l)	**St5 (mg/l)**	**St6 (mg/l)**	**St7 (mg/l)**
Peak	0.76	2.02	1.11	4.06
99th percentile	0.16	0.59	0.23	1.42
95th percentile	0.07	0.29	0.12	0.84
50th percentile	0.00	0.00	0.00	0.04
Mean	0.01	0.05	0.02	0.18

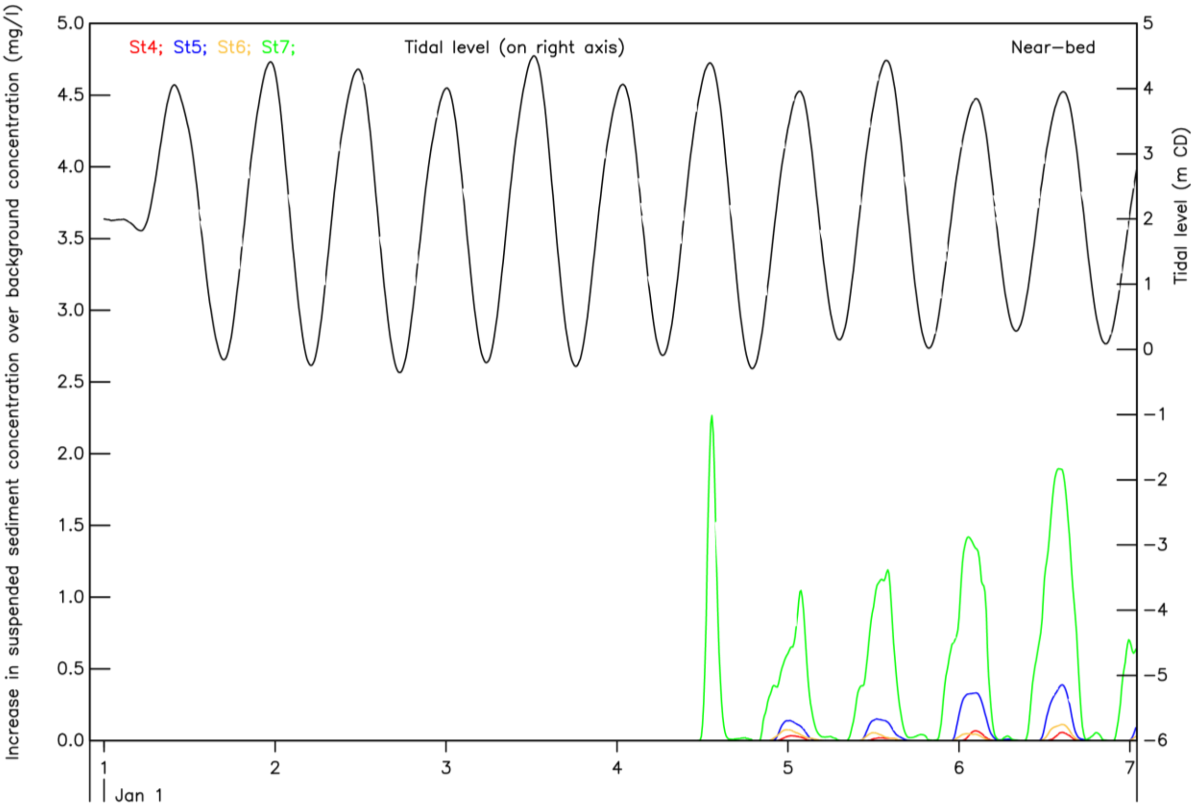

Figure A 77 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the three months following the campaign period at stations: St4, St5, St6 and St7.

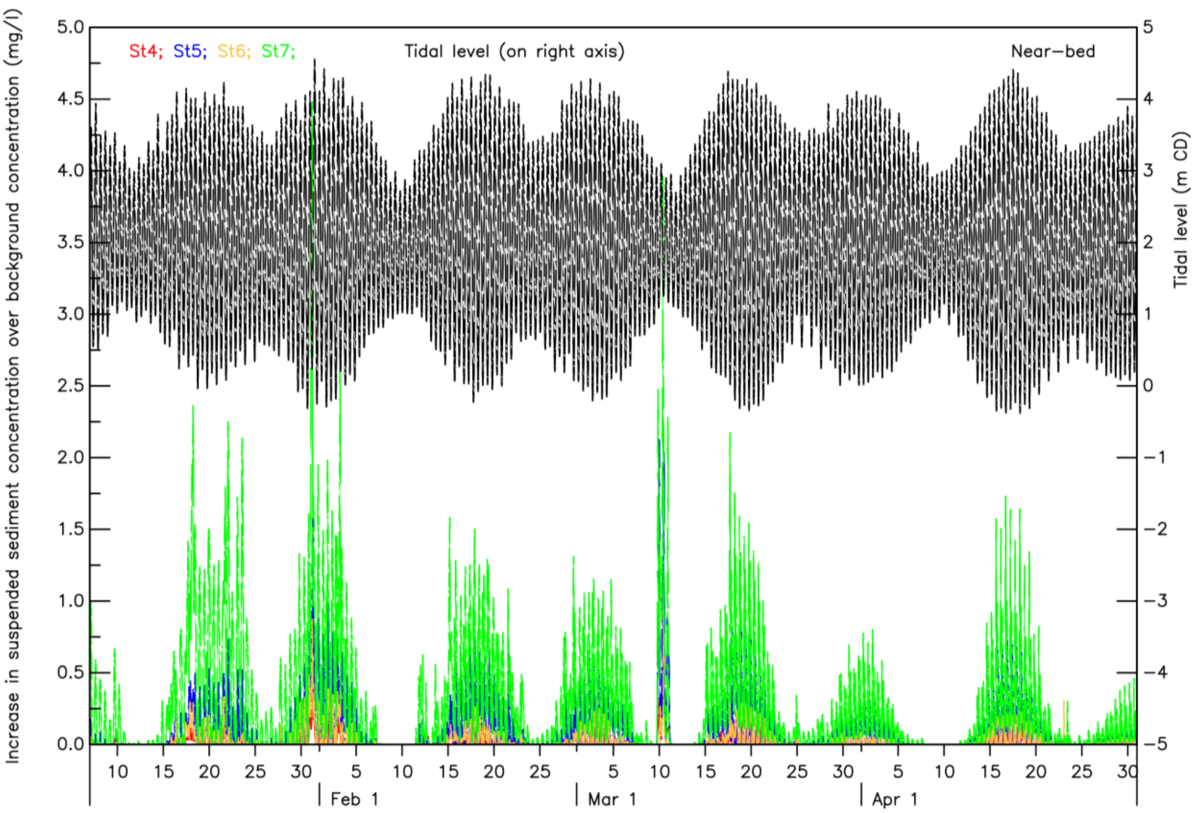

Figure A 78 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the three months following the campaign period at stations: St4, St5, St6 and St7.

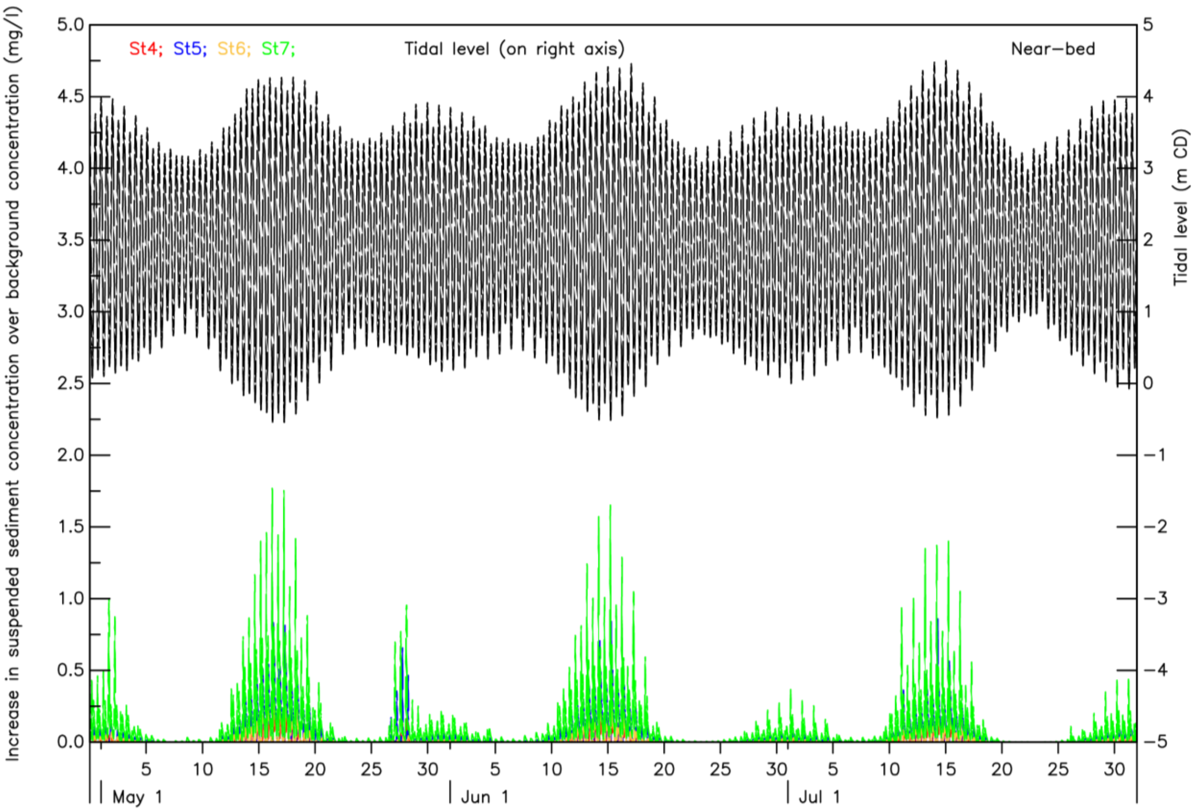

Figure A 79 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the four to six months following the campaign period at stations: St4, St5, St6 and St7.

Table A.14: Scenario A: Statistical indicators for elevated suspended concentrations at the bed at stations St4, St5, St6 and St7.

	Suspended sediment concentration at the bed			
	St4 (mg/l)	**St5 (mg/l)**	**St6 (mg/l)**	**St7 (mg/l)**
Peak	0.84	2.13	1.14	4.48
99th percentile	0.19	0.64	0.25	1.55
95th percentile	0.09	0.34	0.13	0.93
50th percentile	0.00	0.00	0.00	0.05
Mean	0.02	0.06	0.02	0.20

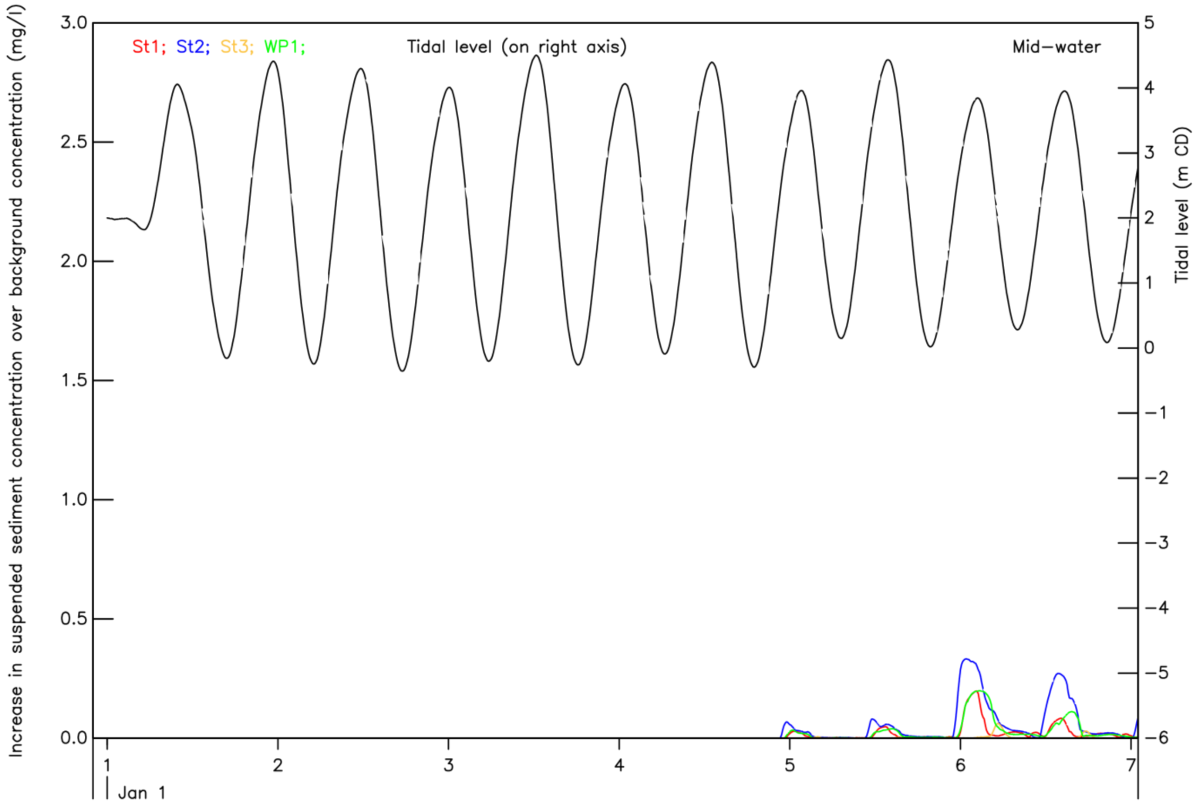

Figure A 80 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth during the campaign period at stations: St1, St2, St3 and WP1.

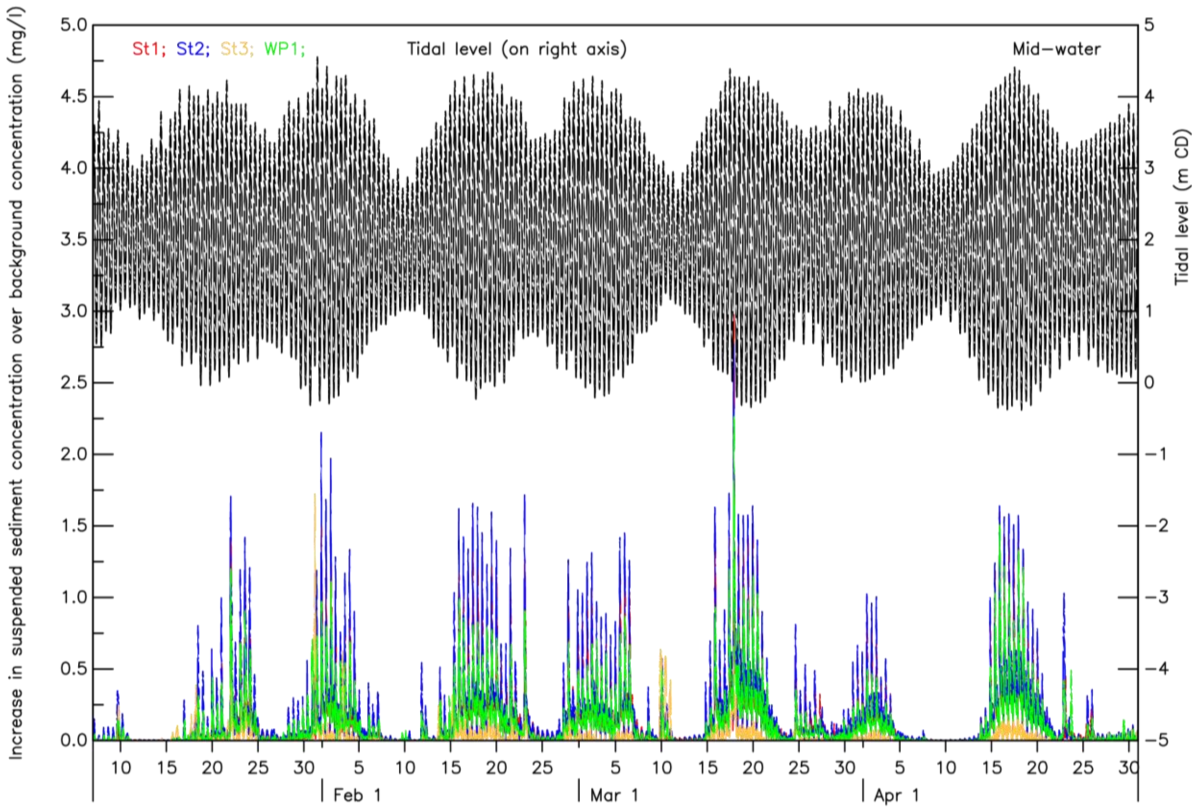

Figure A 81 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the three months following the campaign period at stations: St1, St2, St3 and WP1.

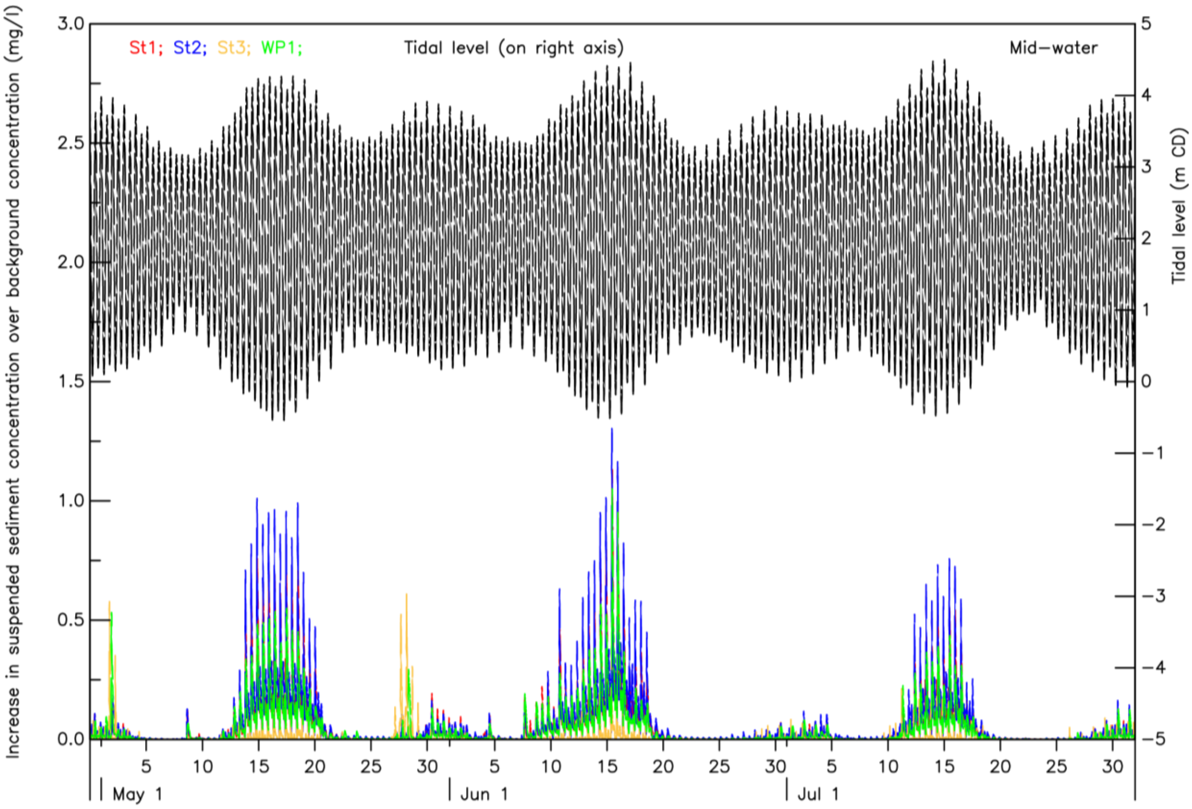

Figure A 82 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the four to six months following the campaign period at stations: St1, St2, St3 and WP1.

Table A.13: **Scenario A: Statistical indicators for elevated suspended concentrations at mid-depth at stations St1, St2, St3 and WP1.**

	Suspended sediment concentration at the bed			
	St1 (mg/l)	**St2 (mg/l)**	**St3 (mg/l)**	**WP1 (mg/l)**
Peak	2.98	2.78	1.72	2.26
99th percentile	1.02	1.20	0.25	0.80
95th percentile	0.43	0.54	0.08	0.41
50th percentile	0.02	0.03	0.00	0.02
Mean	0.00	0.12	0.02	0.09

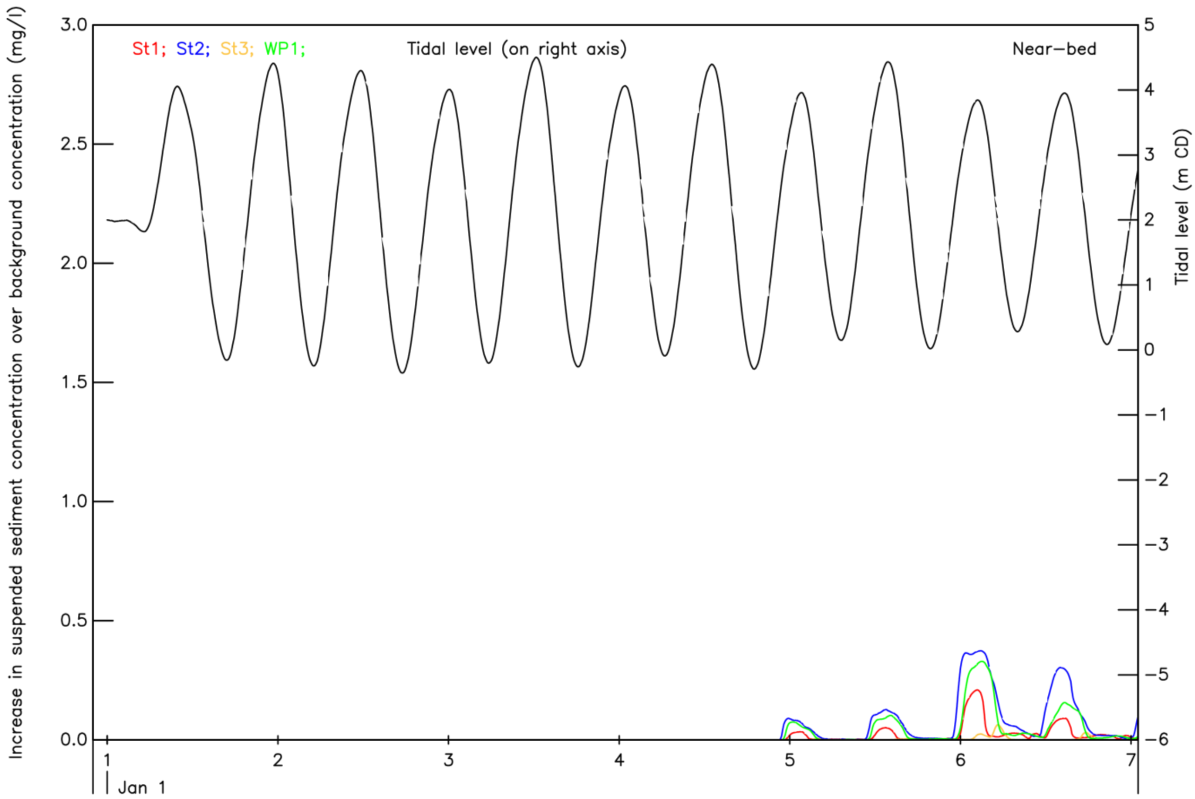

Figure A 83 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the three months following the campaign period at stations: St1, St2, St3 and WP1.

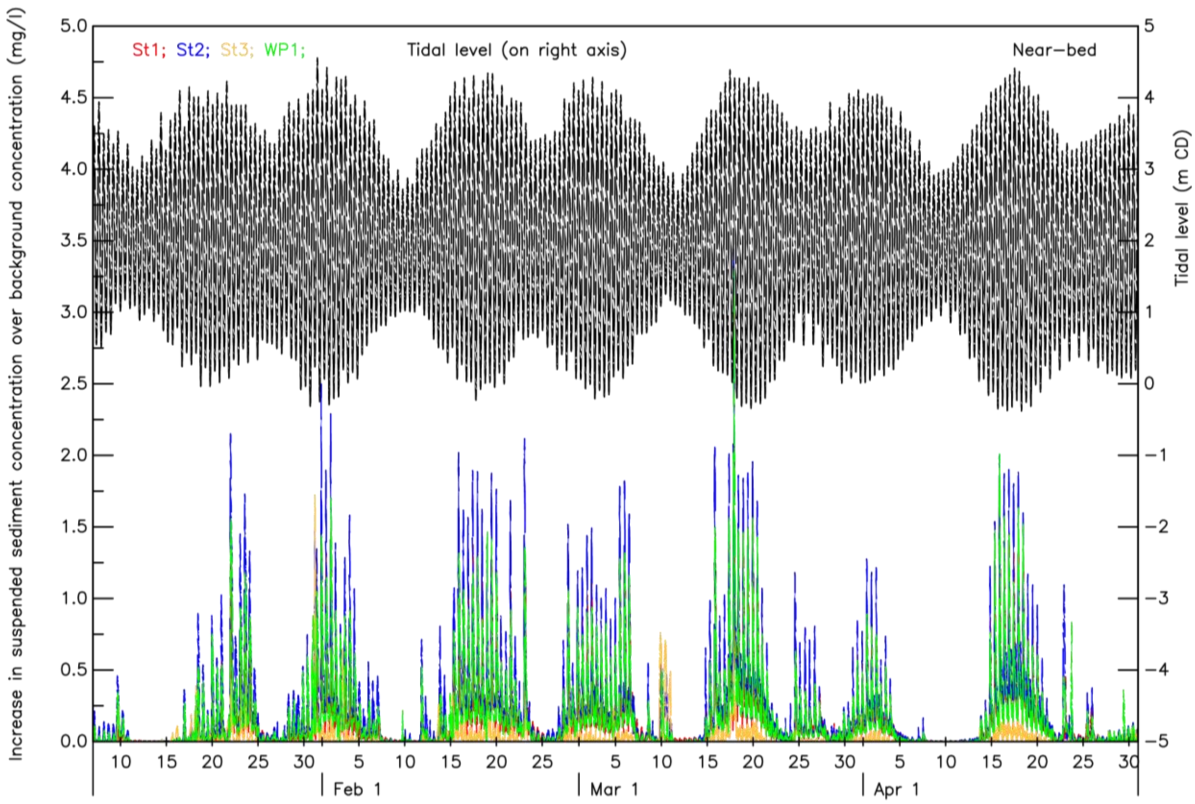

Figure A 84 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the three months following the campaign period at stations: St1, St2, St3 and WP1.

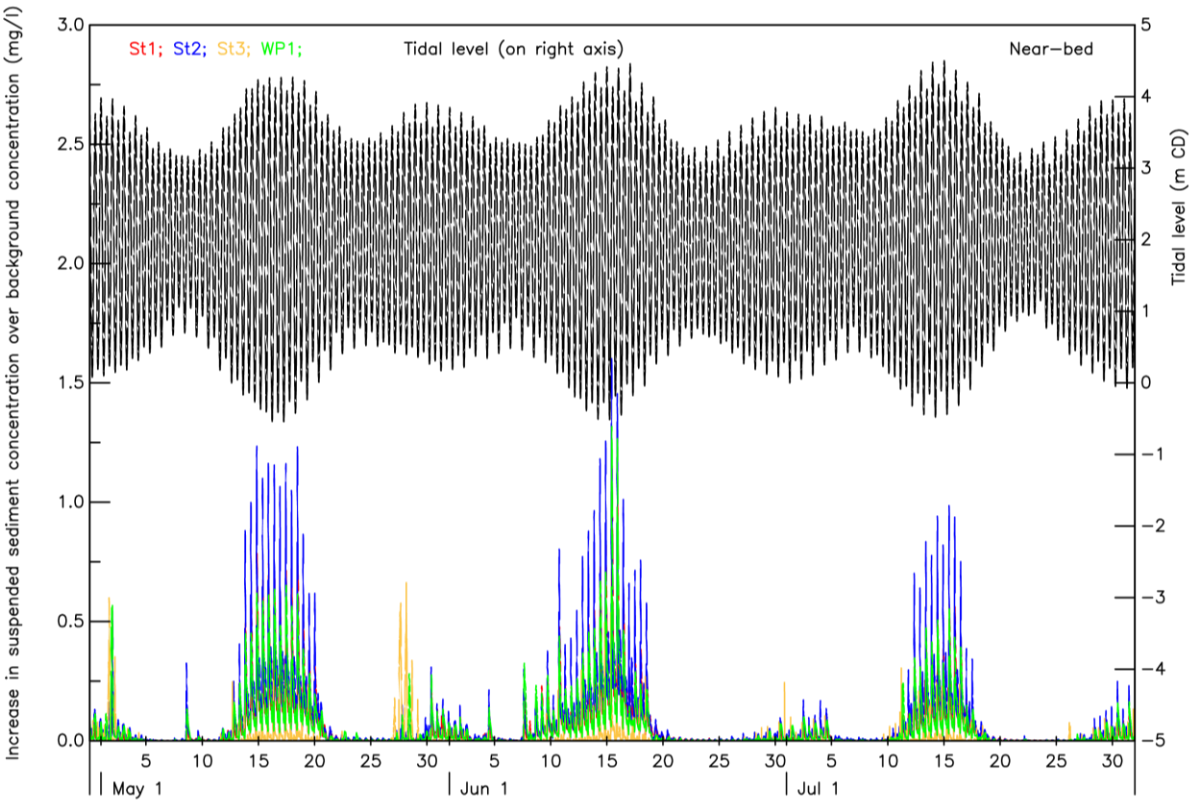

Figure A 85 – Scenario A: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the four to six months following the campaign period at stations: St1, St2, St3 and WP1.

Table A.14: **Scenario A: Statistical indicators for elevated suspended concentrations at the bed at stations St1, St2, St3 and WP1.**

	Suspended sediment concentration at the bed			
	St1 (mg/l)	**St2 (mg/l)**	**St3 (mg/l)**	**WP1 (mg/l)**
Peak	3.11	3.44	1.72	3.30
99th percentile	1.10	1.49	0.30	1.15
95th percentile	0.47	0.70	0.09	0.57
50th percentile	0.02	0.04	0.00	0.02
Mean	0.10	0.15	0.02	0.12

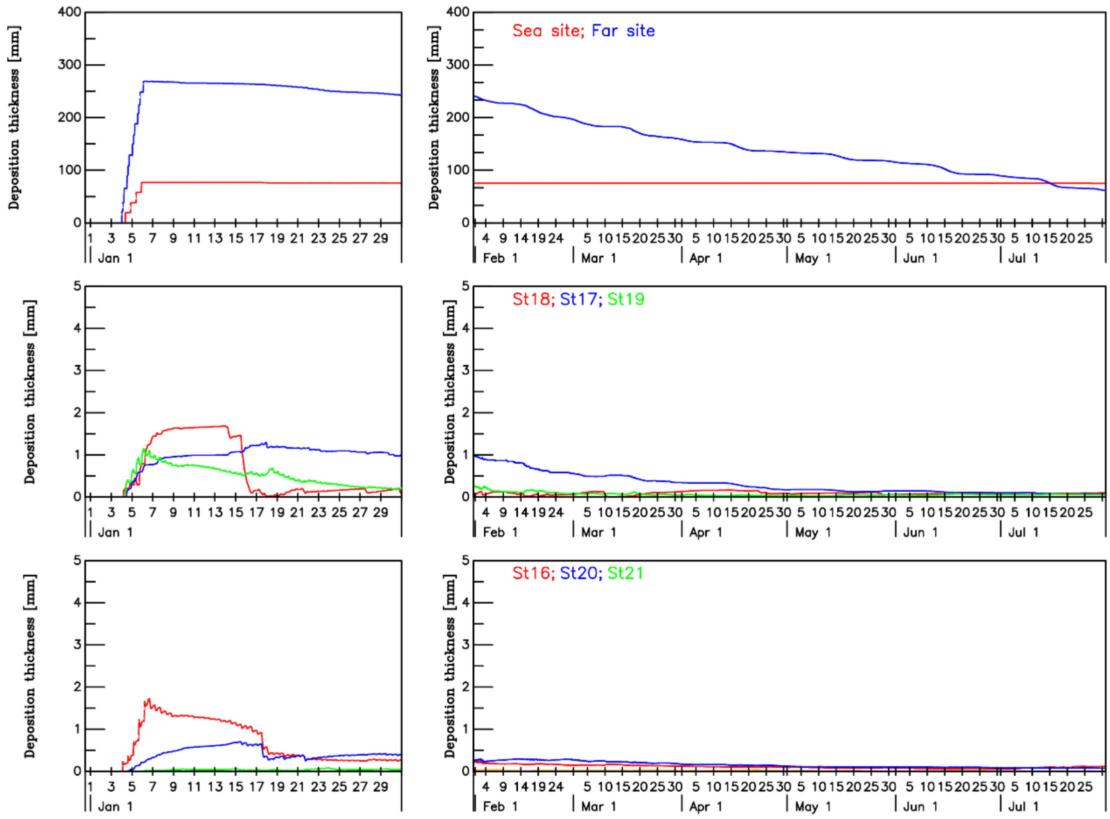

Figure A 86 – Scenario A: Sediment deposition during the campaign month (left) and for six months after the campaign (right) at the disposal and surrounding sites.

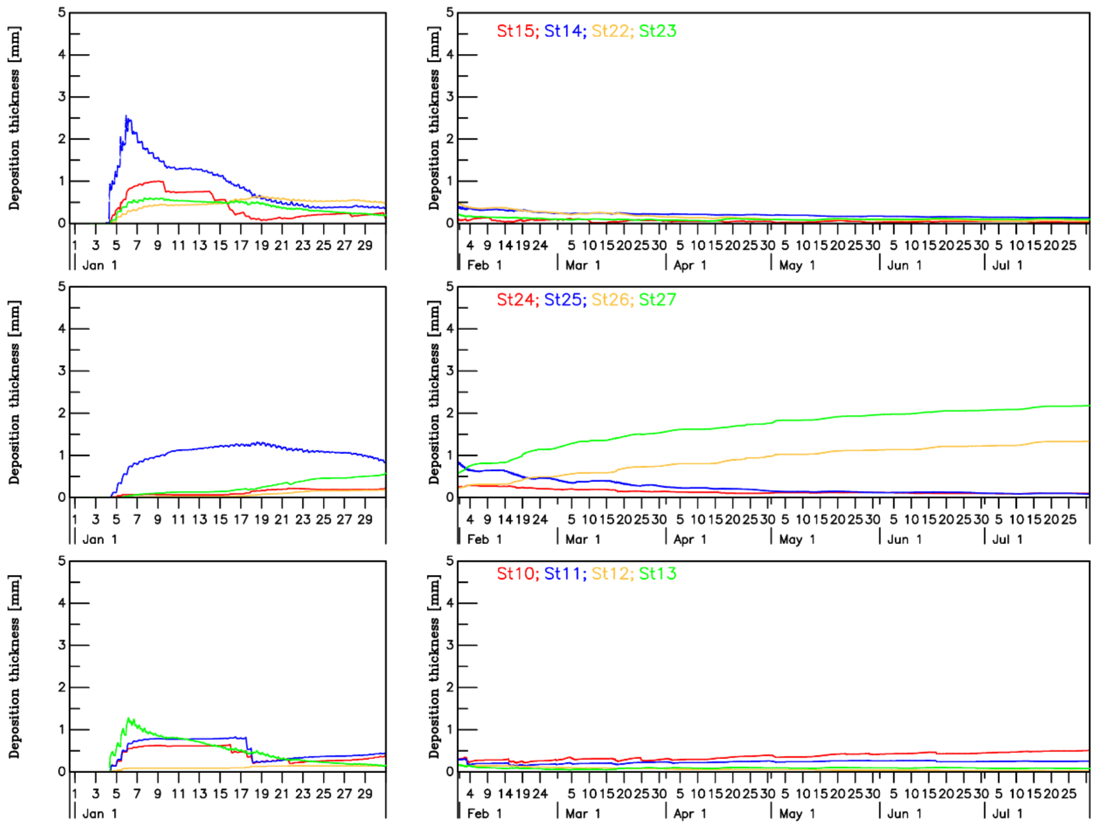

Figure A 87 – Scenario A: Sediment deposition during the campaign month (left) and for six months after the campaign (right) at sites near the centre of the lough.

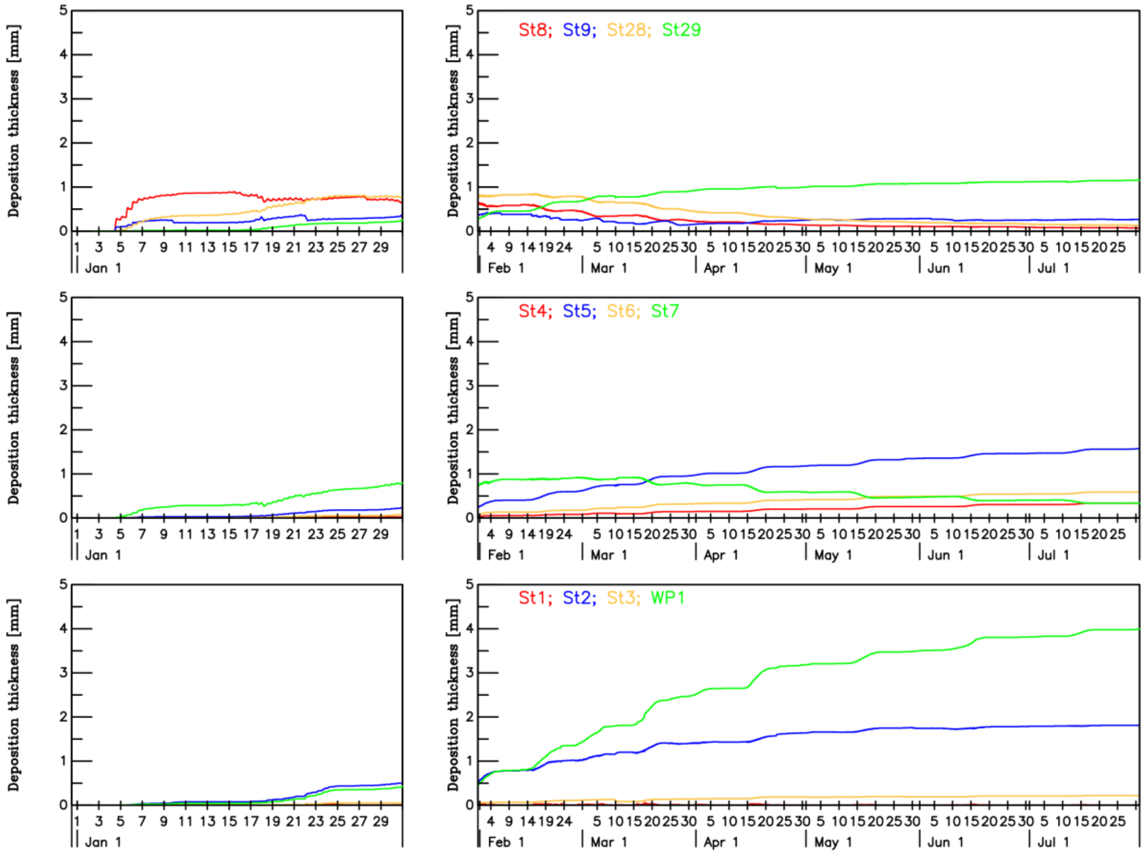

Figure A 88 – Scenario A: Sediment deposition during the campaign month (left) and for six months after the campaign (right) at sites in the upper part of the lough.

Scenario B

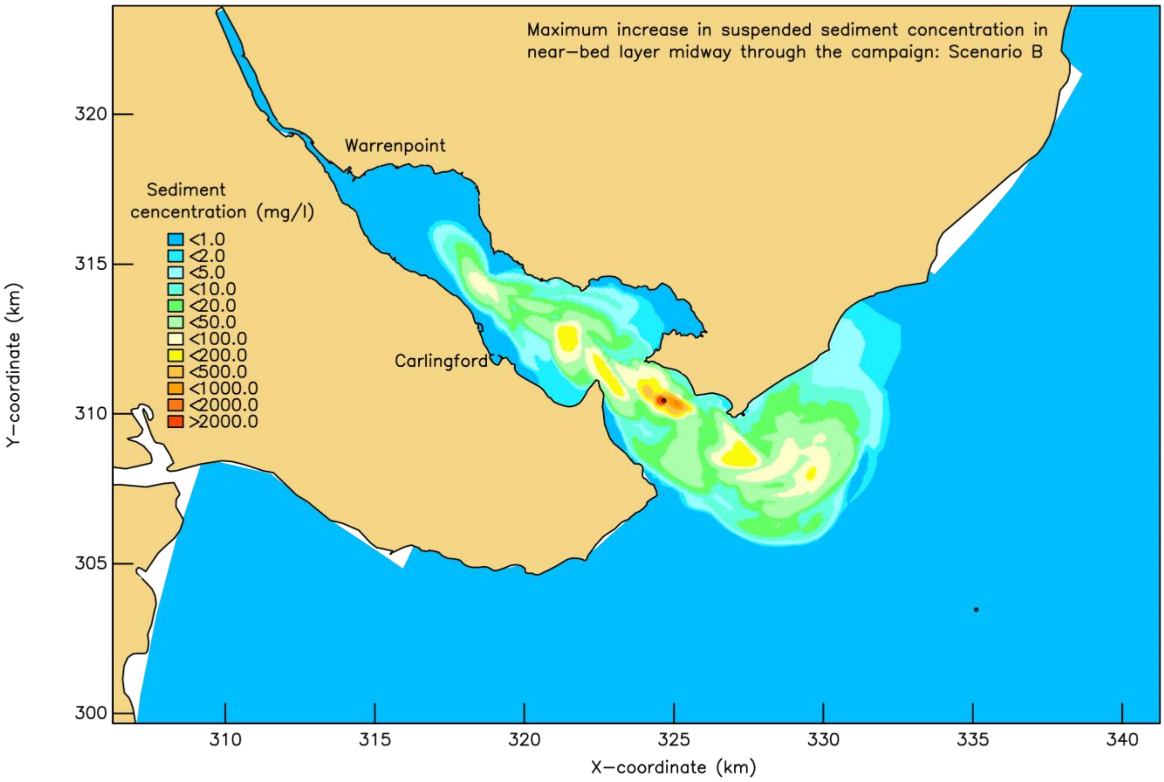

Figure B 1 – Scenario B: Maximum increase in suspended sediment concentration above the background in the near-bed layer over the first half of the campaign.

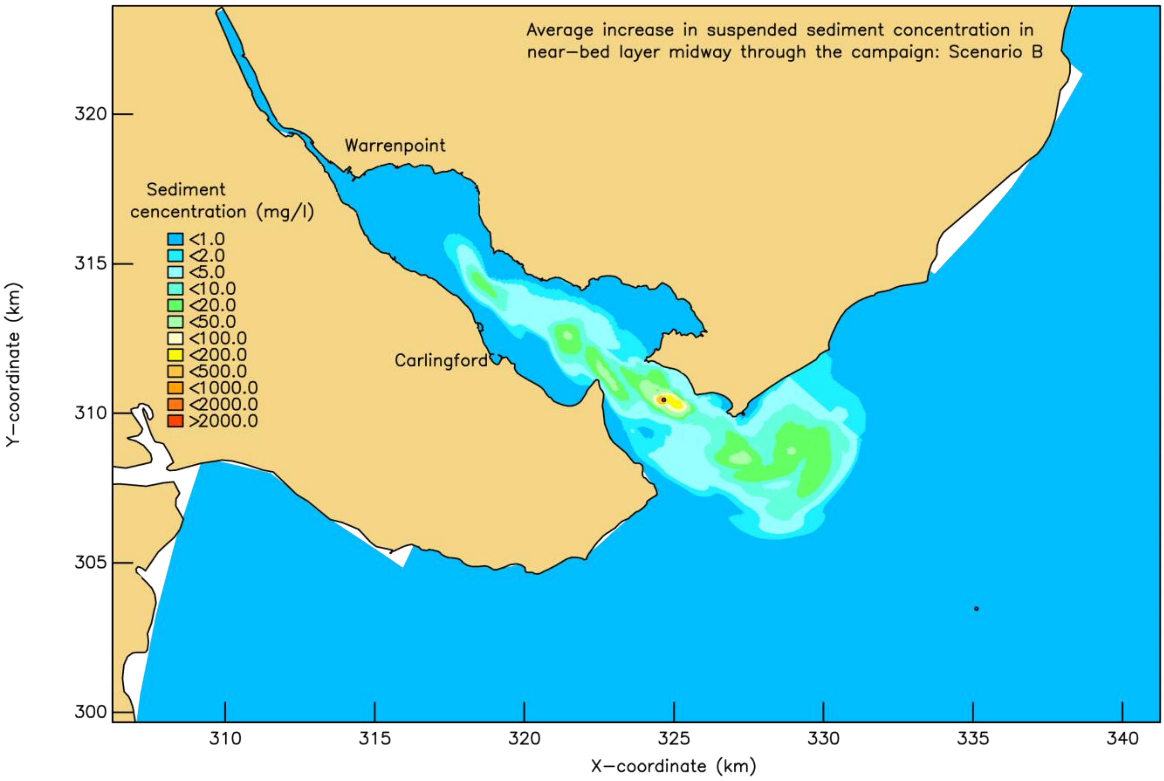

Figure B 2 – Scenario B: Average increase in suspended sediment concentration above the background in the near-bed layer over the first half of the campaign.

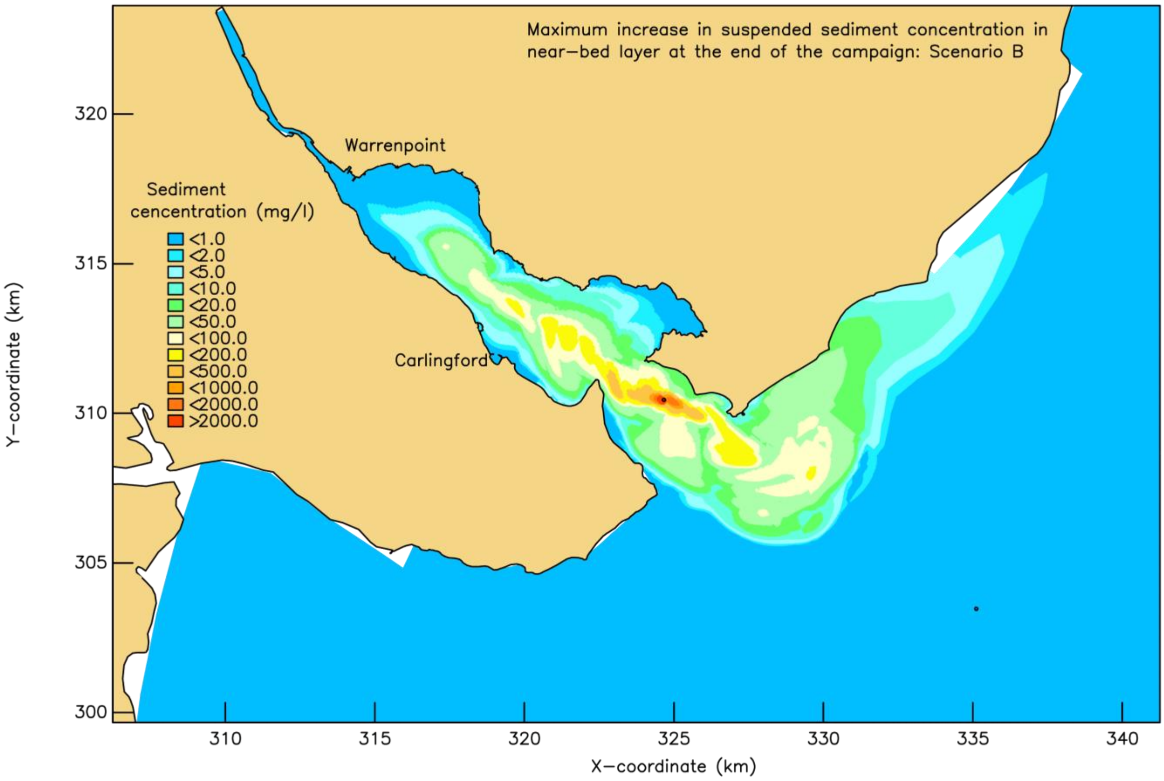

Figure B 3 – Scenario B: Maximum increase in suspended sediment concentration above the background in the near-bed layer over the campaign period.

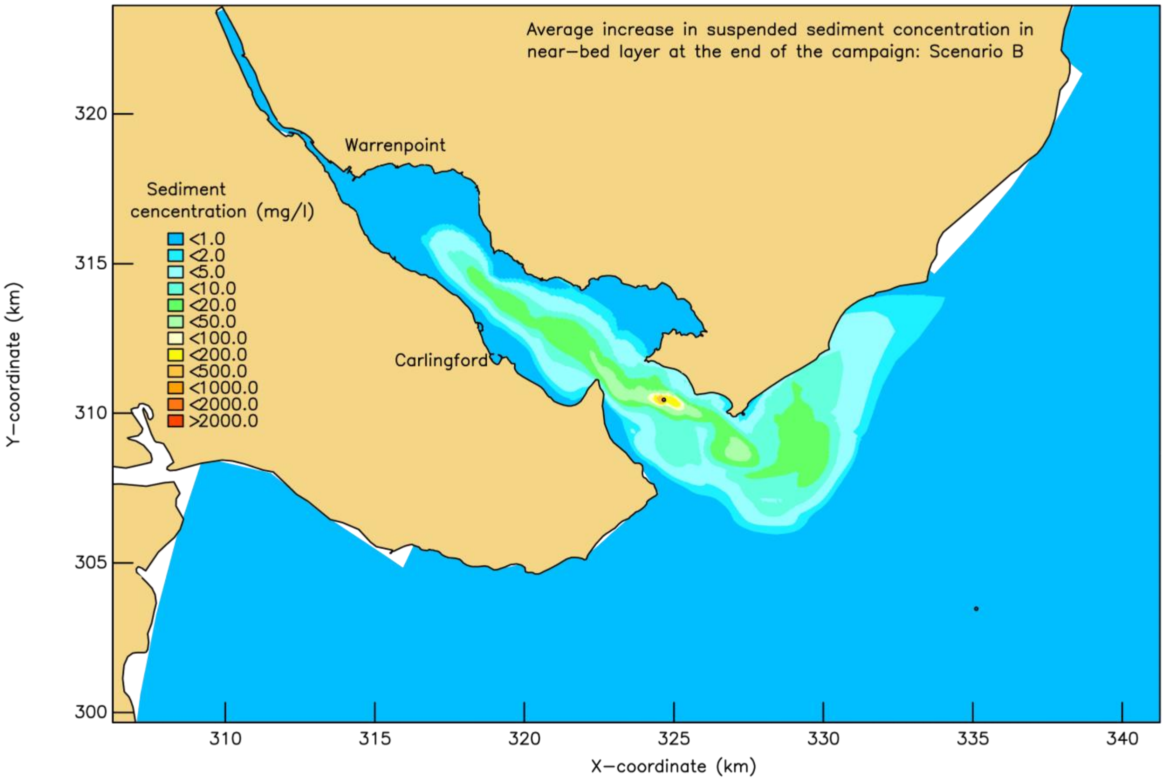

Figure B 4 – Scenario B: Average increase in suspended sediment concentration above the background in the near-bed layer over the campaign period.

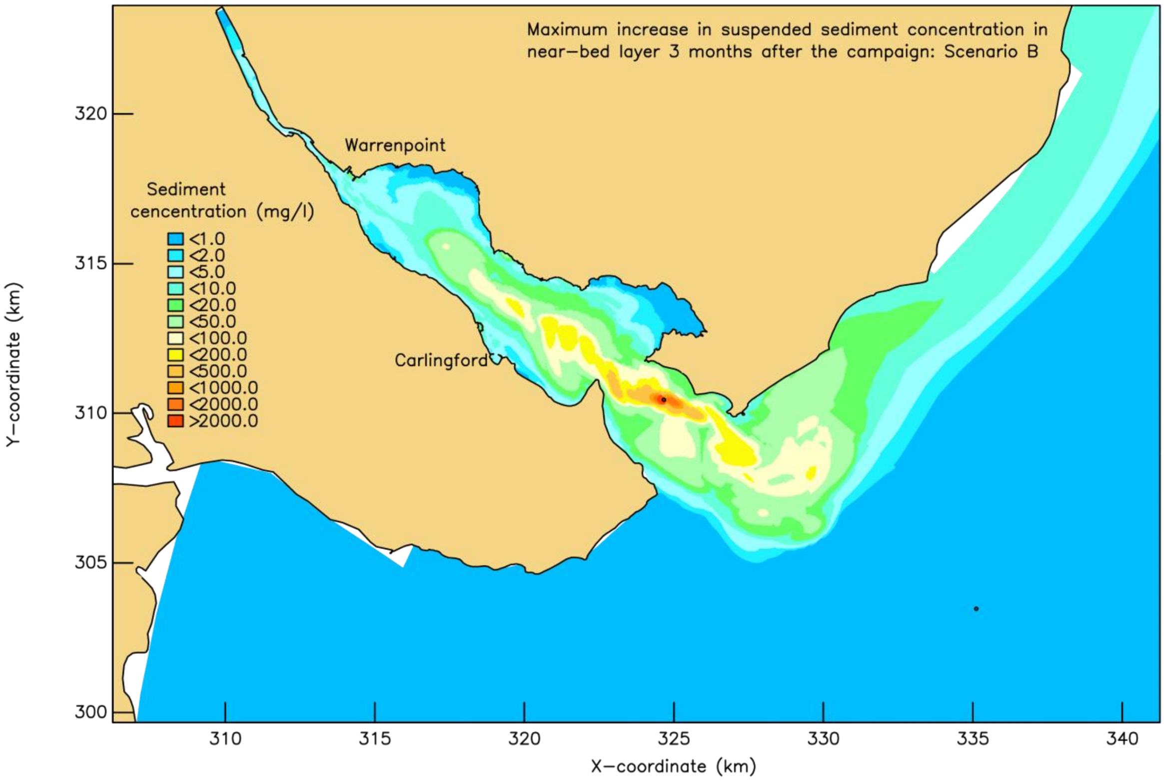

Figure B 5 – Scenario B: Maximum increase in suspended sediment concentration above the background in the near-bed layer over the campaign period and the three months thereafter.

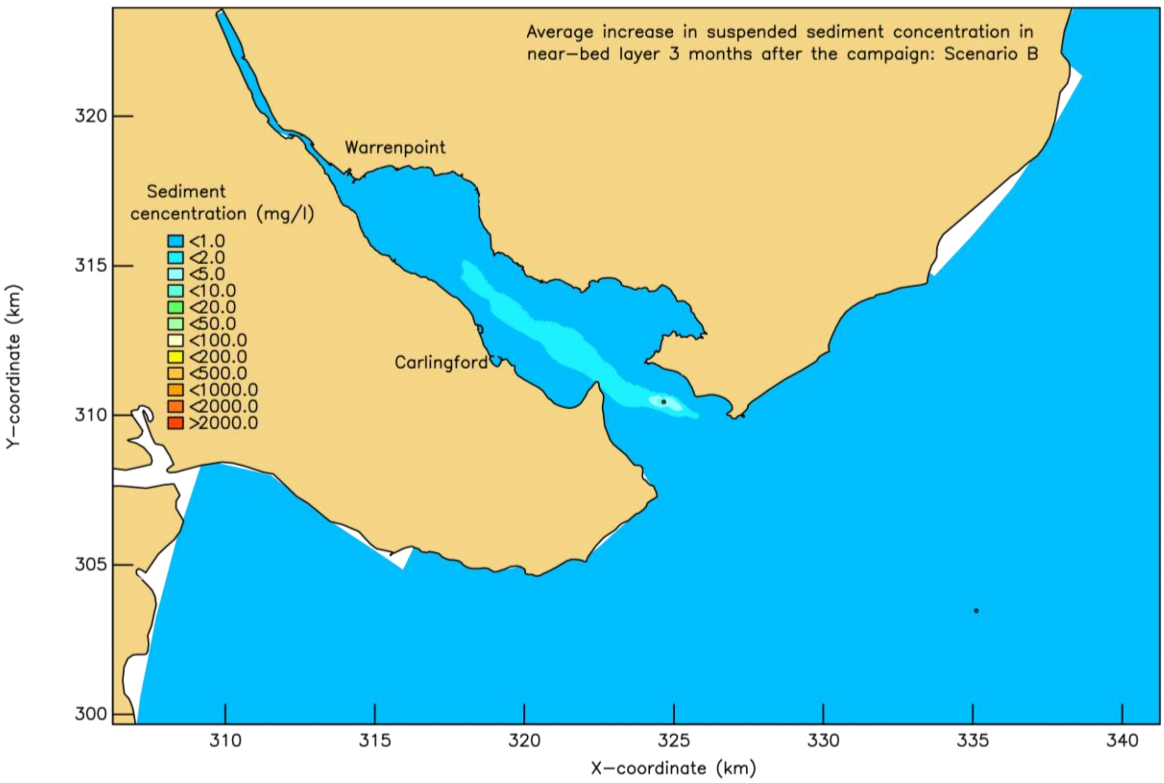

Figure B 6 – Scenario B: Average increase in suspended sediment concentration above the background in the near-bed layer over the campaign period and the three months thereafter.

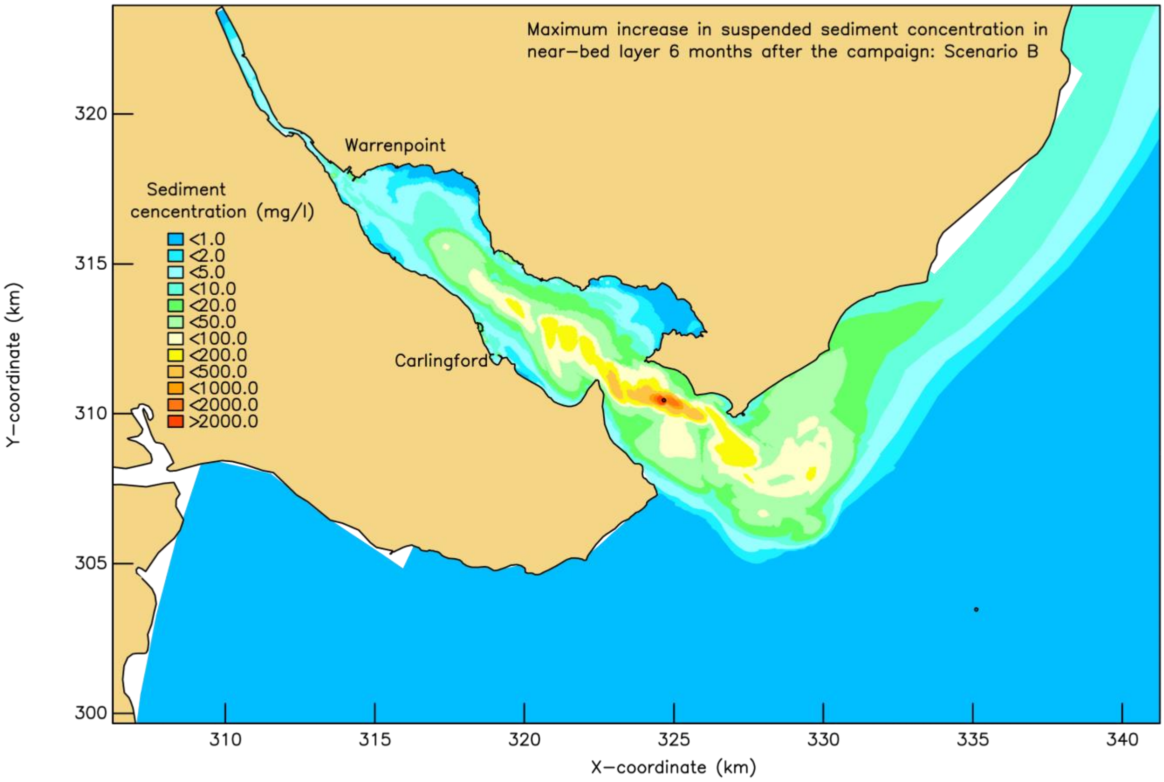

Figure B 7 – Scenario B: Maximum increase in suspended sediment concentration above the background in the near-bed layer over the campaign period and the six months thereafter.

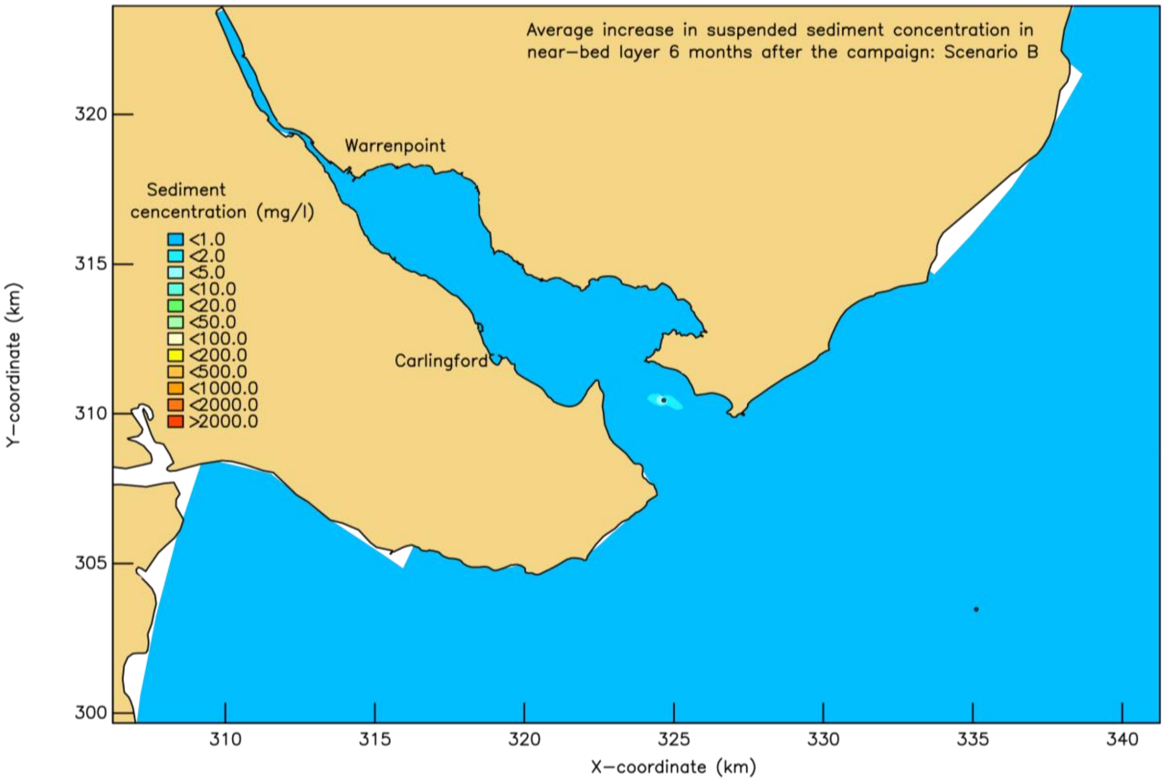

Figure B 8 – Scenario B: Average increase in suspended sediment concentration above the background in the near-bed layer over the campaign period and the six months thereafter.

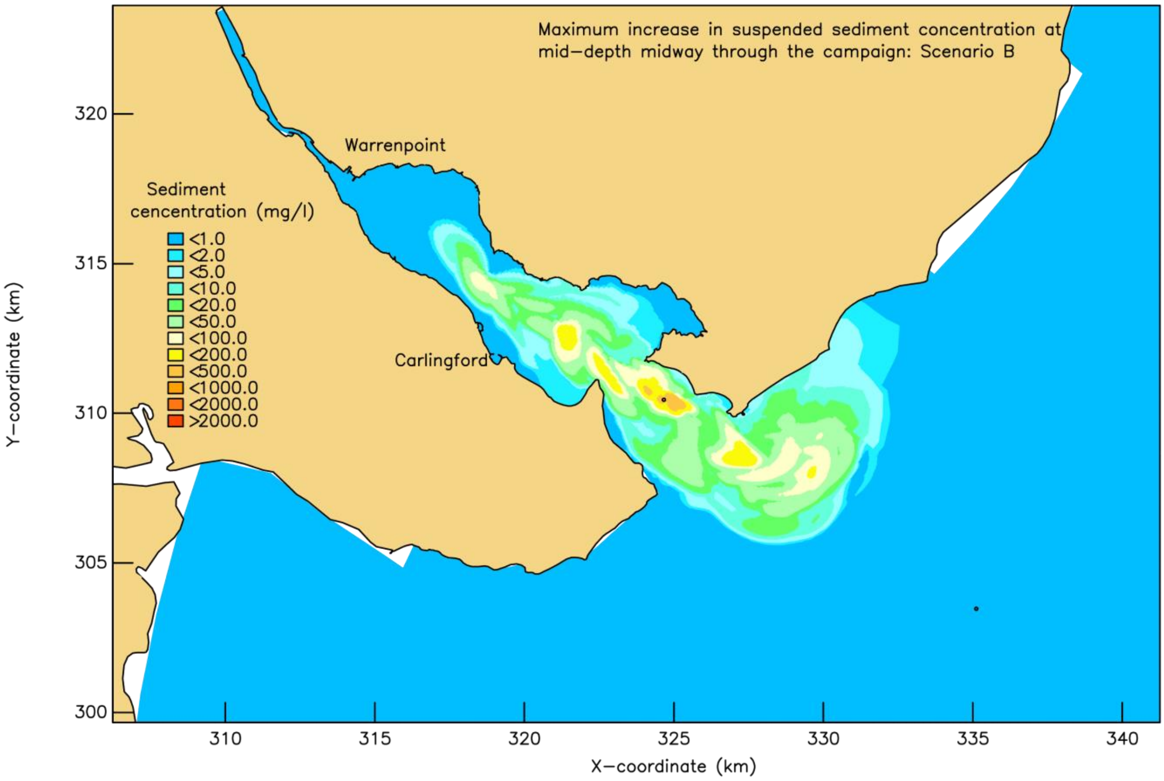

Figure B 9 – Scenario B: Maximum increase in suspended sediment concentration above the background at mid-depth over the first half of the campaign.

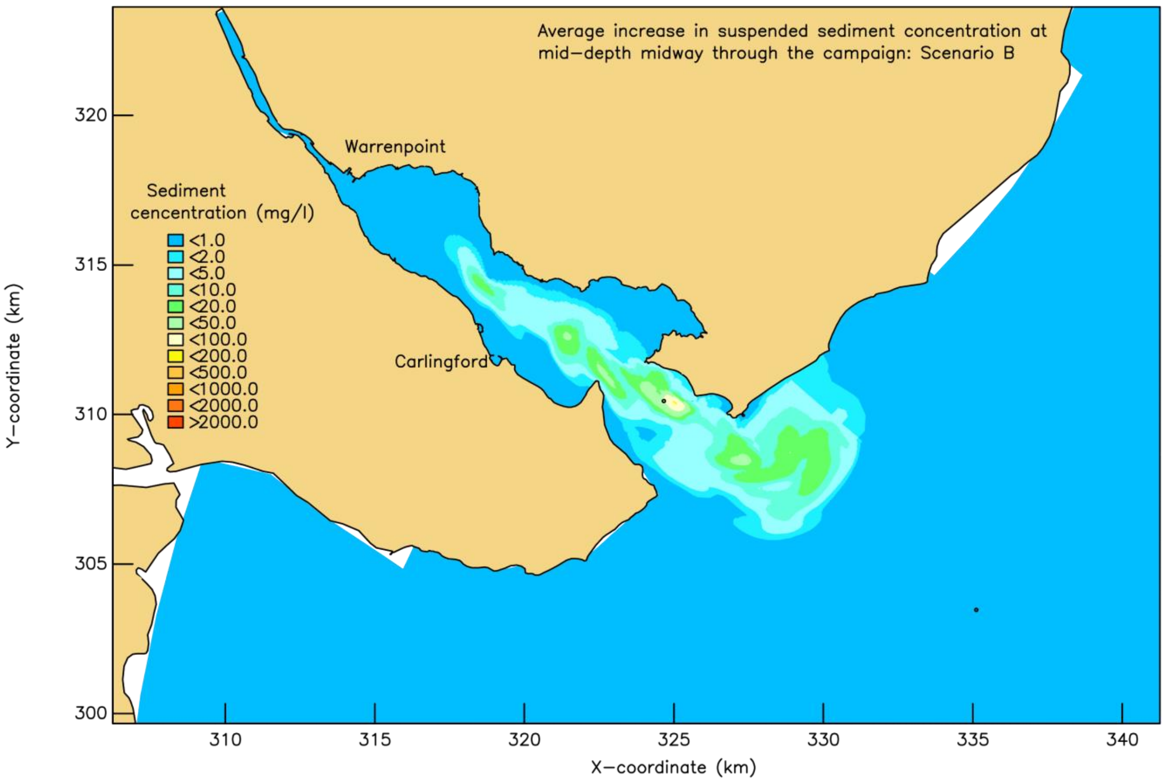

Figure B 10 – Scenario B: Average increase in suspended sediment concentration above the background at mid-depth over the first half of the campaign.

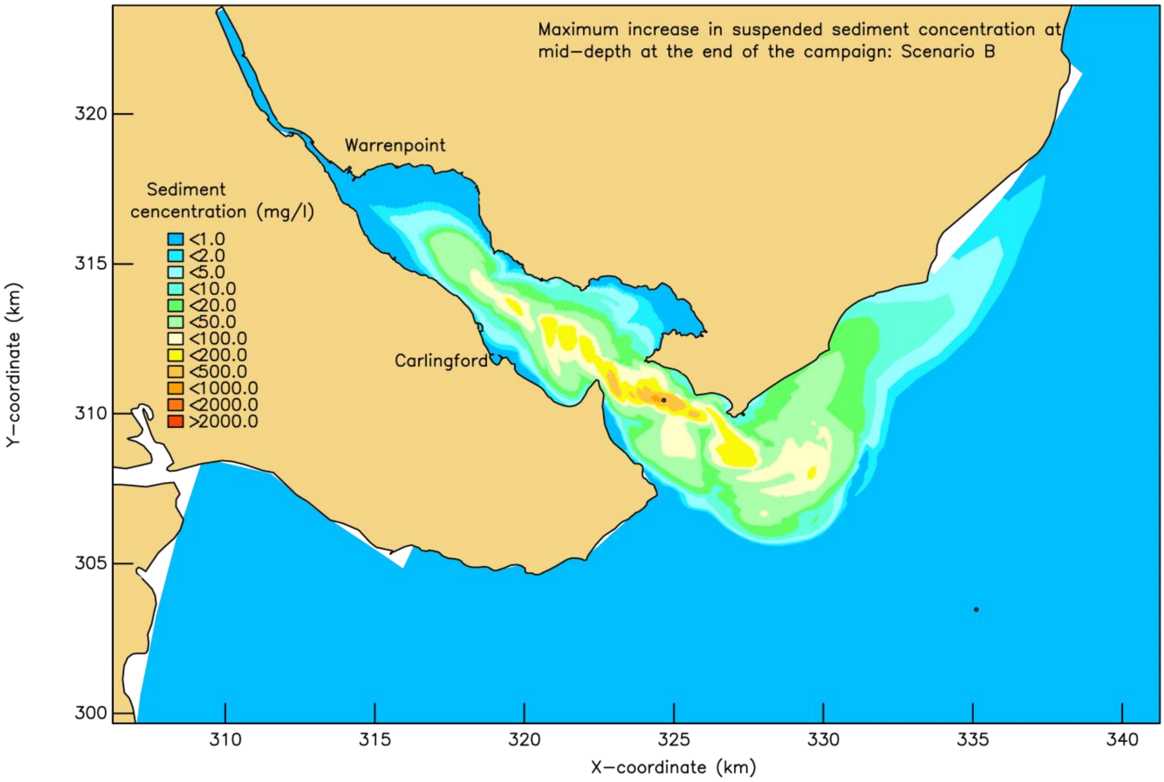

Figure B 11 – Scenario B: Maximum increase in suspended sediment concentration above the background at mid-depth over the campaign period.

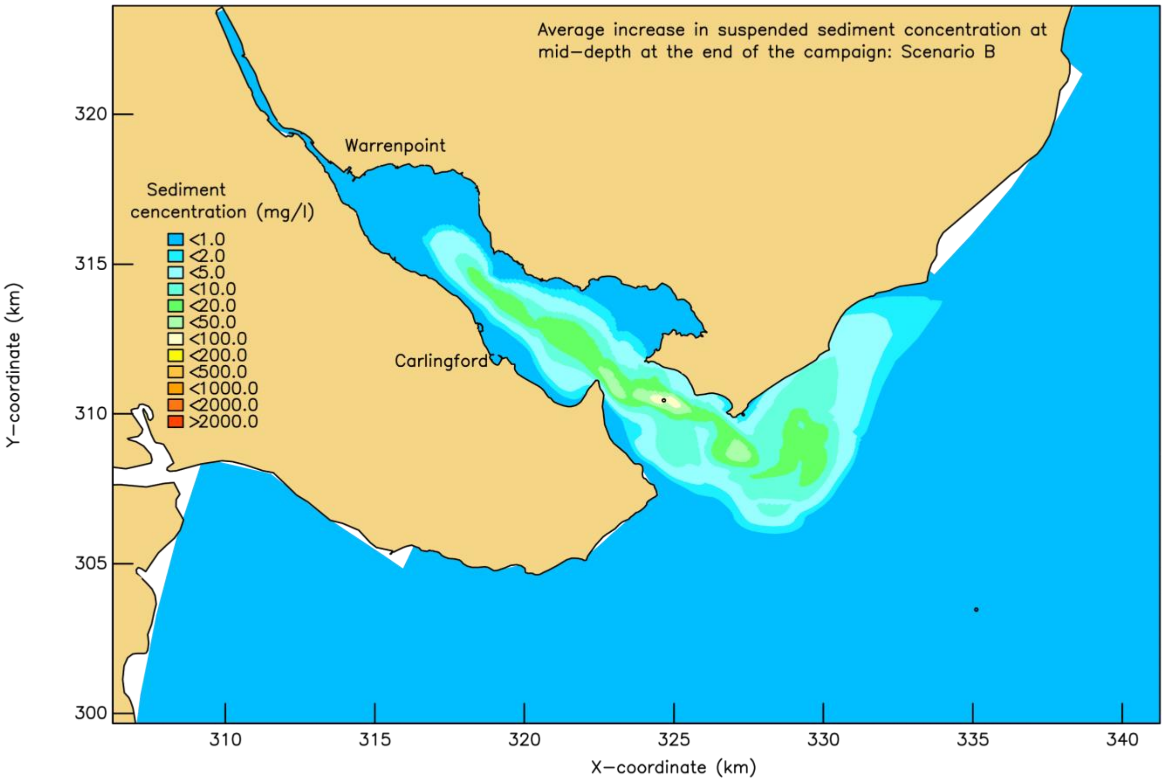

Figure B 12 – Scenario B: Average increase in suspended sediment concentration above the background at mid-depth over the campaign period.

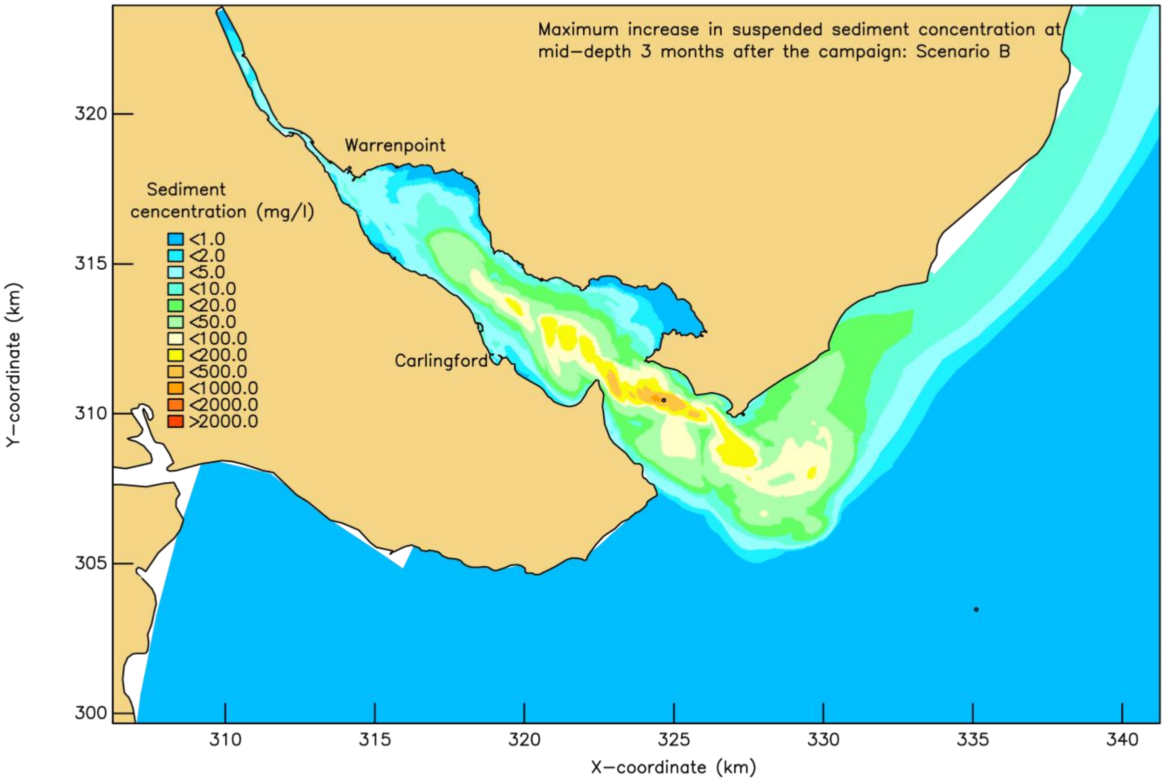

Figure B 13 – Scenario B: Maximum increase in suspended sediment concentration above the background at mid-depth over the campaign period and the three months thereafter.

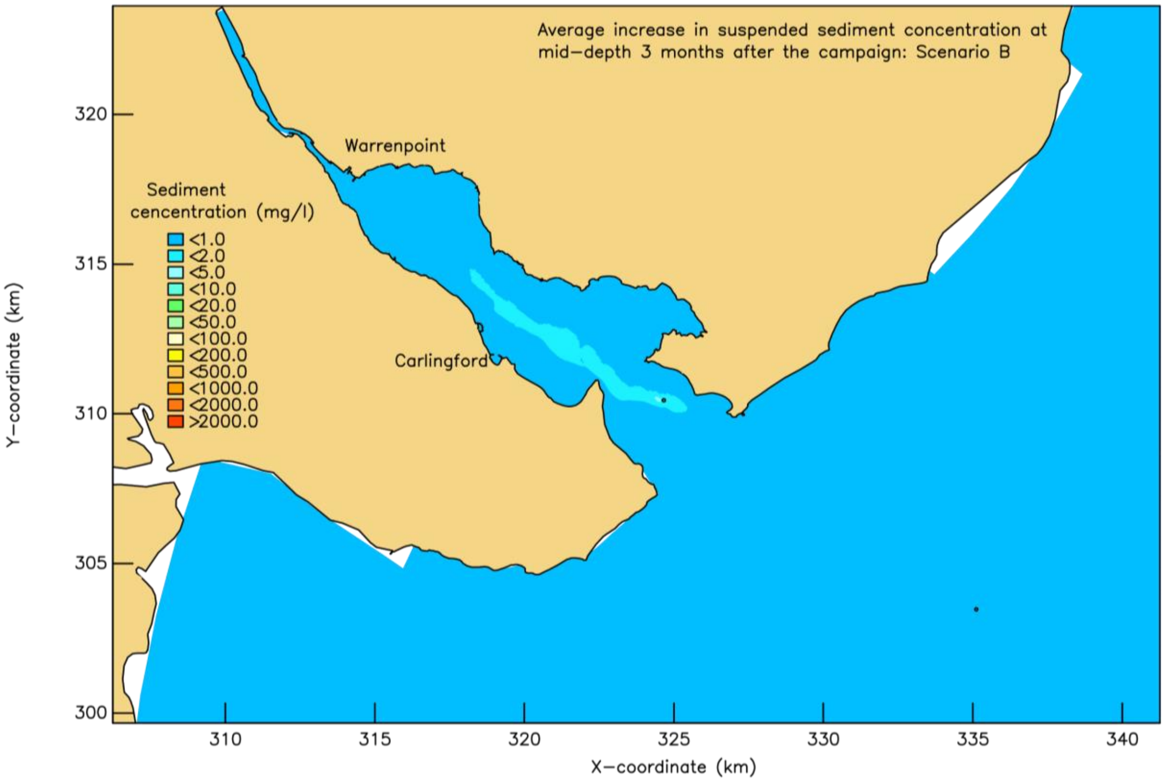

Figure B 14 – Scenario B: Average increase in suspended sediment concentration above the background at mid-depth over the campaign period and the three months thereafter.

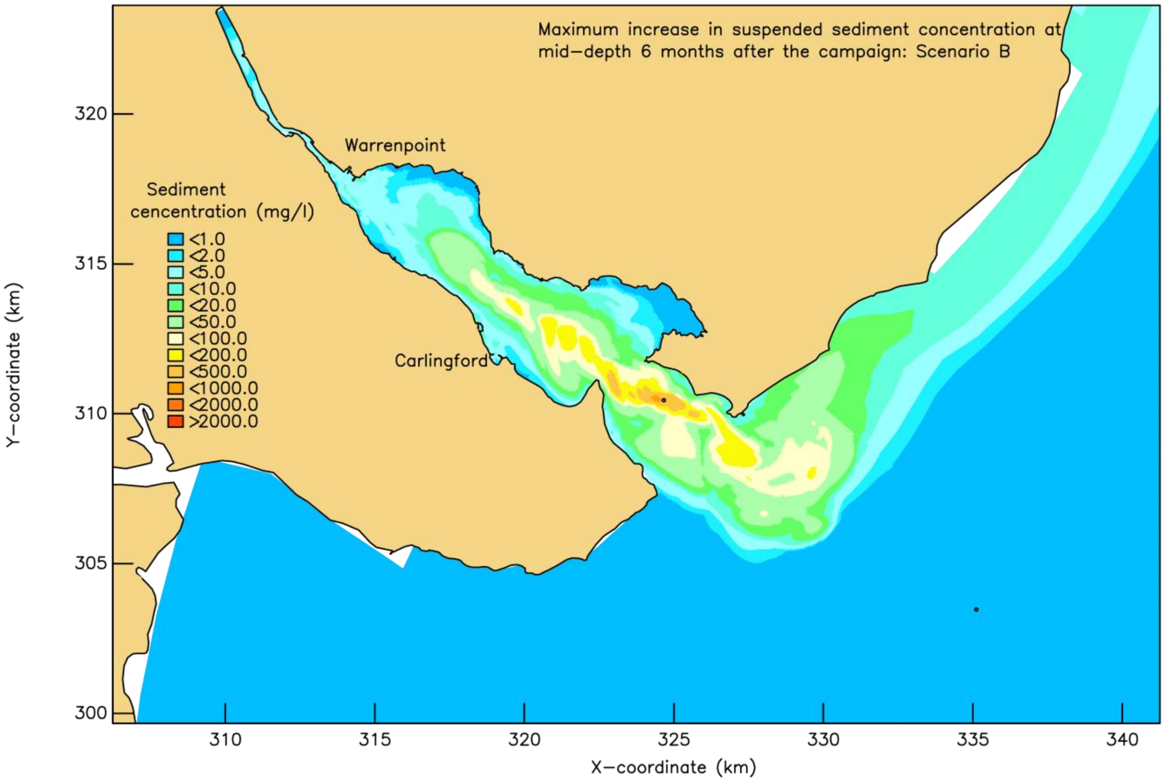

Figure B 15 – Scenario B: Maximum increase in suspended sediment concentration above the background at mid-depth over the campaign period and the six months thereafter.

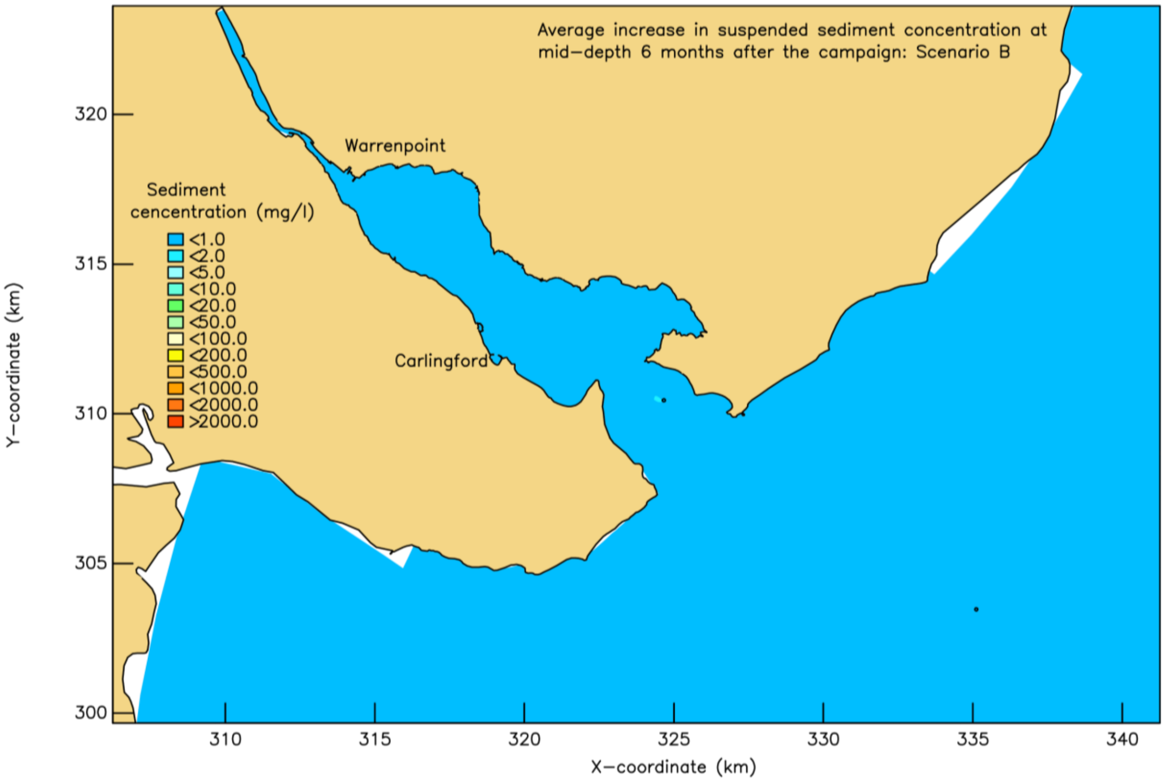

Figure B 16 – Scenario B: Average increase in suspended sediment concentration above the background at mid-depth over the campaign period and the six months thereafter.

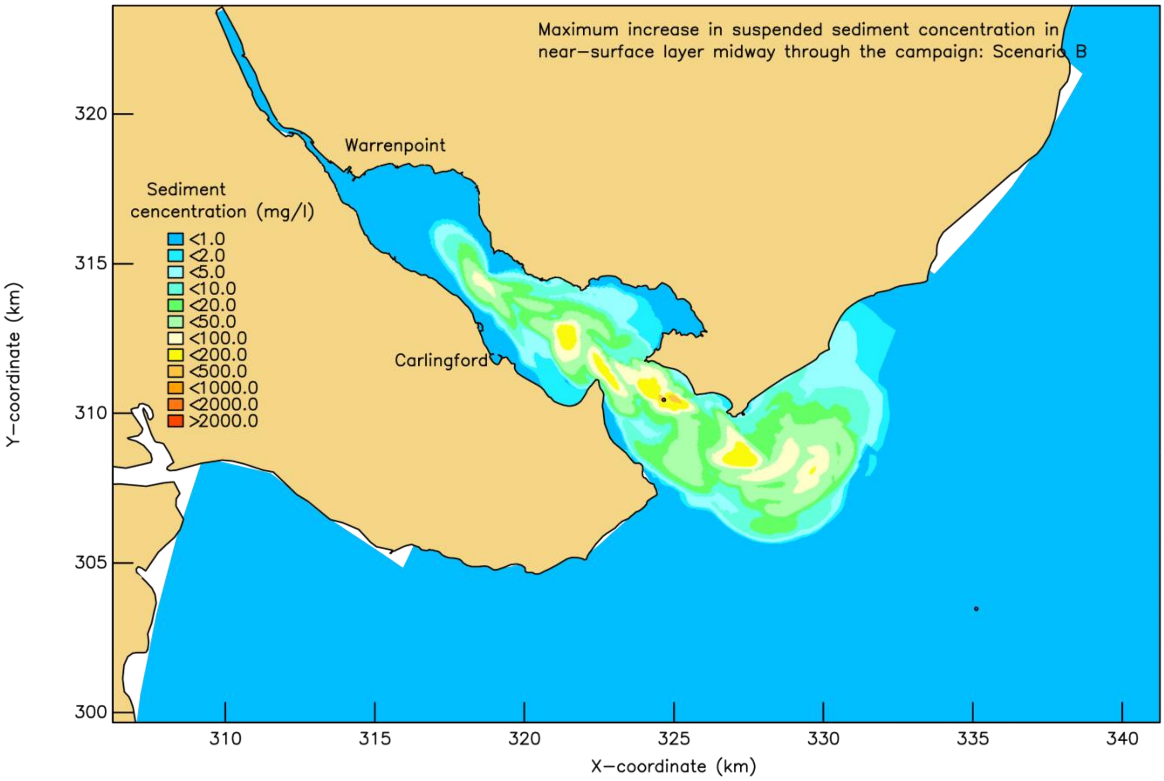

Figure B 17 – Scenario B: Maximum increase in suspended sediment concentration above the background in the near-surface layer over the first half of the campaign.

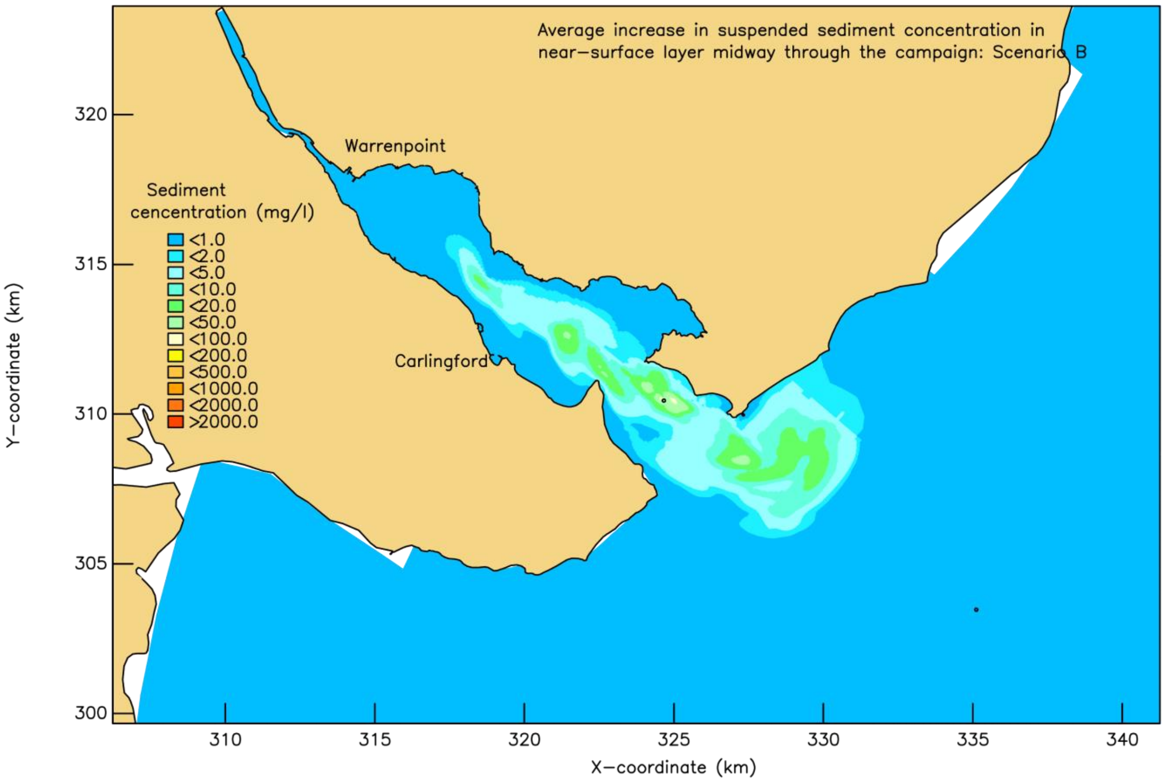

Figure B 18 – Scenario B: Average increase in suspended sediment concentration above the background in the near-surface layer over the first half of the campaign.

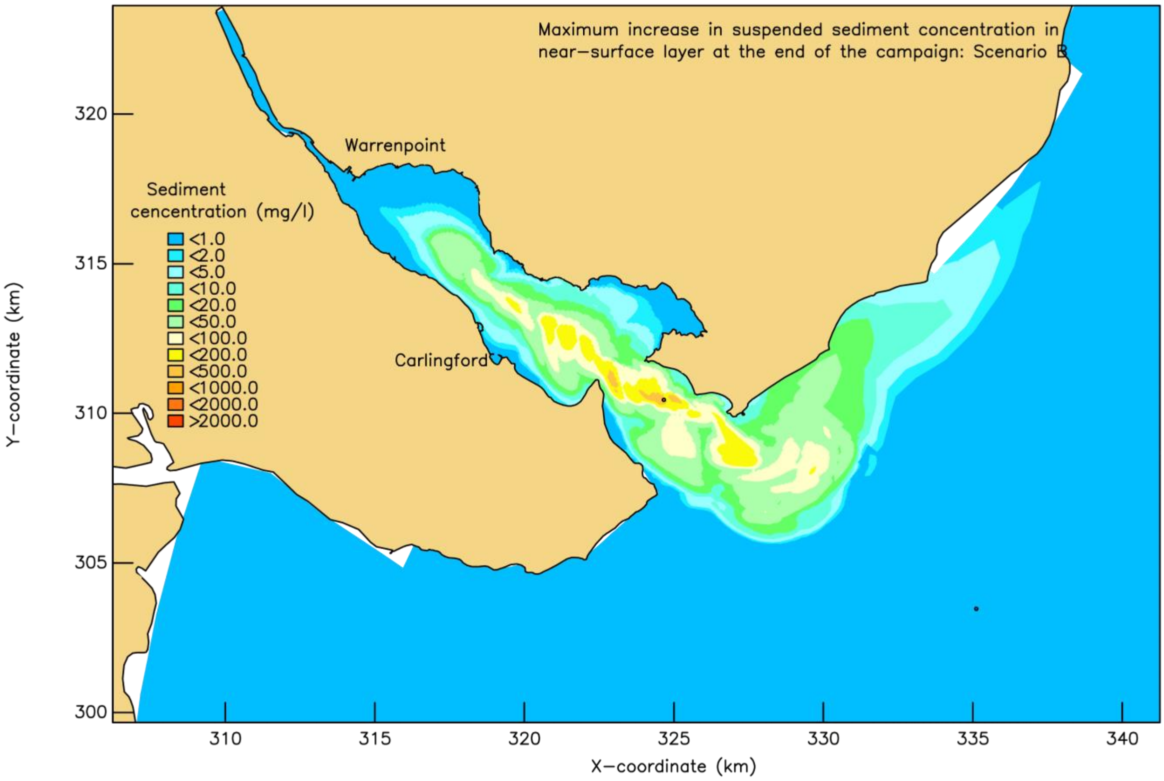

Figure B 19 – Scenario B: Maximum increase in suspended sediment concentration above the background in the near-surface layer over the campaign period.

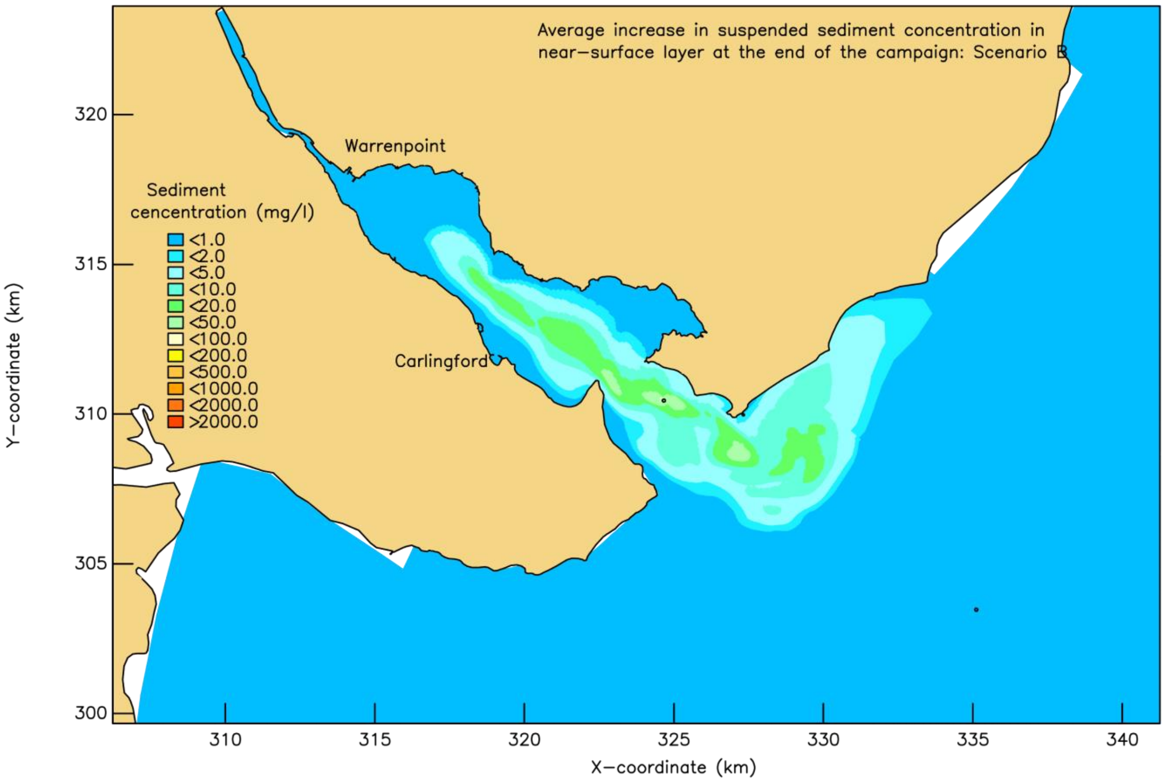

Figure B 20 – Scenario B: Average increase in suspended sediment concentration above the background in the near-surface layer over the campaign period.

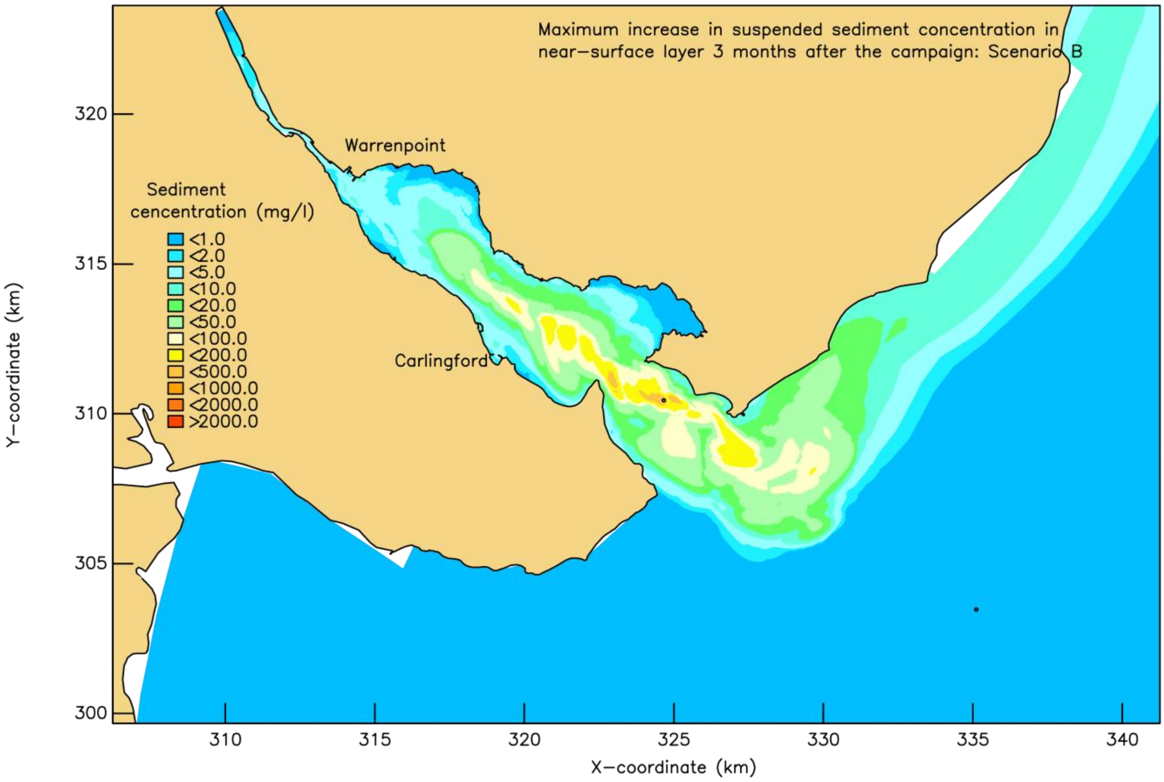

Figure B 21 – Scenario B: Maximum increase in suspended sediment concentration above the background in the near-surface layer over the campaign period and the three months thereafter.

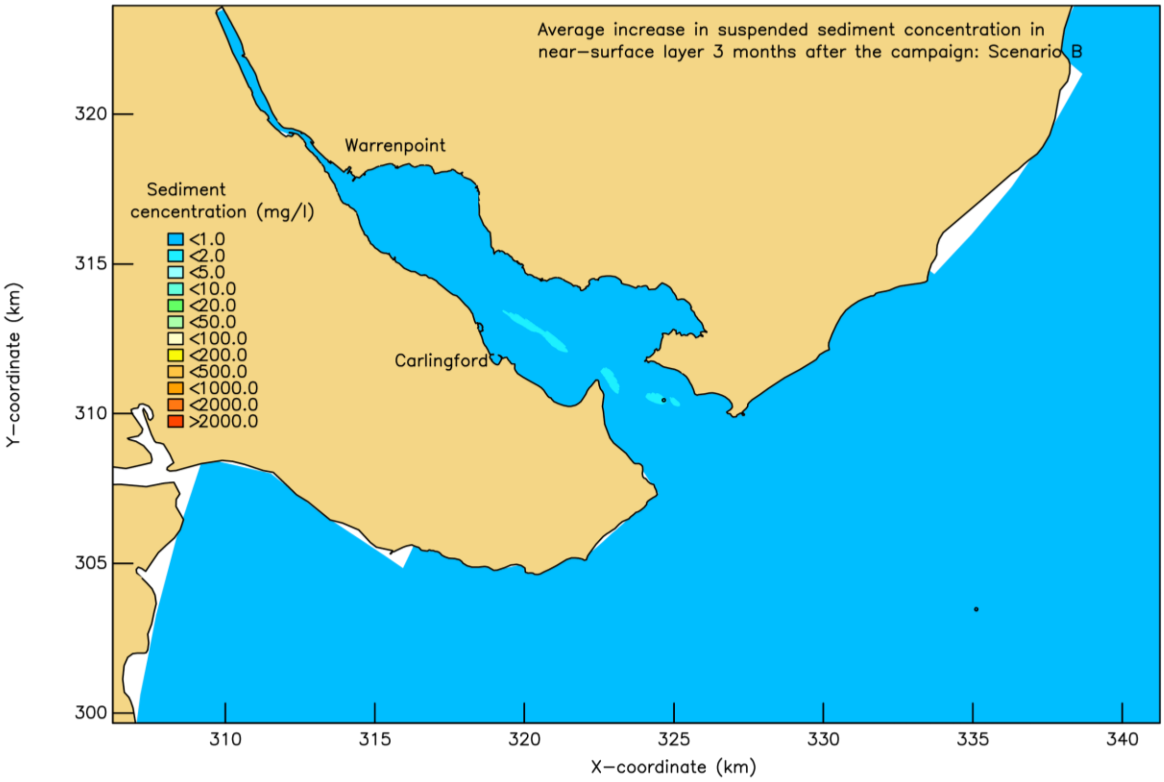

Figure B 22 – Scenario B: Average increase in suspended sediment concentration above the background in the near-surface layer over the campaign period and the three months thereafter.

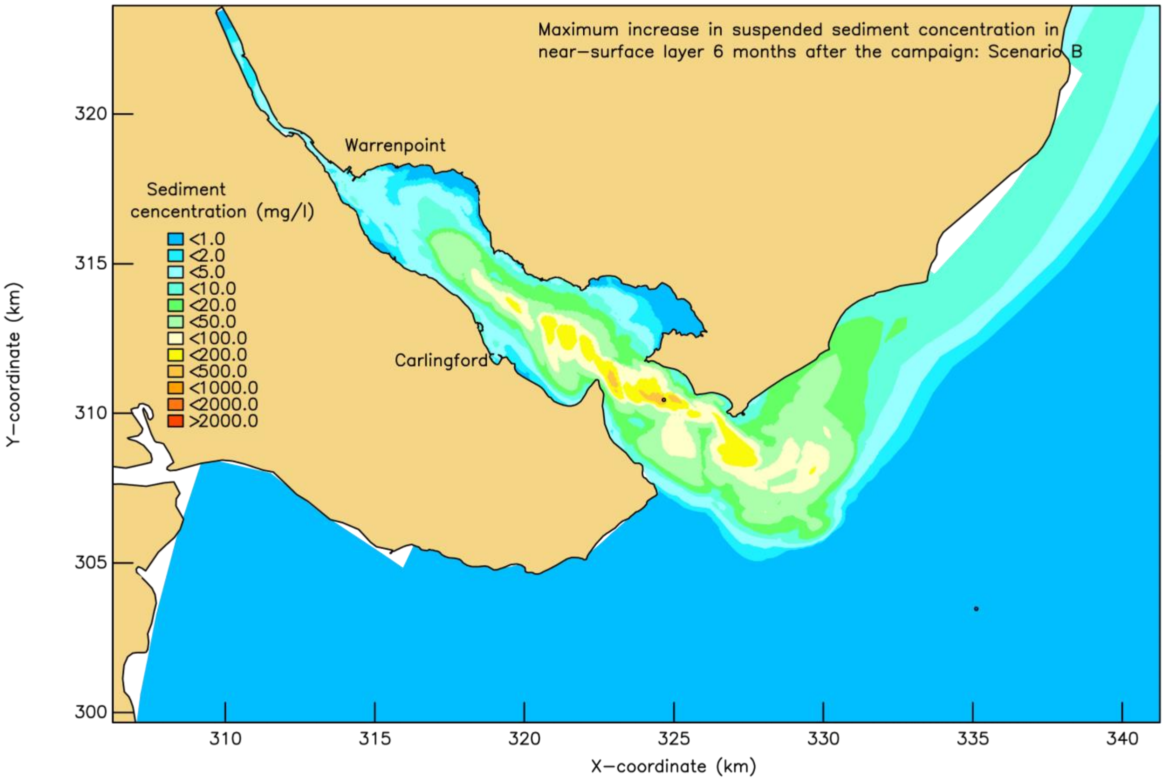

Figure B 23 – Scenario B: Maximum increase in suspended sediment concentration above the background in the near-surface layer over the campaign period and the six months thereafter.

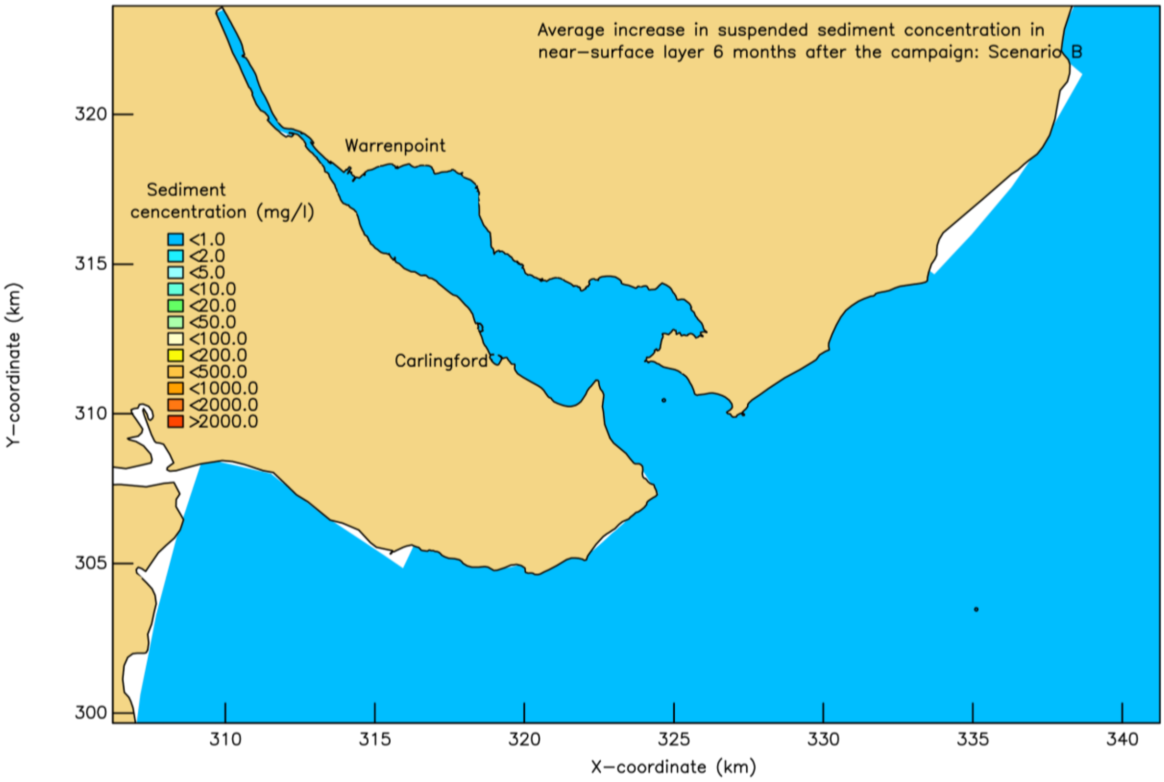

Figure B 24 – Scenario B: Average increase in suspended sediment concentration above the background in the near-surface layer over the campaign period and the six months thereafter.

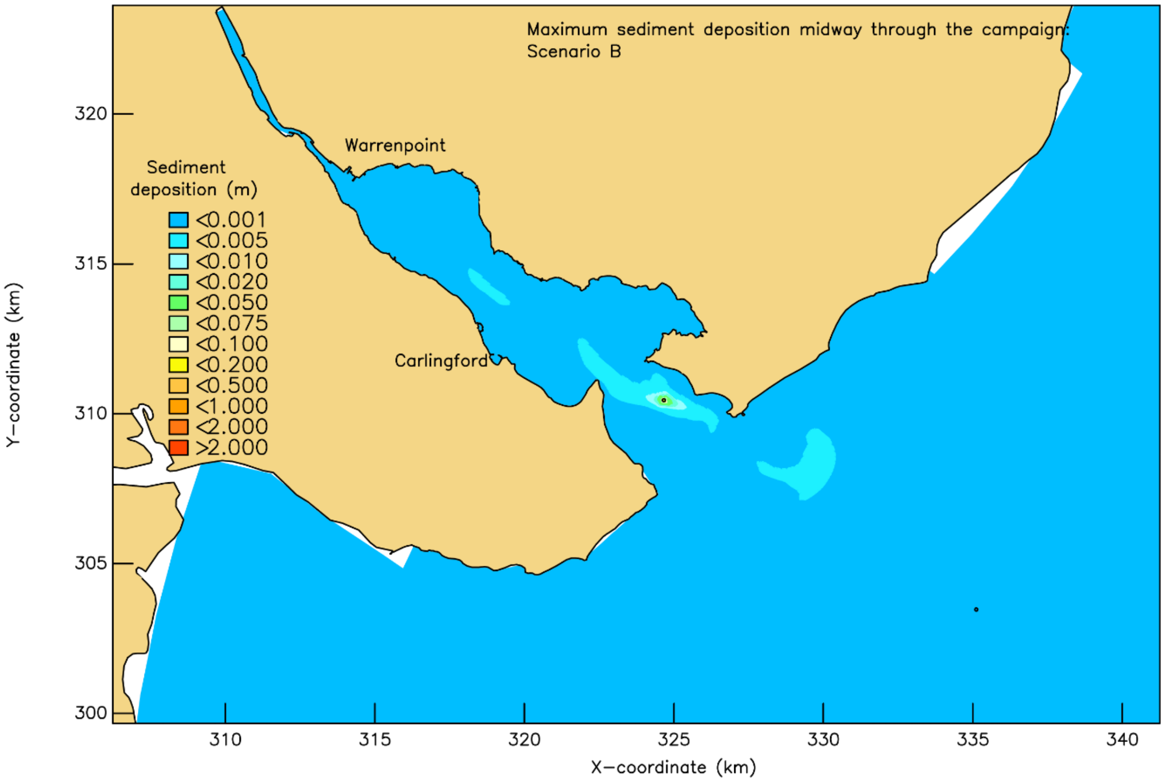

Figure B 25 – Scenario B: Maximum sediment deposition that occurred over the first half of the campaign period.

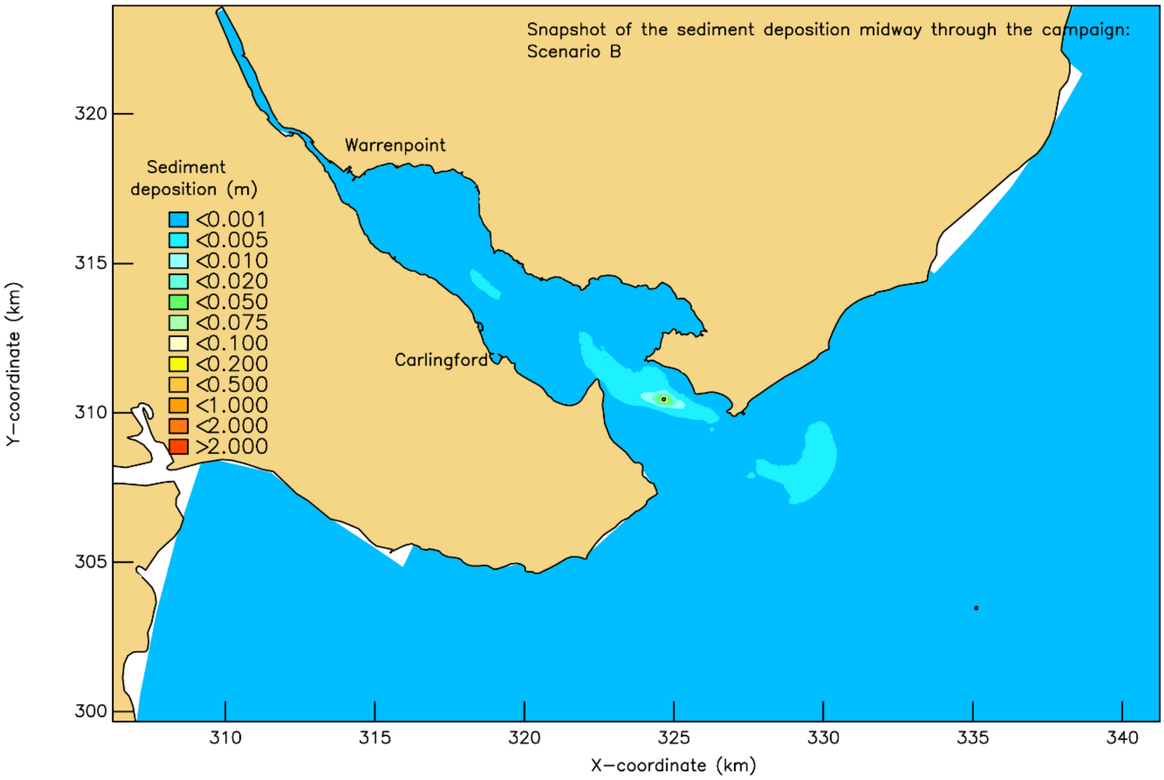

Figure B 26 – Scenario B: Instantaneous sediment deposition midway through the campaign.

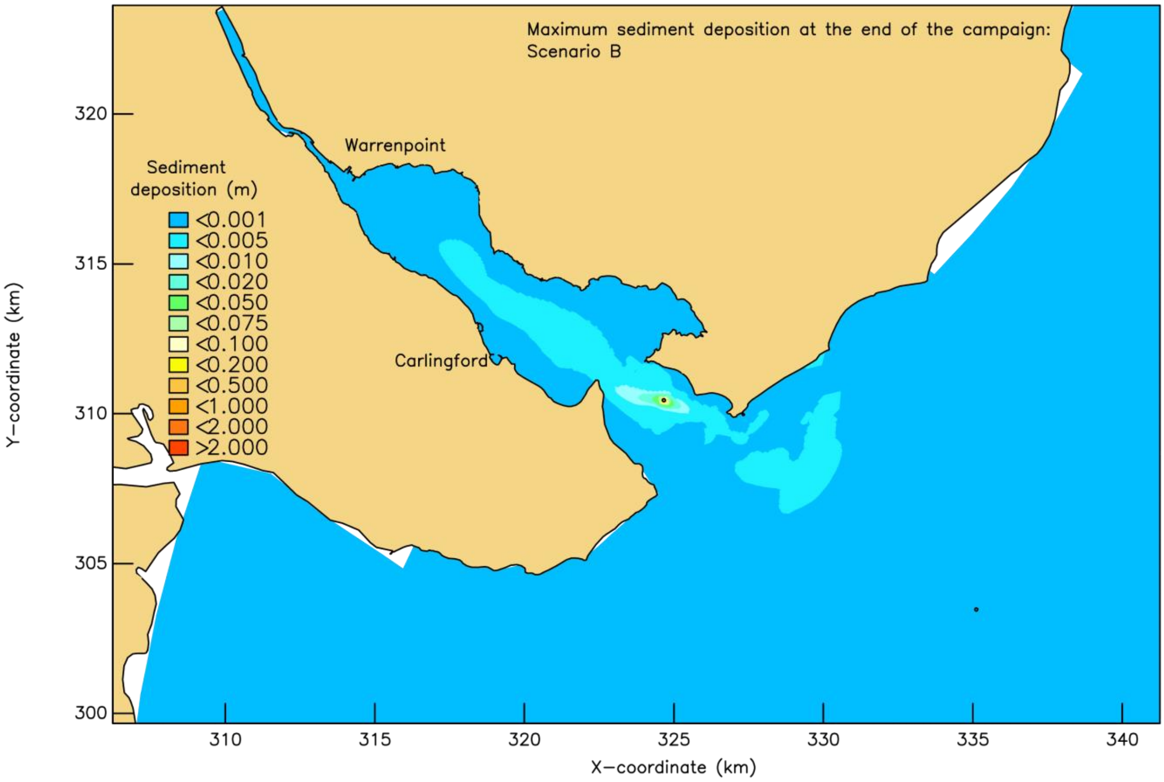

Figure B 27 – Scenario B: Maximum sediment deposition that occurred over the campaign period.

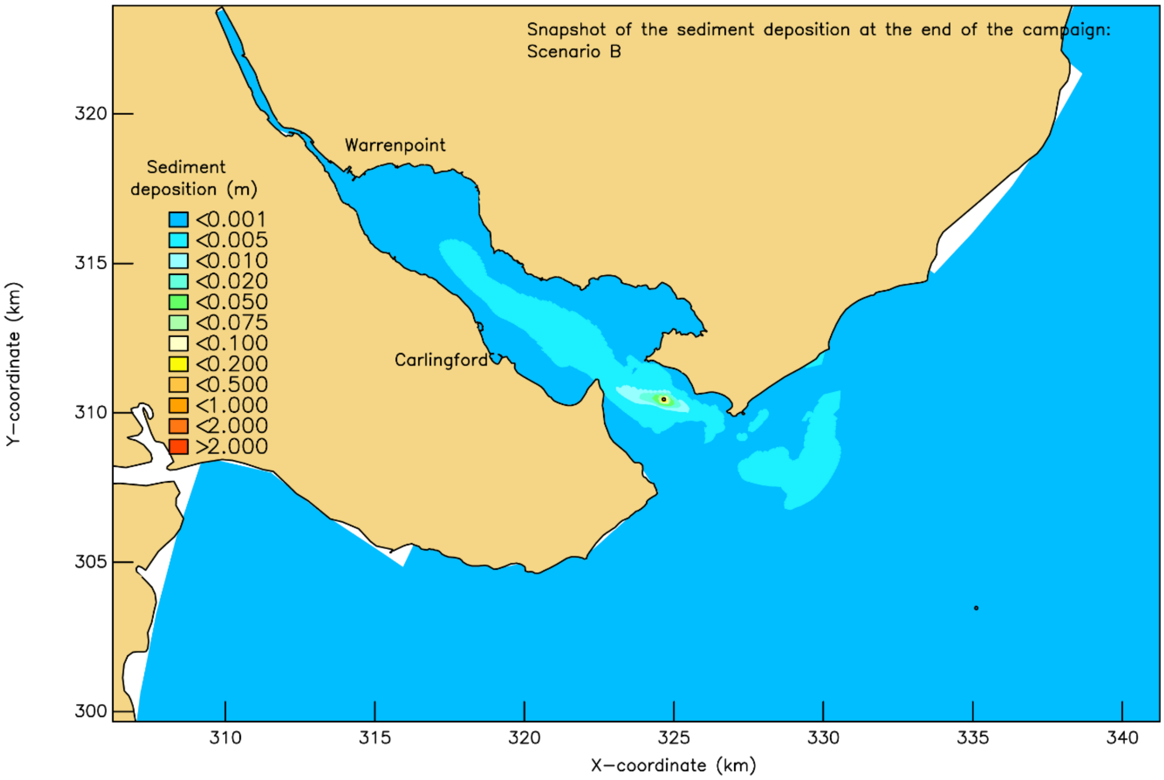

Figure B 28 – Scenario B: Instantaneous sediment deposition at the end of the campaign.

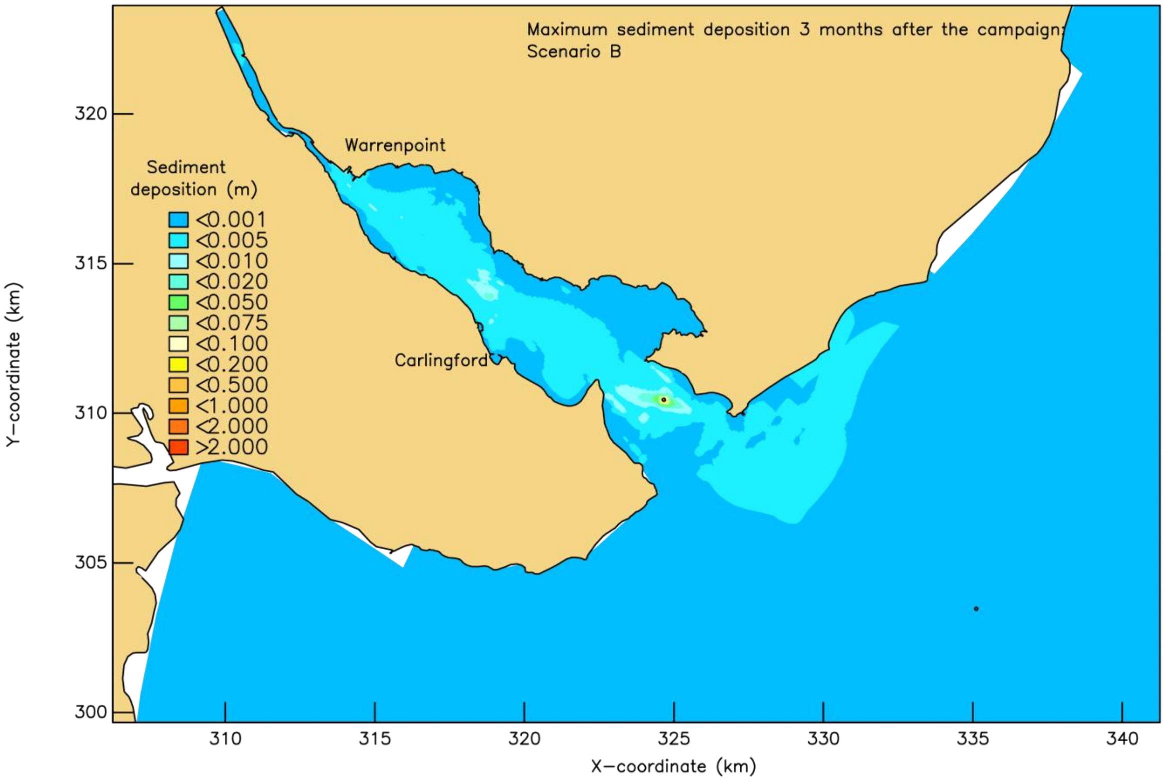

Figure B 29 – Scenario B: Maximum sediment deposition that occurred over the campaign period and the three months thereafter.

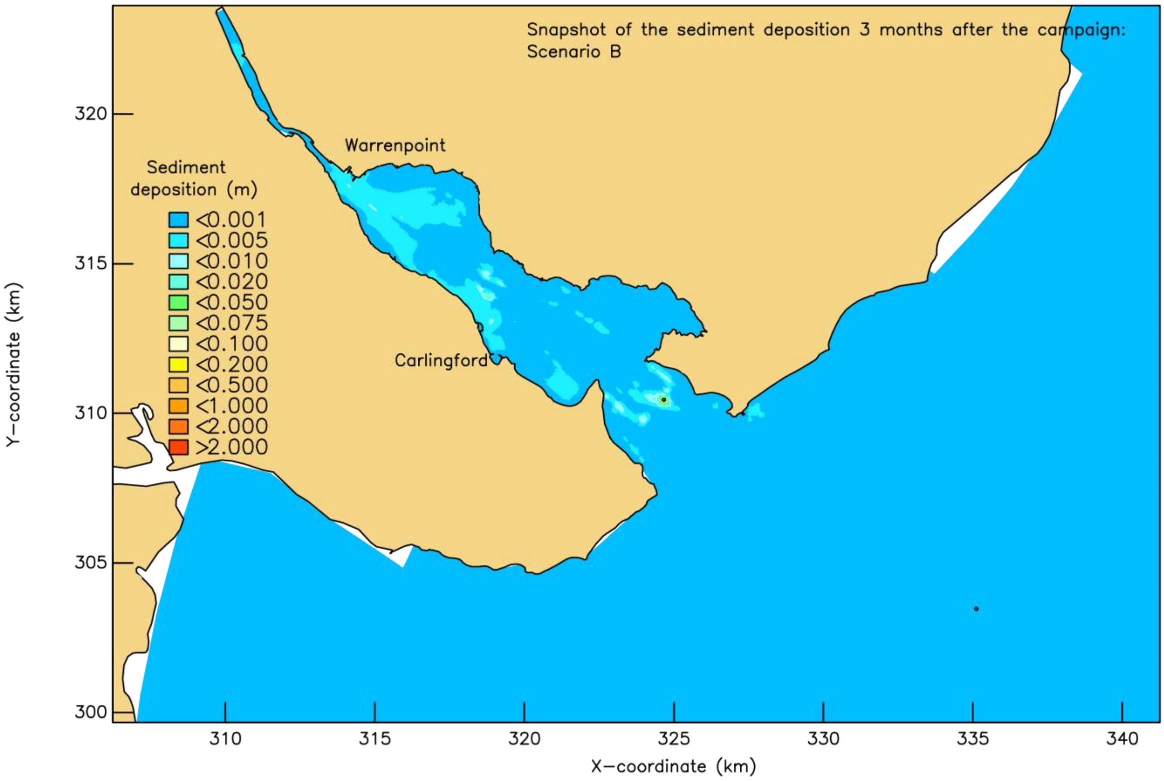

Figure B 30 – Scenario B: Instantaneous sediment deposition three months after the campaign ended.

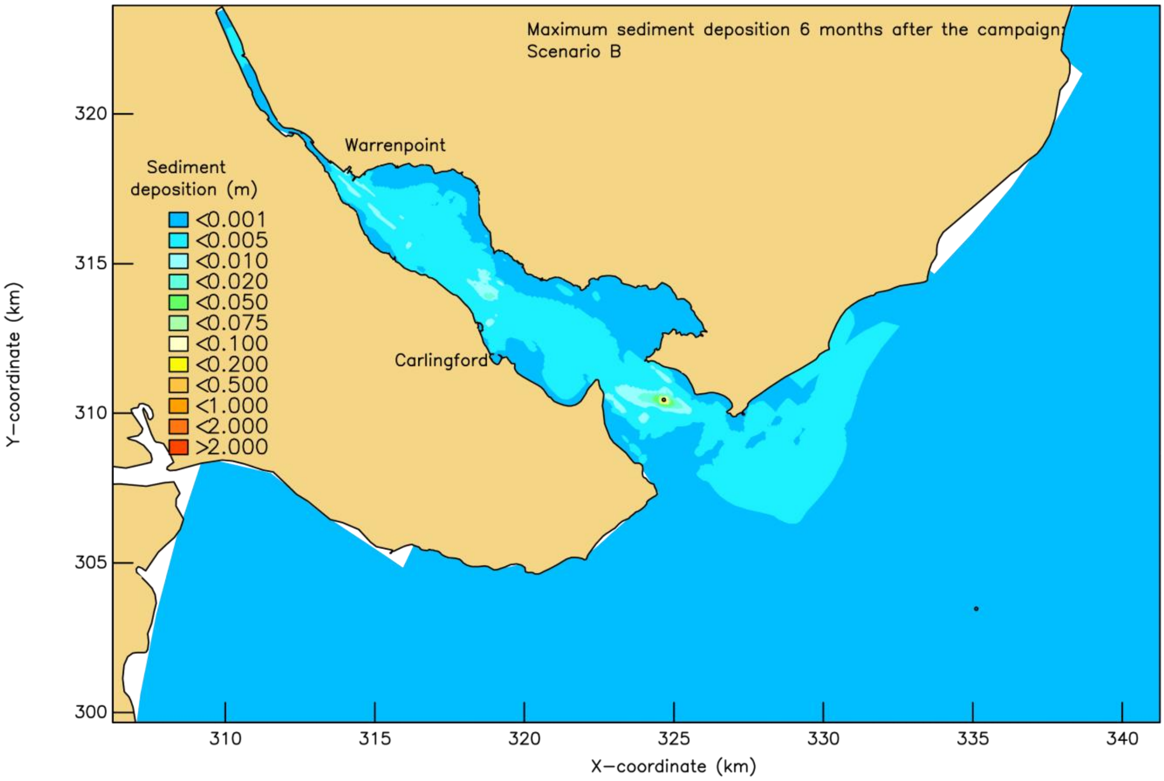

Figure B 31 – Scenario B: Maximum sediment deposition that occurred over the campaign period and the six months thereafter.

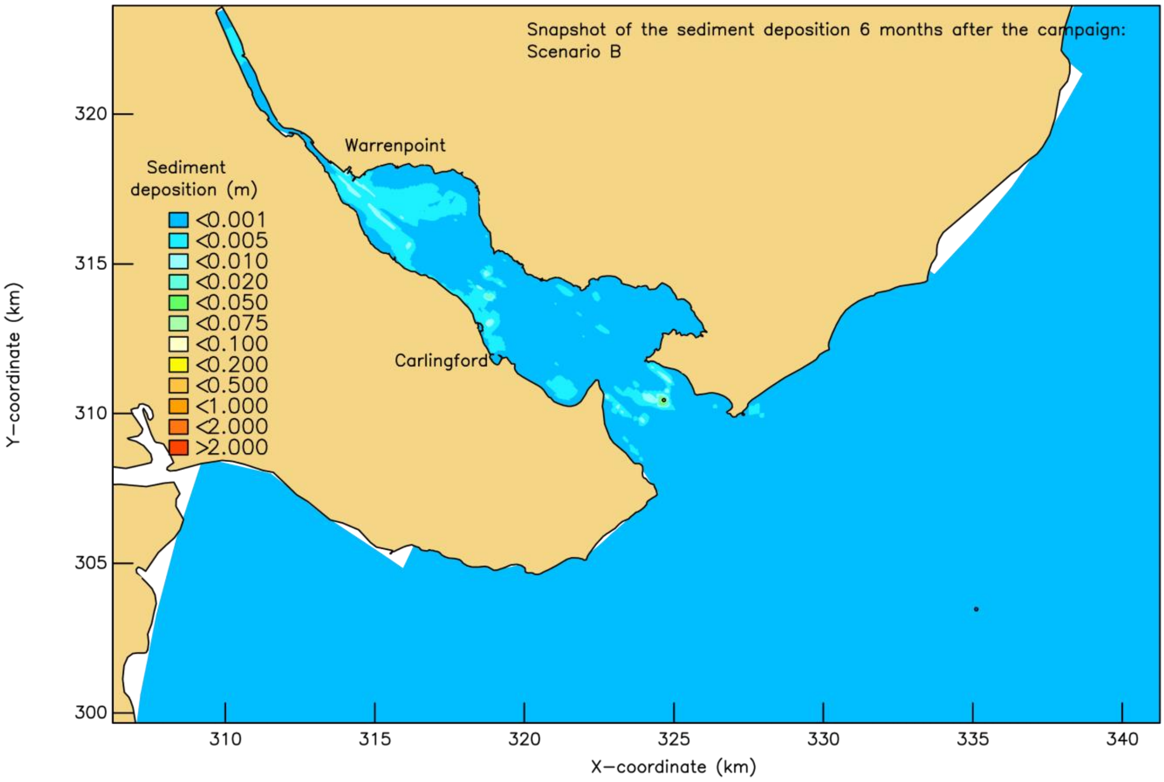

Figure B 32 – Scenario B: Instantaneous sediment deposition six months after the campaign ended.

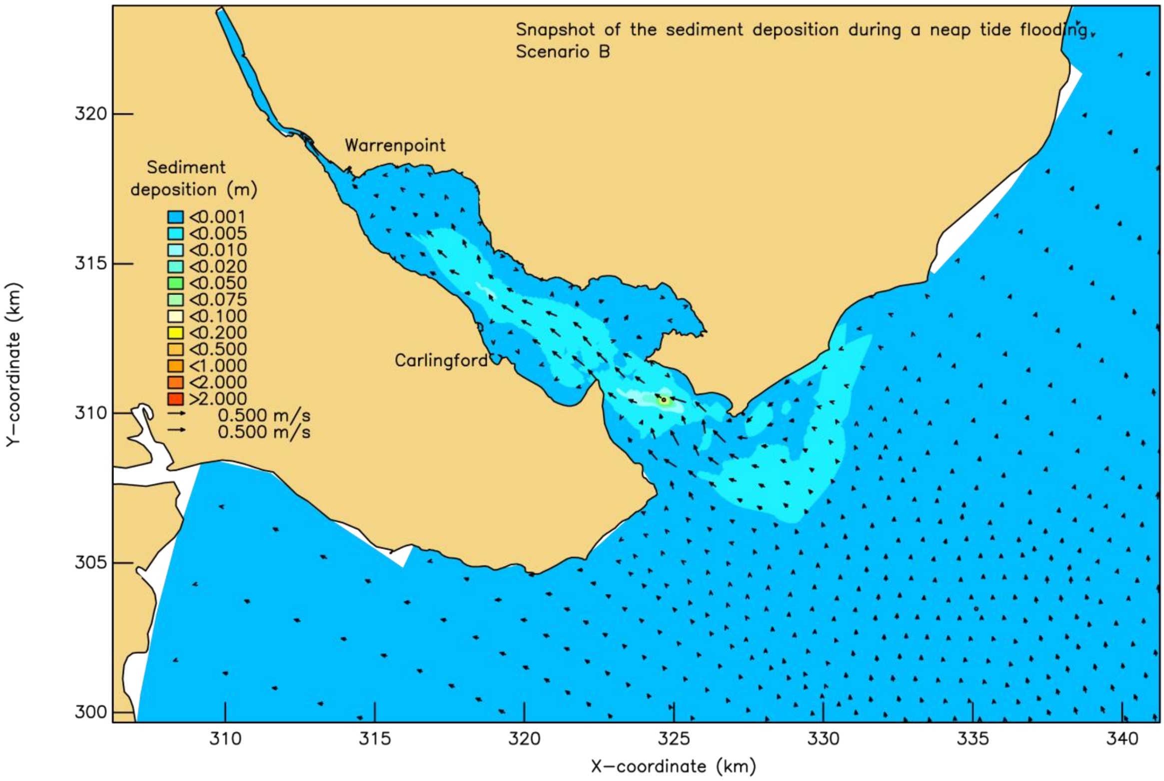

Figure B 33 – Scenario B: Snapshot of the sediment deposition during a neap tide flooding.

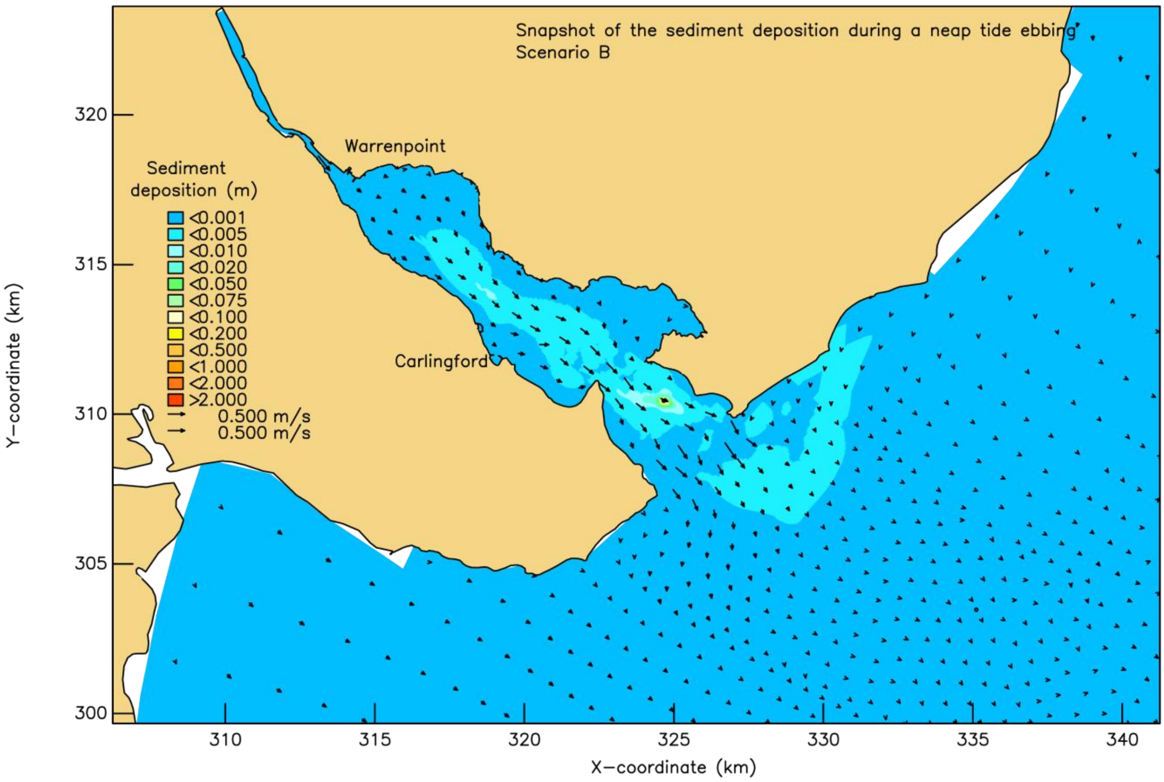

Figure B 34 – Scenario B: Snapshot of the sediment deposition during a neap tide ebbing.

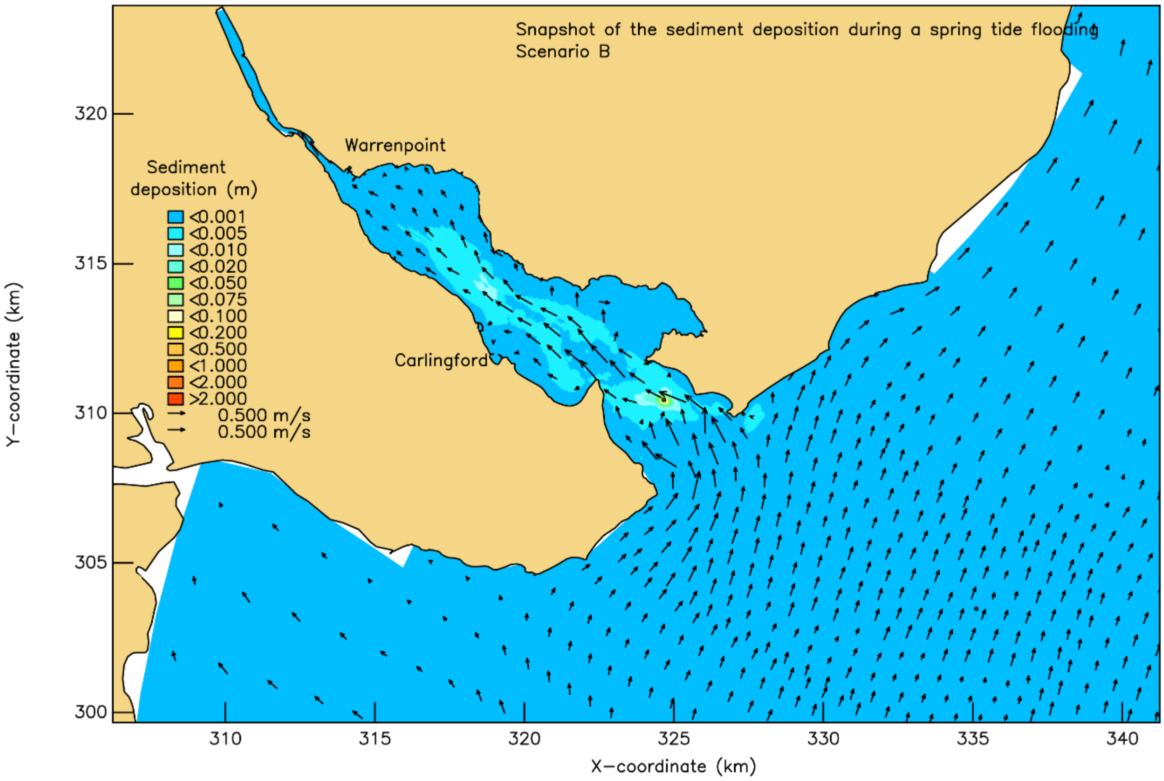

Figure B 35 – Scenario B: Snapshot of the sediment deposition during a spring tide flooding.

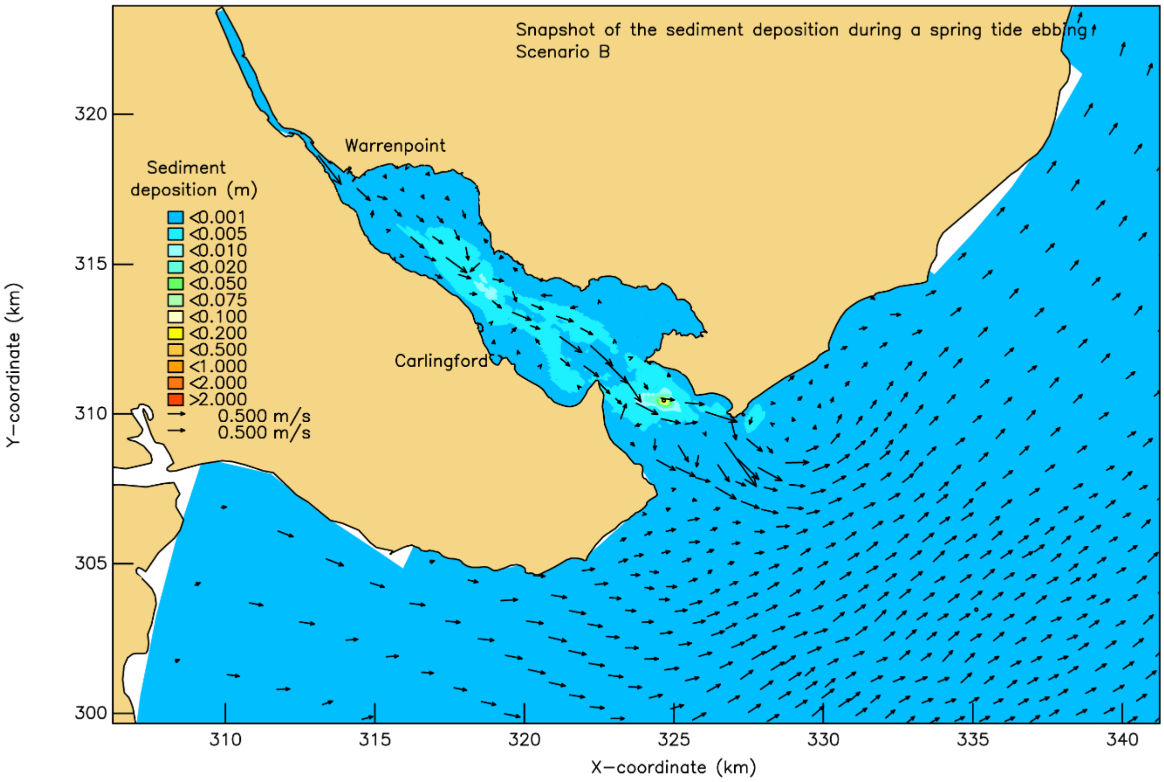

Figure B 36 – Scenario B: Snapshot of the sediment deposition during a spring tide ebbing.

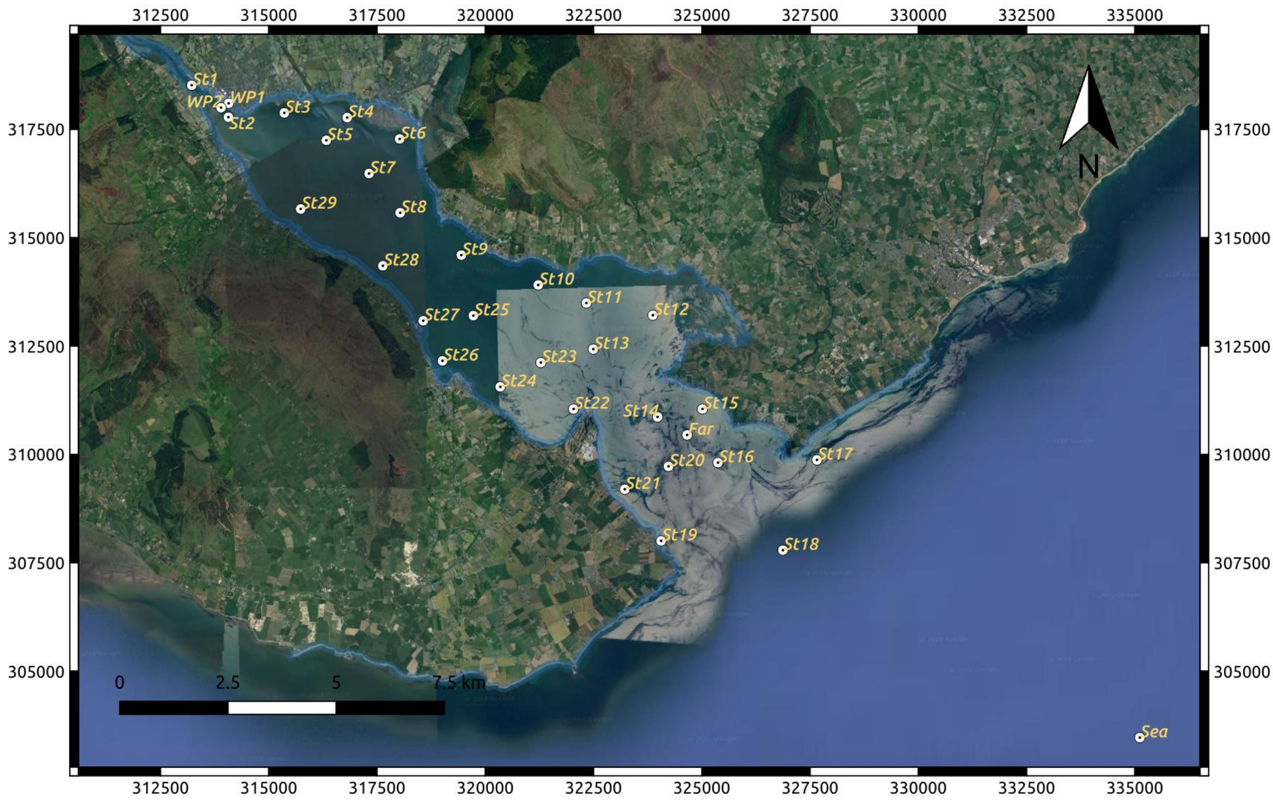

Figure B 37 – The locations of the output stations for the time series graphs.

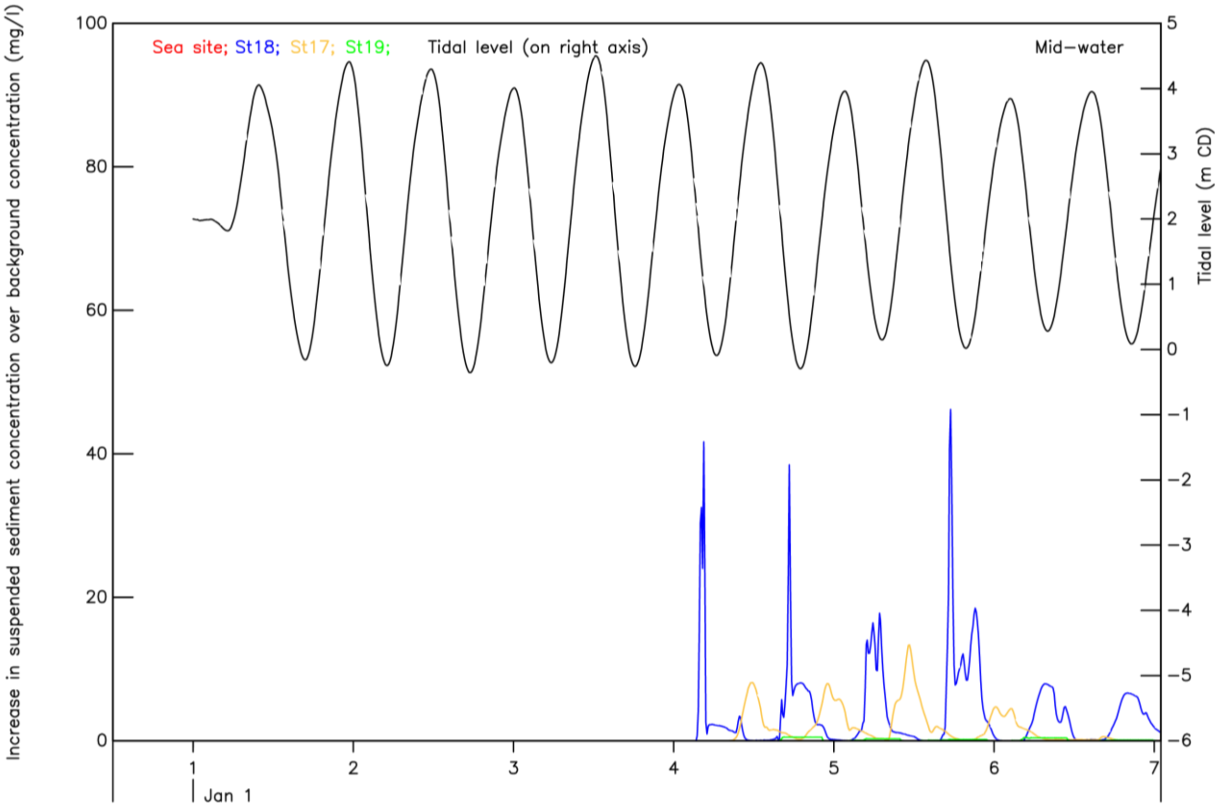

Figure B 38 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth during the campaign period at stations: Sea site, St18, St17 and St19.

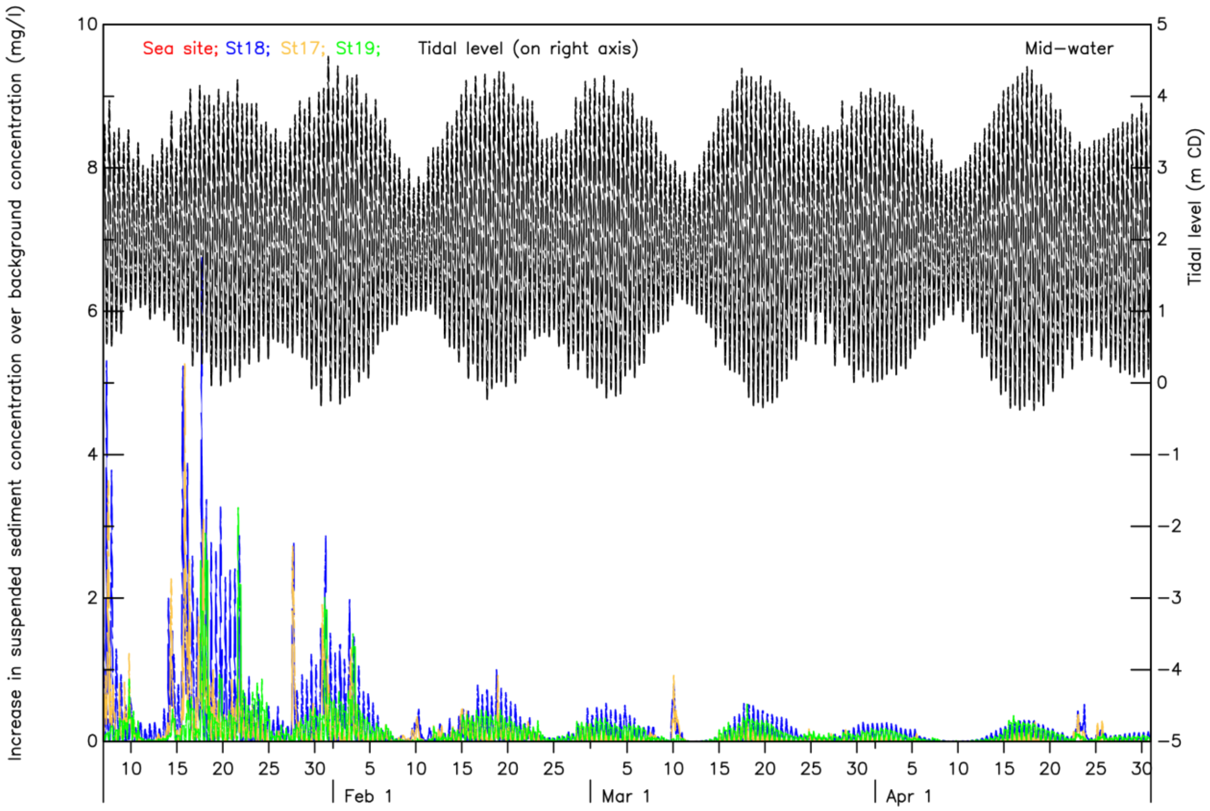

Figure B 39 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the three months following the campaign period at stations: Sea site, St18, St17 and St19.

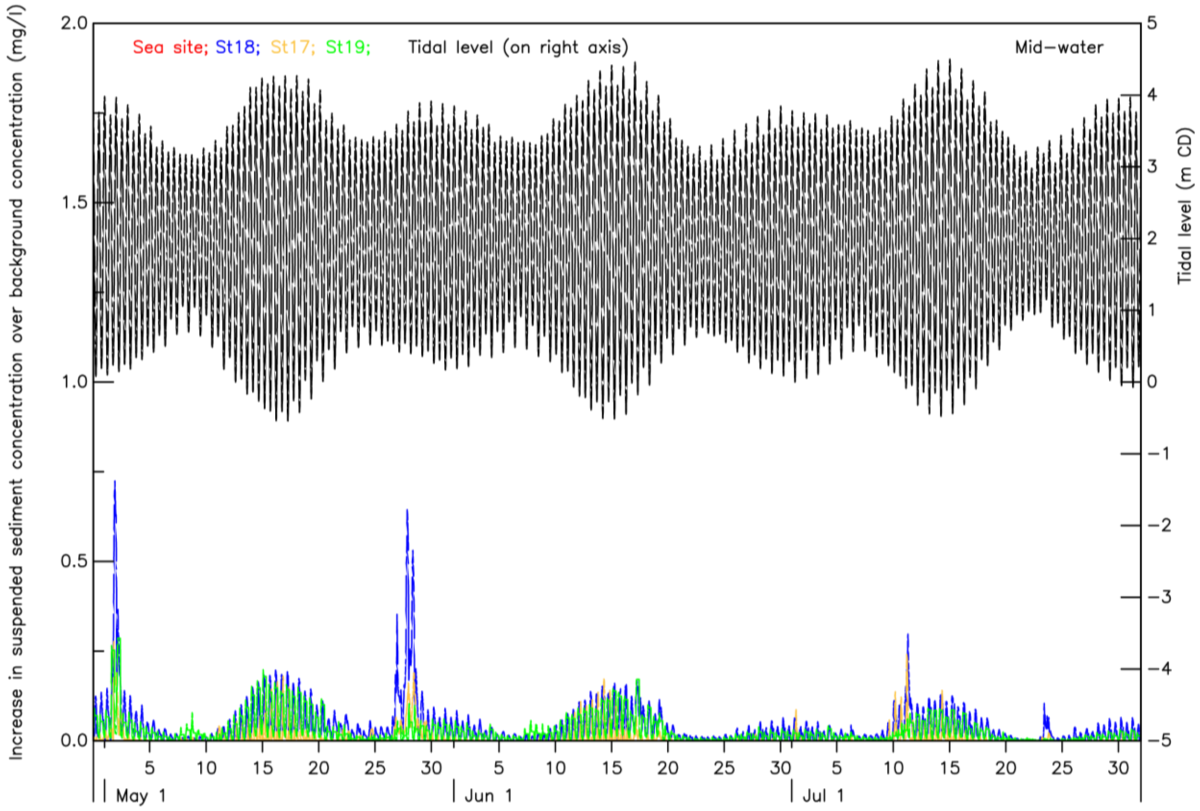

Figure B 40 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the four to six months following the campaign period at stations: Sea site, St18, St17 and St19.

Table B.1: Scenario B: Statistical indicators for elevated suspended concentrations at mid-depth at stations Sea site, St18, St17 and St19.

	Suspended sediment concentration at mid-depth			
	Sea site (mg/l)	**St18 (mg/l)**	**St17 (mg/l)**	**St19 (mg/l)**
Peak	0.00	46.21	13.38	3.26
99th percentile	0.00	2.65	1.71	0.69
95th percentile	0.00	0.60	0.34	0.31
50th percentile	0.00	0.03	0.00	0.03
Mean	0.00	0.18	0.09	0.09

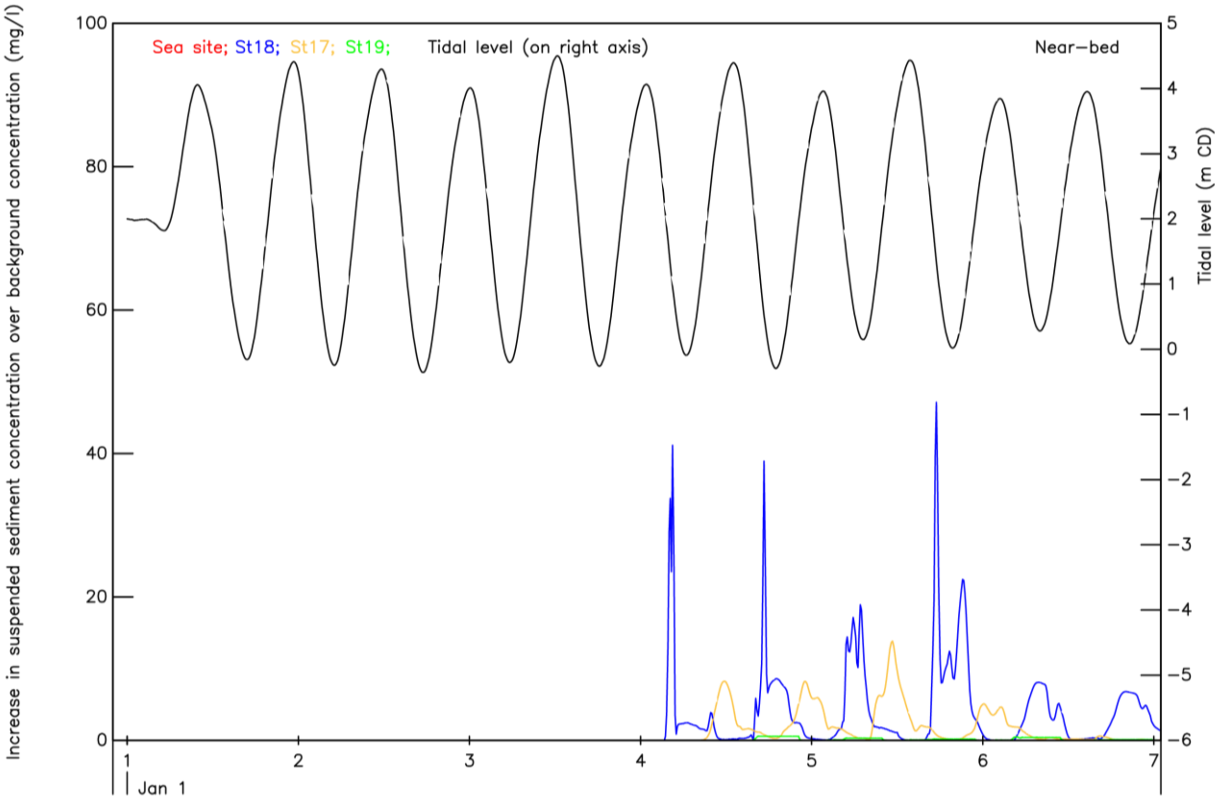

Figure B 41 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed during the campaign period at stations Sea site, St18, St17 and St19.

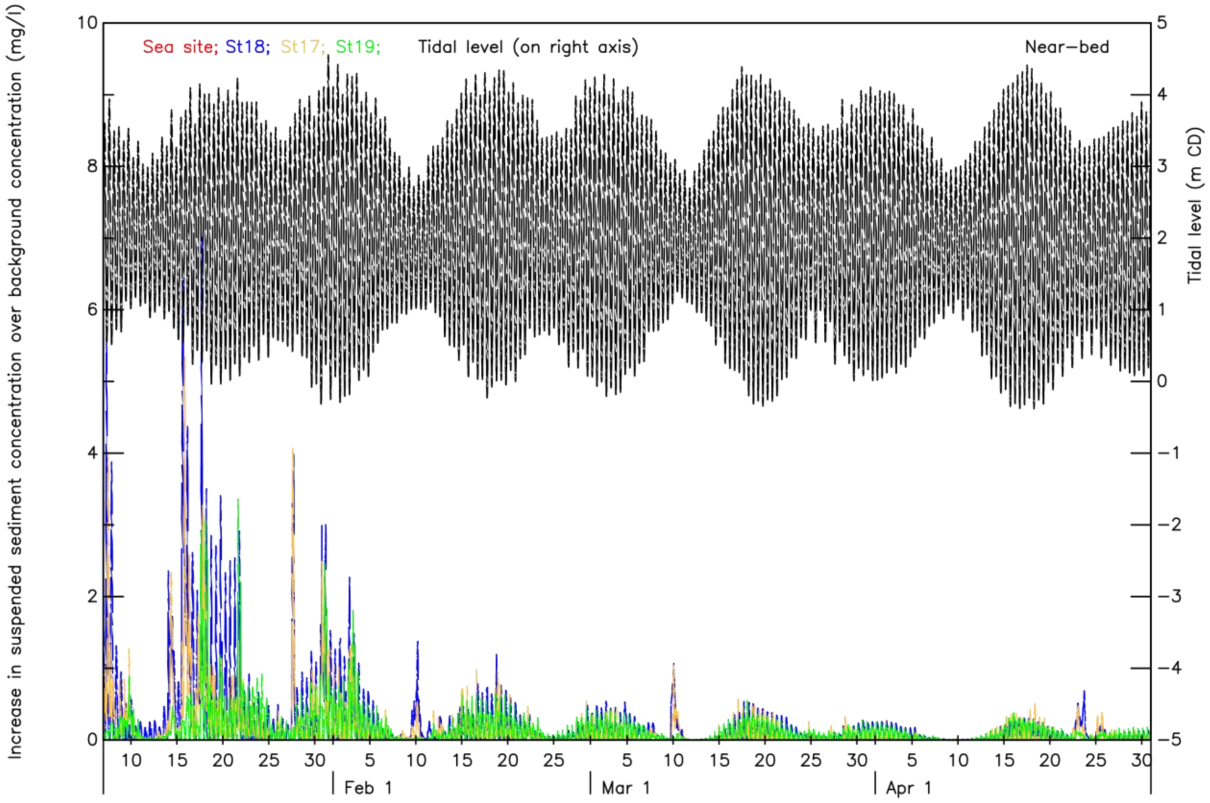

Figure B 42 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the three months following the campaign period at stations: Sea site, St18, St17 and St19.

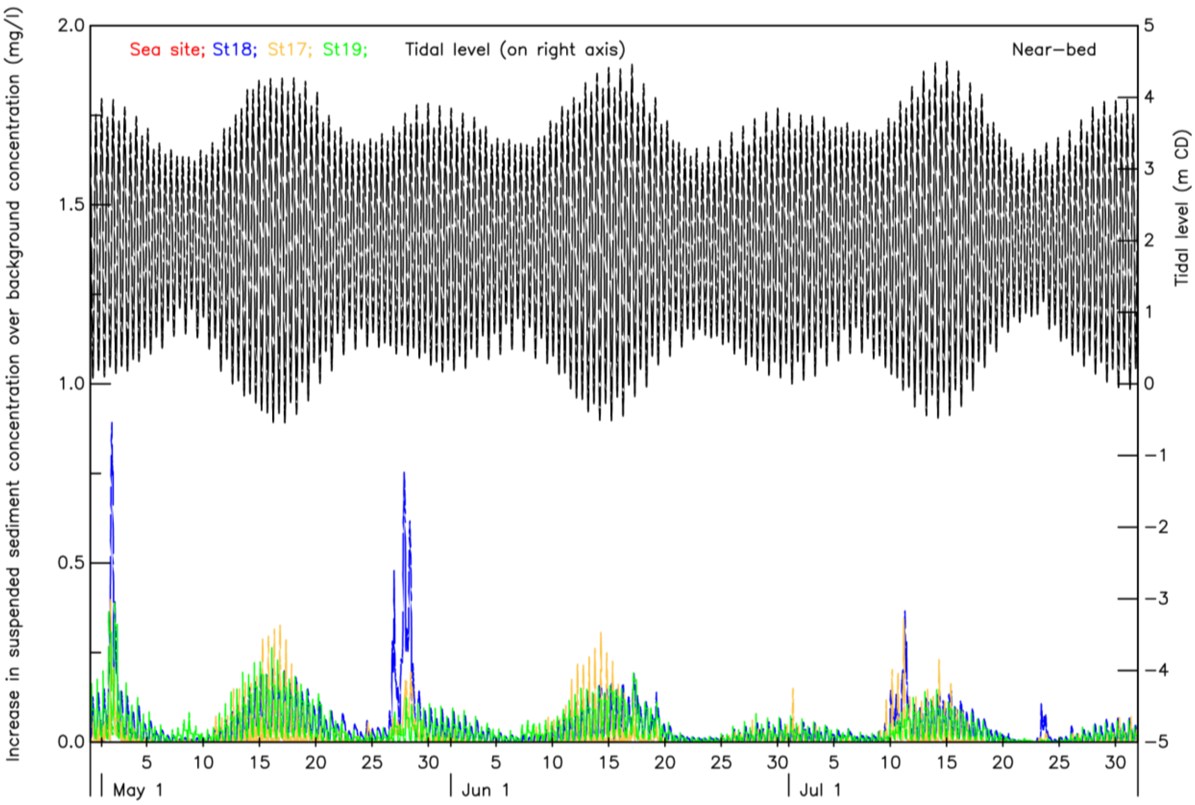

Figure B 43 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the four to six months following the campaign period at stations: Sea site, St18, St17 and St19.

Table B.2: **Scenario B: Statistical indicators for elevated suspended concentrations at the bed at stations Sea site, St18, St17 and St19.**

	Suspended sediment concentration at the bed			
	Sea site (mg/l)	**St18 (mg/l)**	**St17 (mg/l)**	**St19 (mg/l)**
Peak	0.00	47.16	13.86	3.36
99th percentile	0.00	3.01	1.84	0.80
95th percentile	0.00	0.70	0.45	0.37
50th percentile	0.00	0.03	0.01	0.03
Mean	0.00	0.21	0.11	0.10

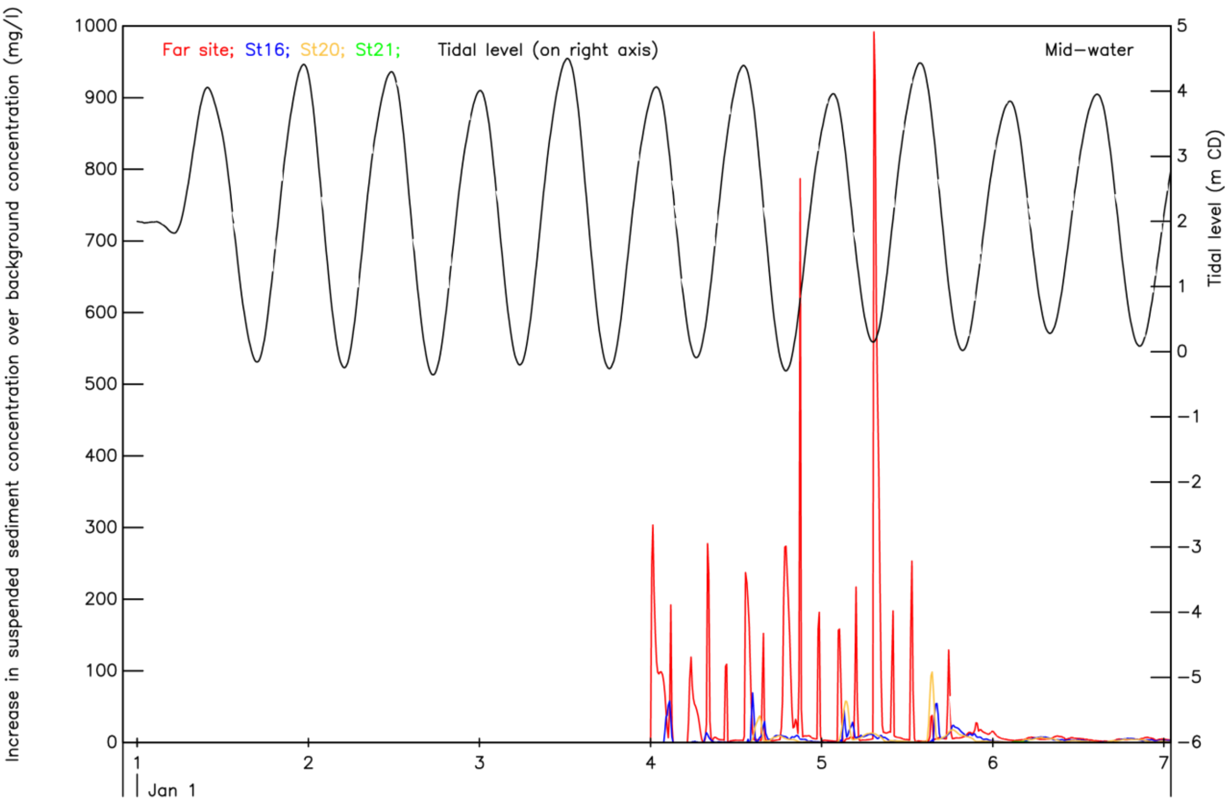

Figure B 44 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth during the campaign period at stations: Far site, St16, St20 and St21.

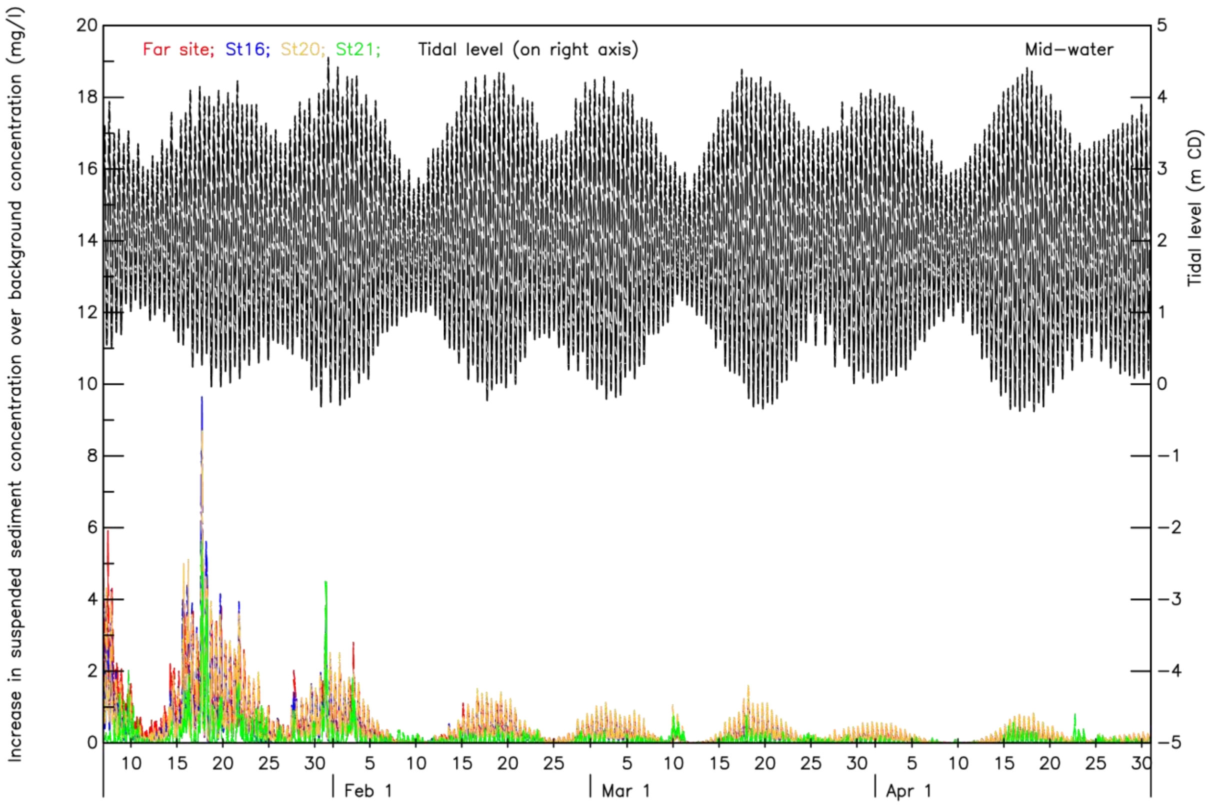

Figure B 45 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the three months following the campaign period at stations: Far site, St16, St20 and St21.

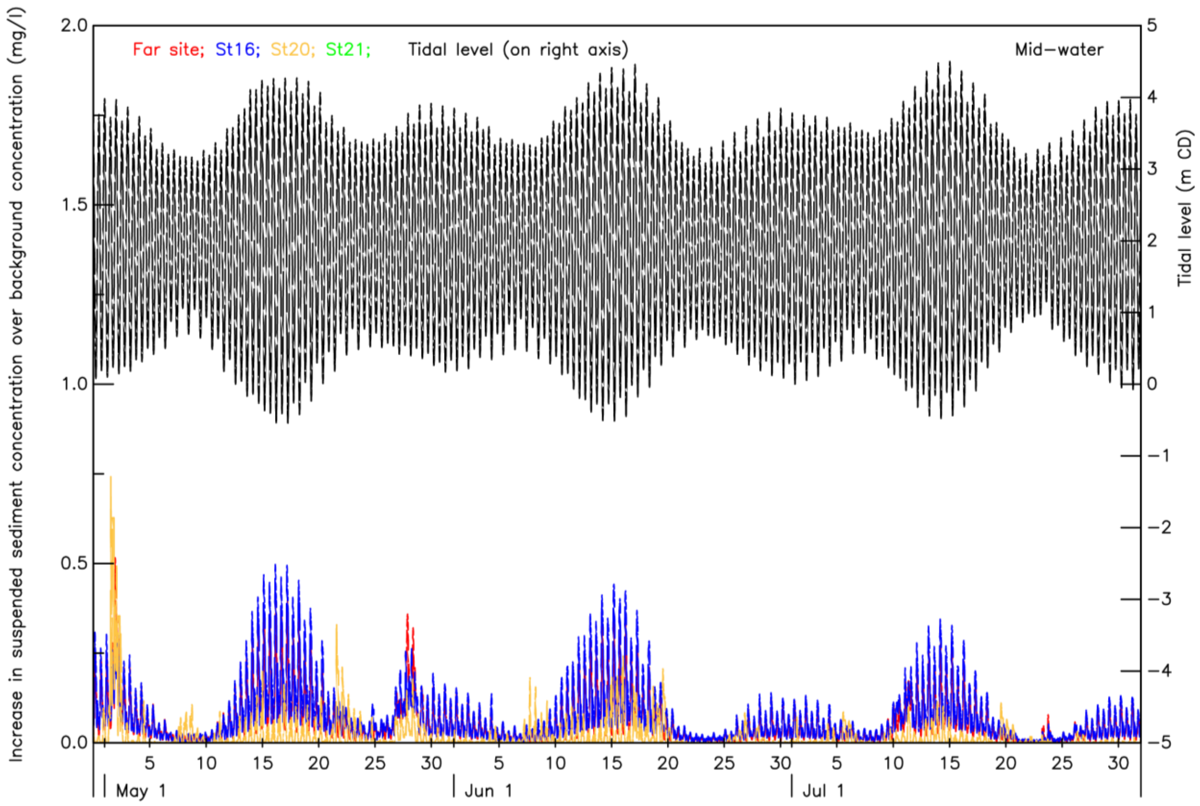

Figure B 46 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the four to six months following the campaign period at stations: Far site, St16, St20 and St21.

Table B.3: **Scenario B: Statistical indicators for elevated suspended concentrations at mid-depth at stations Far site, St16, St20 and St21.**

	Suspended sediment concentration at mid-depth			
	Far site (mg/l)	**St16 (mg/l)**	**St20 (mg/l)**	**St21 (mg/l)**
Peak	991.9	69.40	98.65	5.58
99th percentile	4.56	3.86	3.38	1.13
95th percentile	1.47	1.00	1.08	0.32
50th percentile	0.08	0.07	0.08	0.01
Mean	0.74	0.29	0.30	0.08

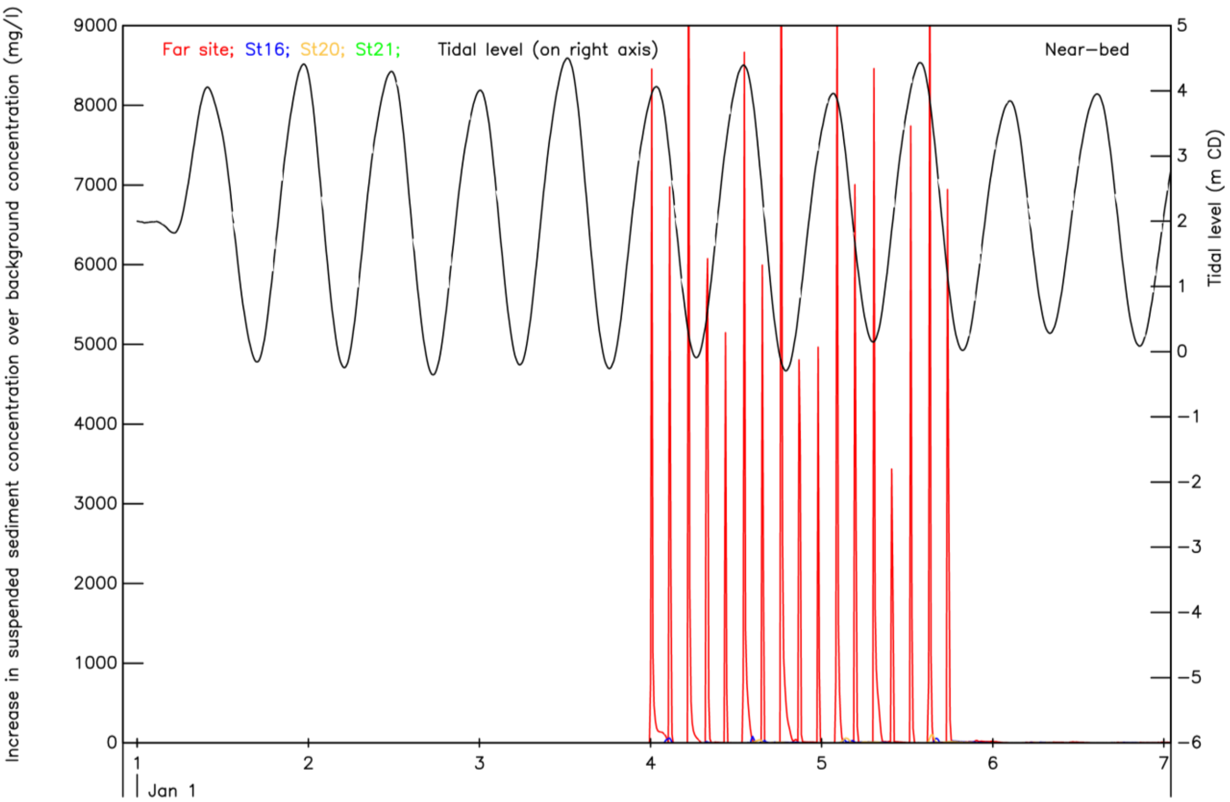

Figure B 47 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed during the campaign period at stations: Far site, St16, St20 and St21.

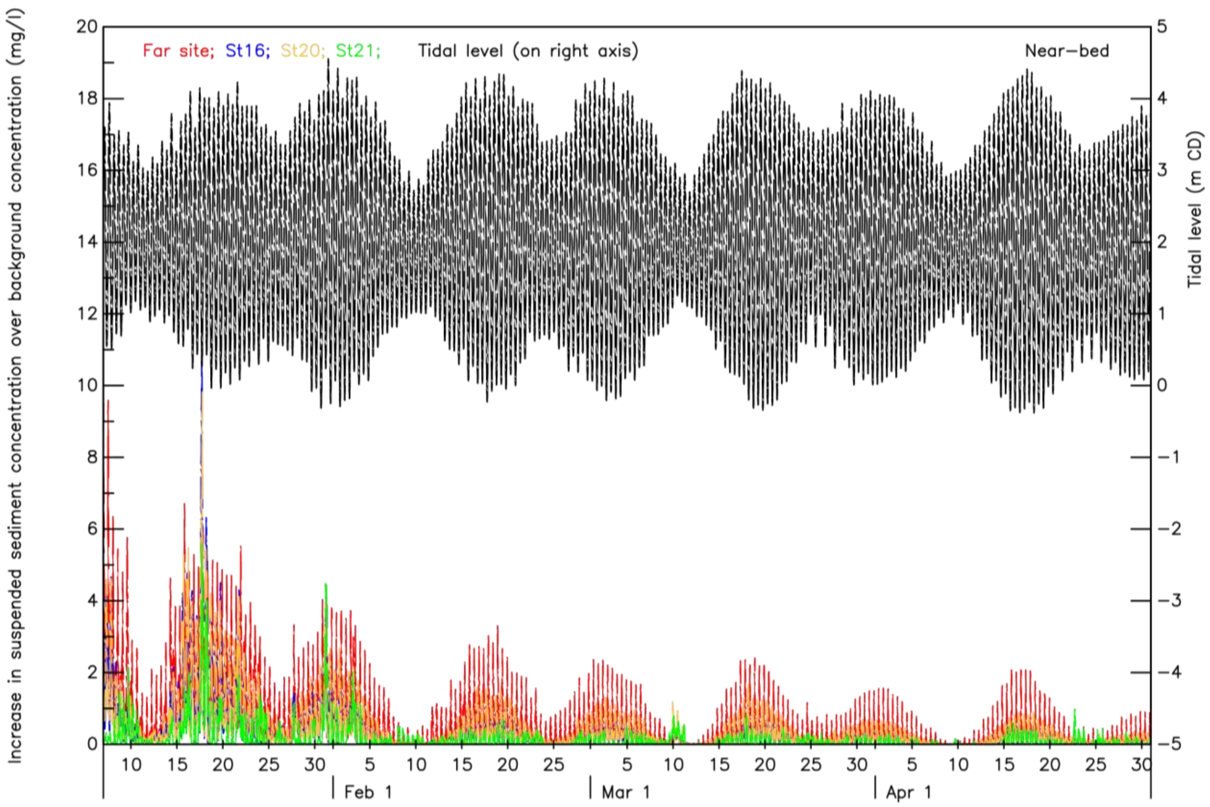

Figure B 48 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the three months following the campaign period at stations: Far site, St16, St20 and St21.

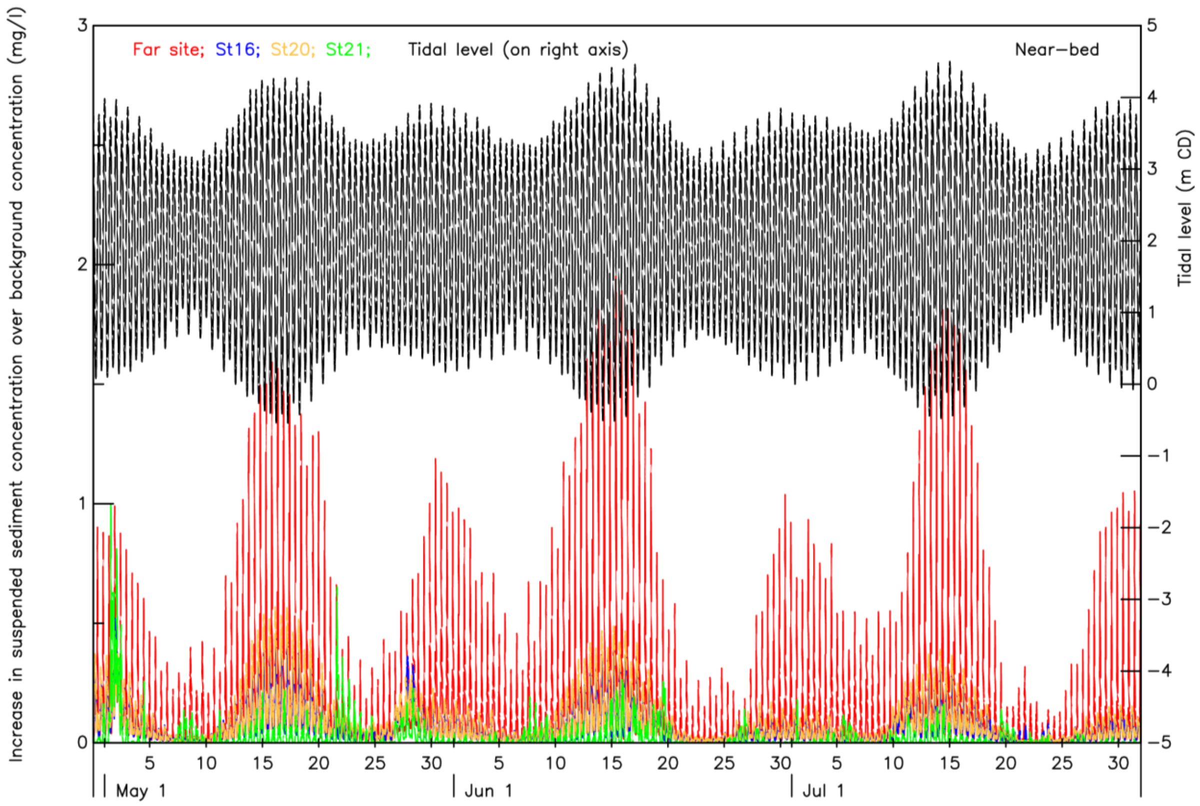

Figure B 49 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the four to six months following the campaign period at stations: Far site, St16, St20 and St21.

Table B.4: Scenario B: Statistical indicators for elevated suspended concentrations at the bed at stations Far site, St16, St20 and St21.

	Suspended sediment concentration at the bed			
	Far site (mg/l)	**St16 (mg/l)**	**St20 (mg/l)**	**St21 (mg/l)**
Peak	12218.7	80.55	104.77	5.60
99th percentile	5.79	4.18	3.79	1.19
95th percentile	2.20	1.09	1.20	0.41
50th percentile	0.13	0.07	0.09	0.01
Mean	6.49	0.31	0.33	0.09

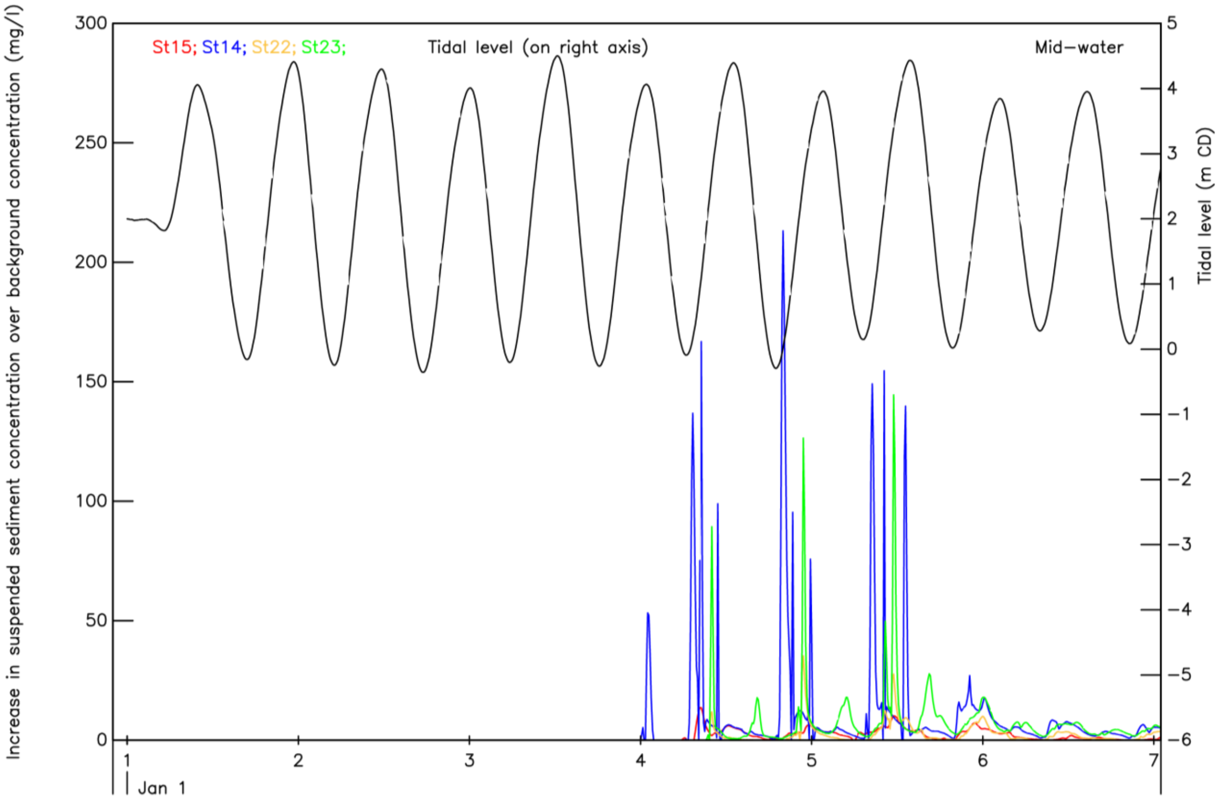

Figure B 50 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth during the campaign period at stations: St15, St14, St22 and St23.

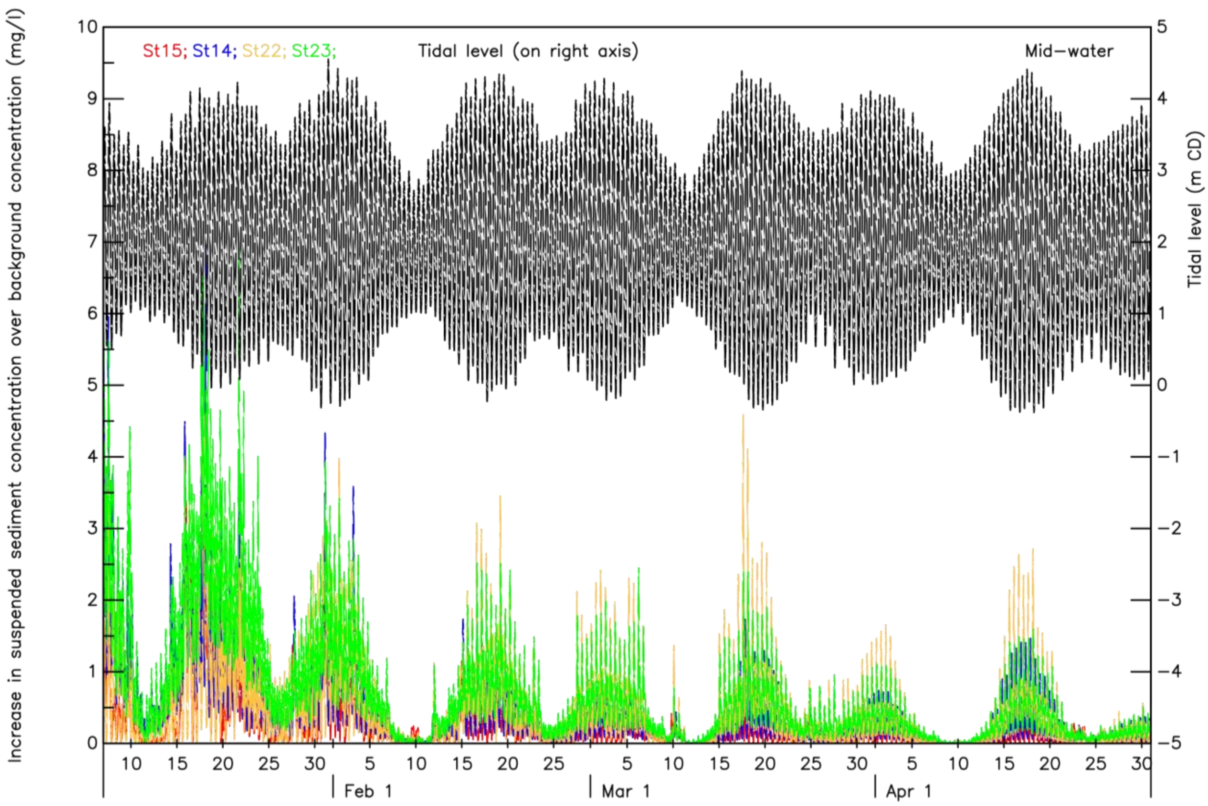

Figure B 51 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the three months following the campaign period at stations: St15, St14, St22 and St23.

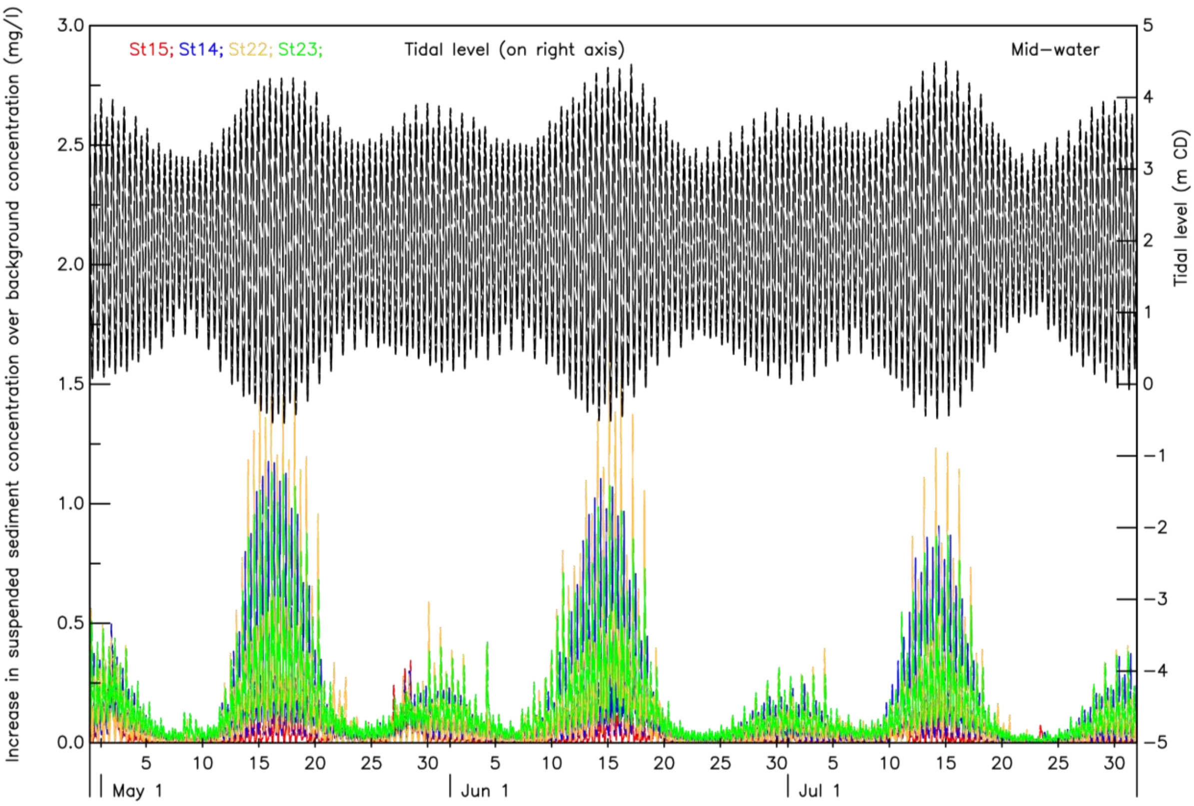

Figure B 52 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the four to six months following the campaign period at stations: St15, St14, St22 and St23.

Table B.5: **Scenario B: Statistical indicators for elevated suspended concentrations at mid-depth at stations St15, St14, St22 and St23.**

	Suspended sediment concentration at mid-depth			
	St15 (mg/l)	**St14 (mg/l)**	**St22 (mg/l)**	**St23 (mg/l)**
Peak	13.62	213.22	35.35	144.51
99th percentile	2.38	3.91	2.86	4.62
95th percentile	0.69	1.49	1.46	2.18
50th percentile	0.03	0.09	0.11	0.17
Mean	0.16	0.45	0.34	0.55

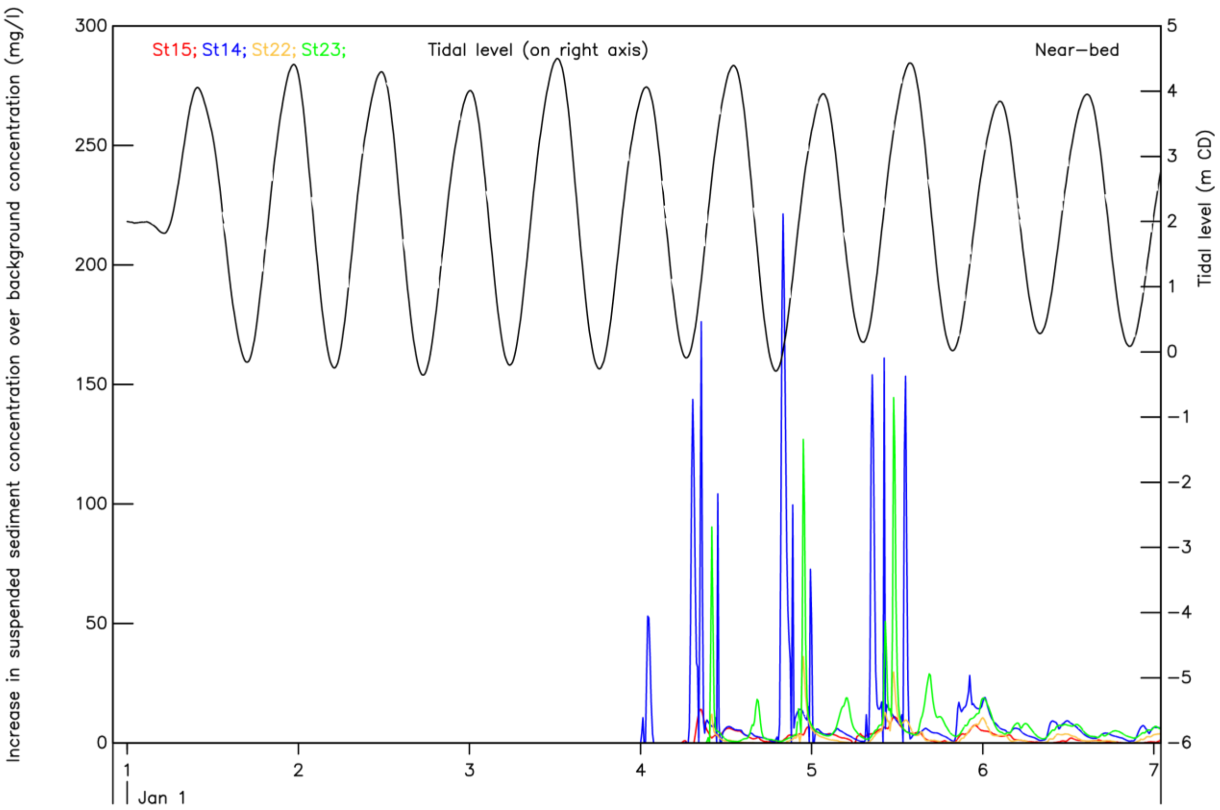

Figure B 53 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed during the campaign period at stations: St15, St14, St22 and St23.

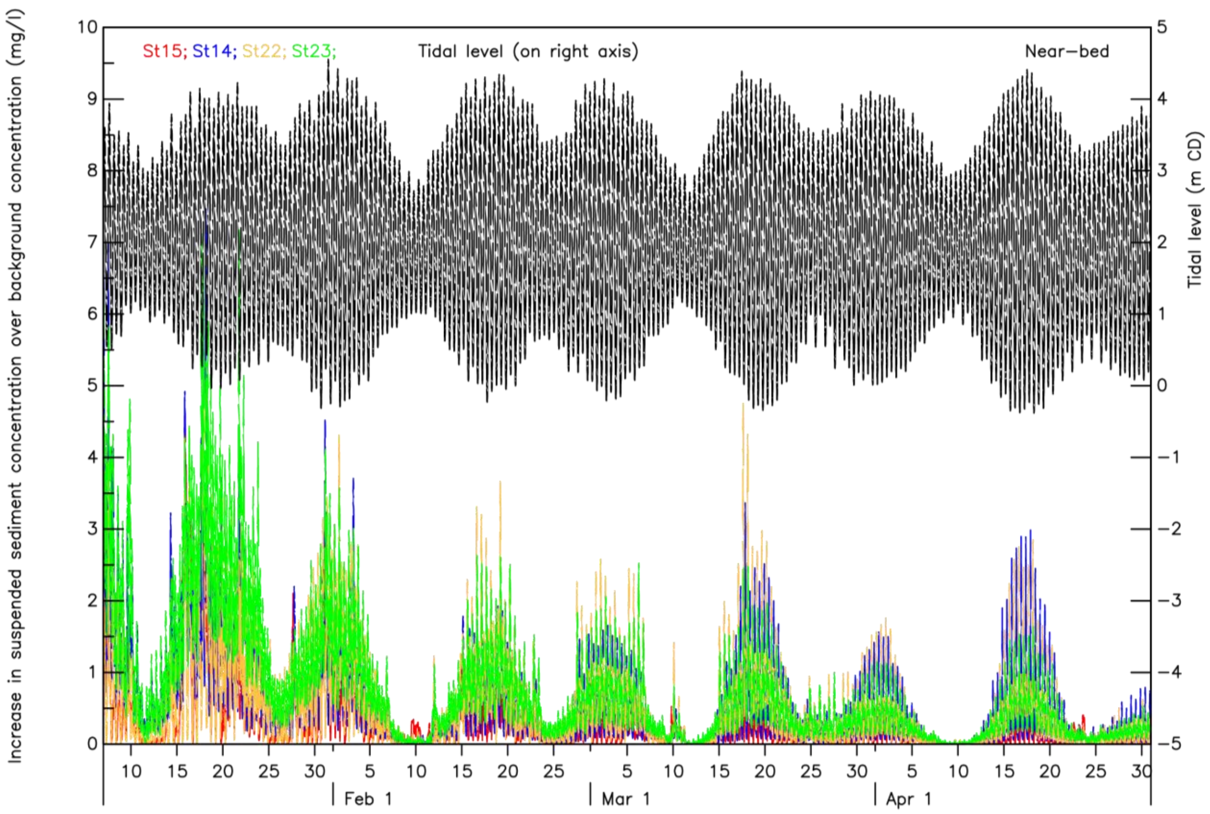

Figure B 54 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the three months following the campaign period at stations: St15, St14, St22 and St23.

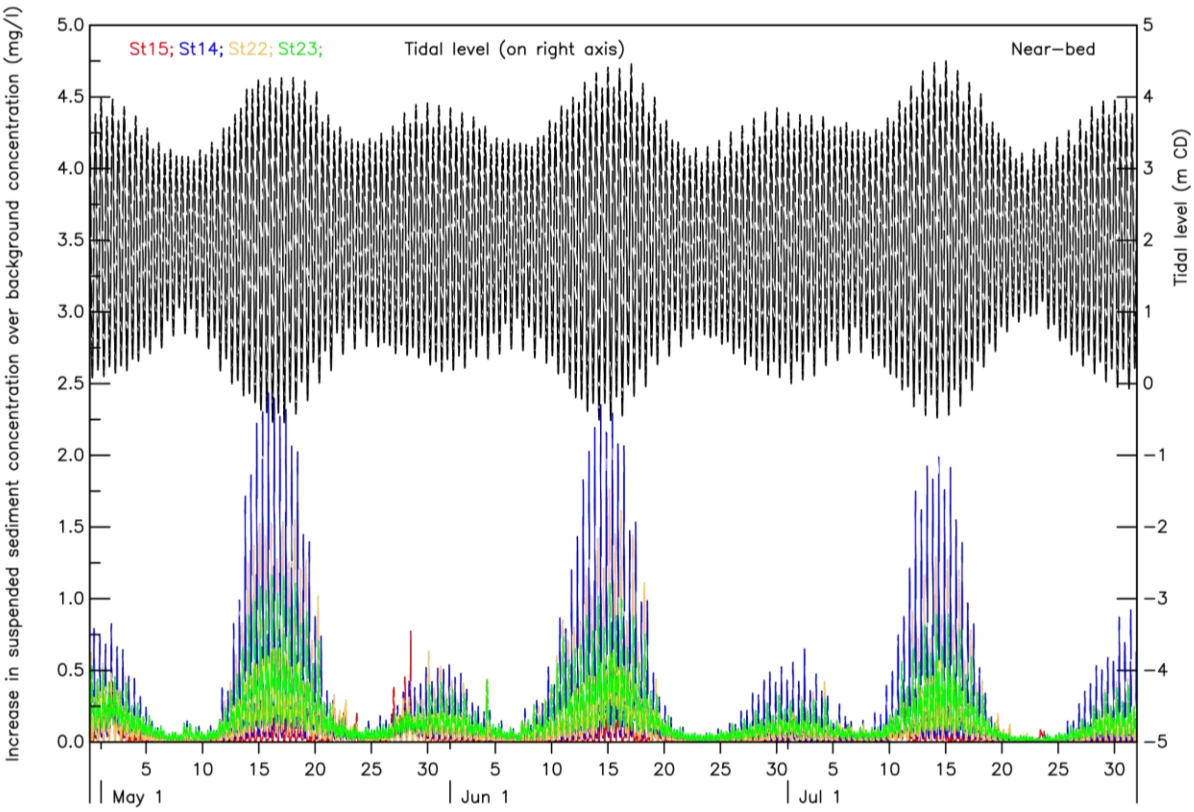

Figure B 55 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the four to six months following the campaign period at stations: St15, St14, St22 and St23.

Table B.6: **Scenario B: Statistical indicators for elevated suspended concentrations at the bed at stations St15, St14, St22 and St23.**

	Suspended sediment concentration at the bed			
	St15 (mg/l)	**St14 (mg/l)**	**St22 (mg/l)**	**St23 (mg/l)**
Peak	14.04	221.34	36.18	144.58
99th percentile	2.68	4.29	3.14	4.98
95th percentile	0.80	1.79	1.63	2.36
50th percentile	0.04	0.11	0.12	0.19
Mean	0.19	0.52	0.38	0.59

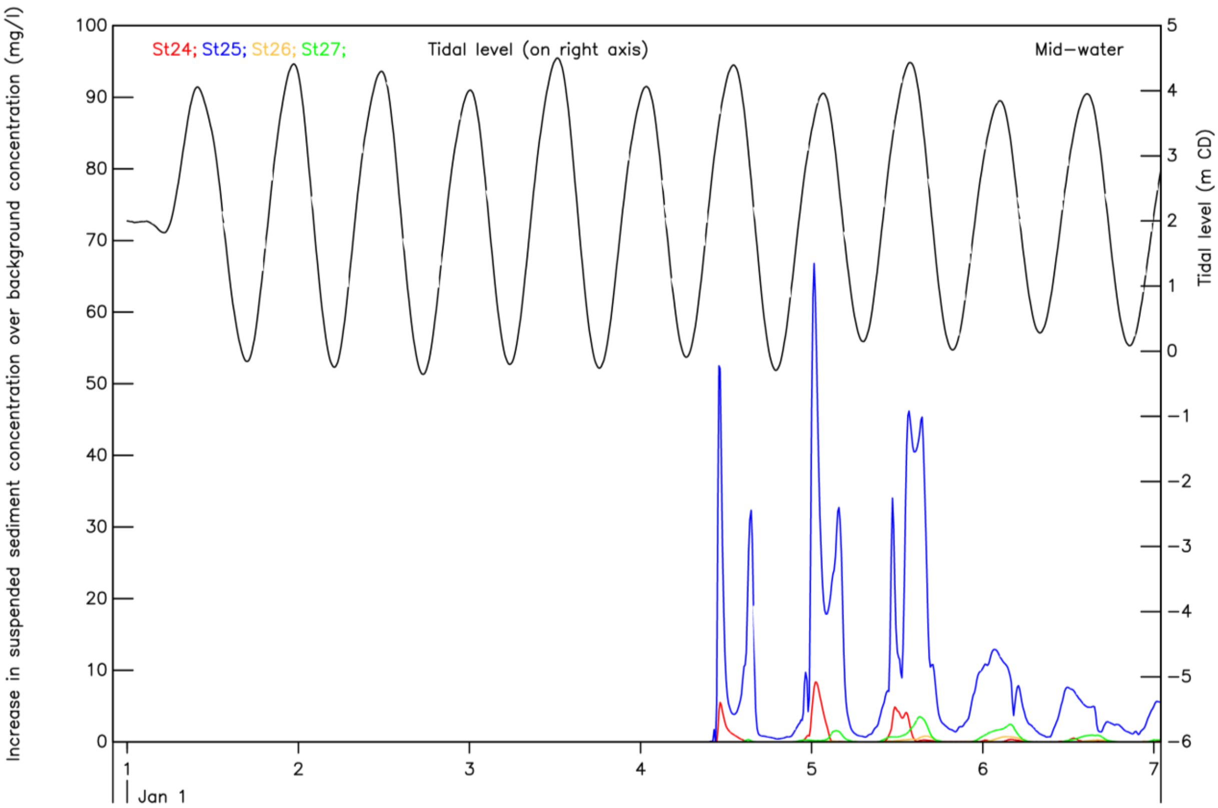

Figure B 56 – Scenario B: : Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth during the campaign period at stations: St24, St25, St26 and St27.

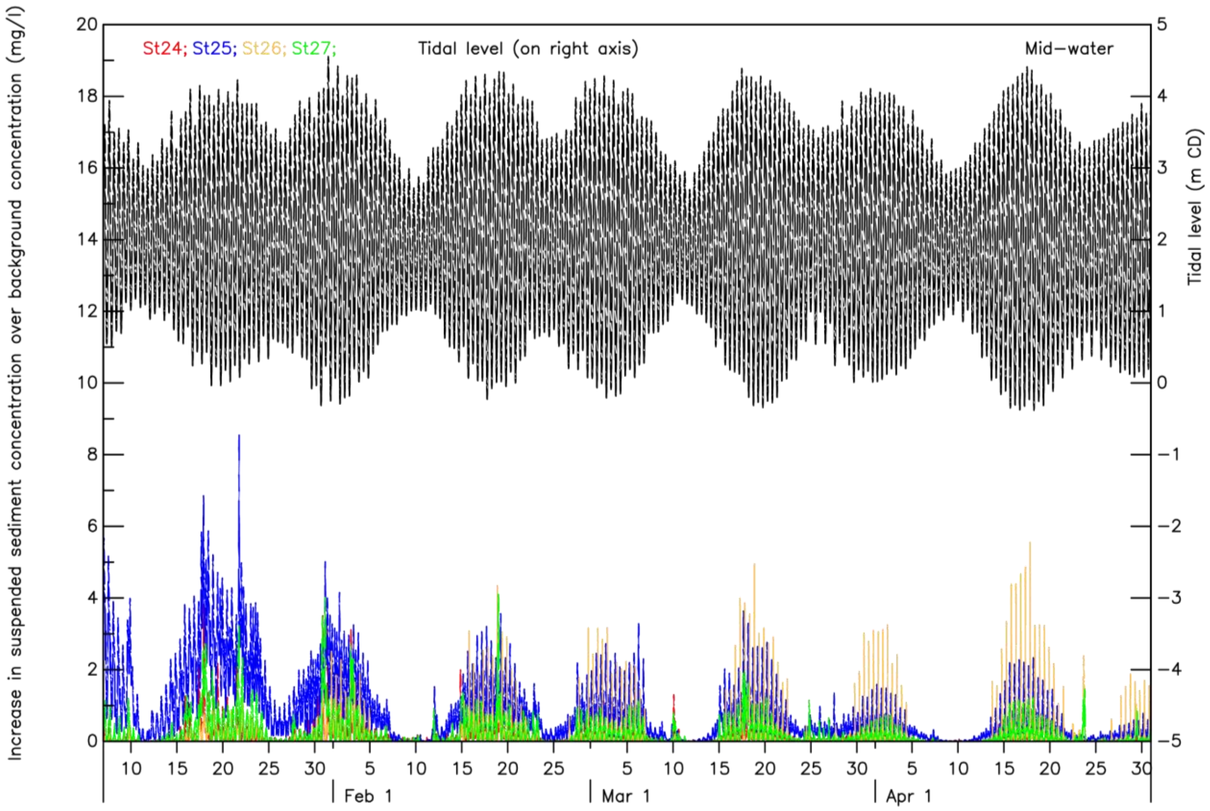

Figure B 57 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the three months following the campaign period at stations: St24, St25, St26 and St27.

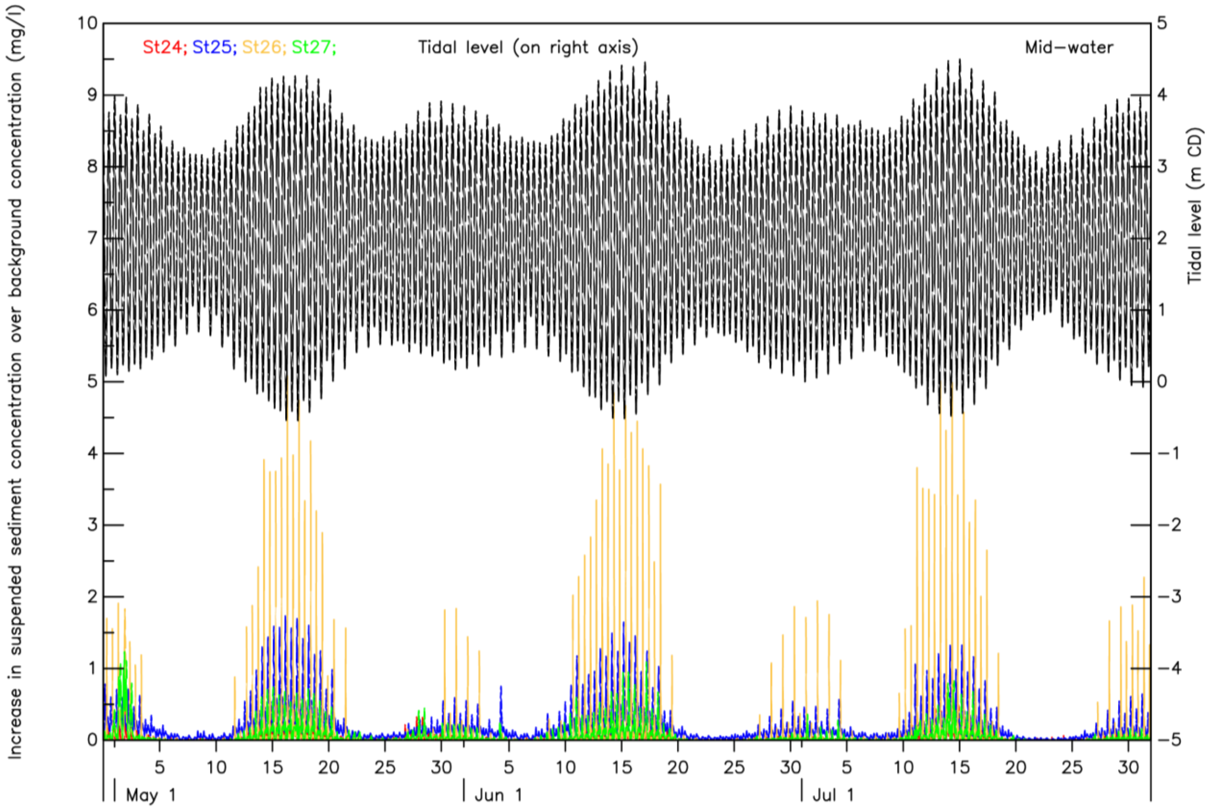

Figure B 58 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the four to six months following the campaign period at stations: St24, St25, St26 and St27.

Table B.7: **Scenario B: Statistical indicators for elevated suspended concentrations at mid-depth at stations St24, St25, St26 and St27.**

	Suspended sediment concentration at mid-depth			
	St24 (mg/l)	**St25 (mg/l)**	**St26 (mg/l)**	**St27 (mg/l)**
Peak	8.35	66.81	5.56	4.10
99th percentile	1.08	4.63	1.64	1.49
95th percentile	0.41	2.35	0.43	0.76
50th percentile	0.02	0.22	0.00	0.03
Mean	0.10	0.64	0.09	0.16

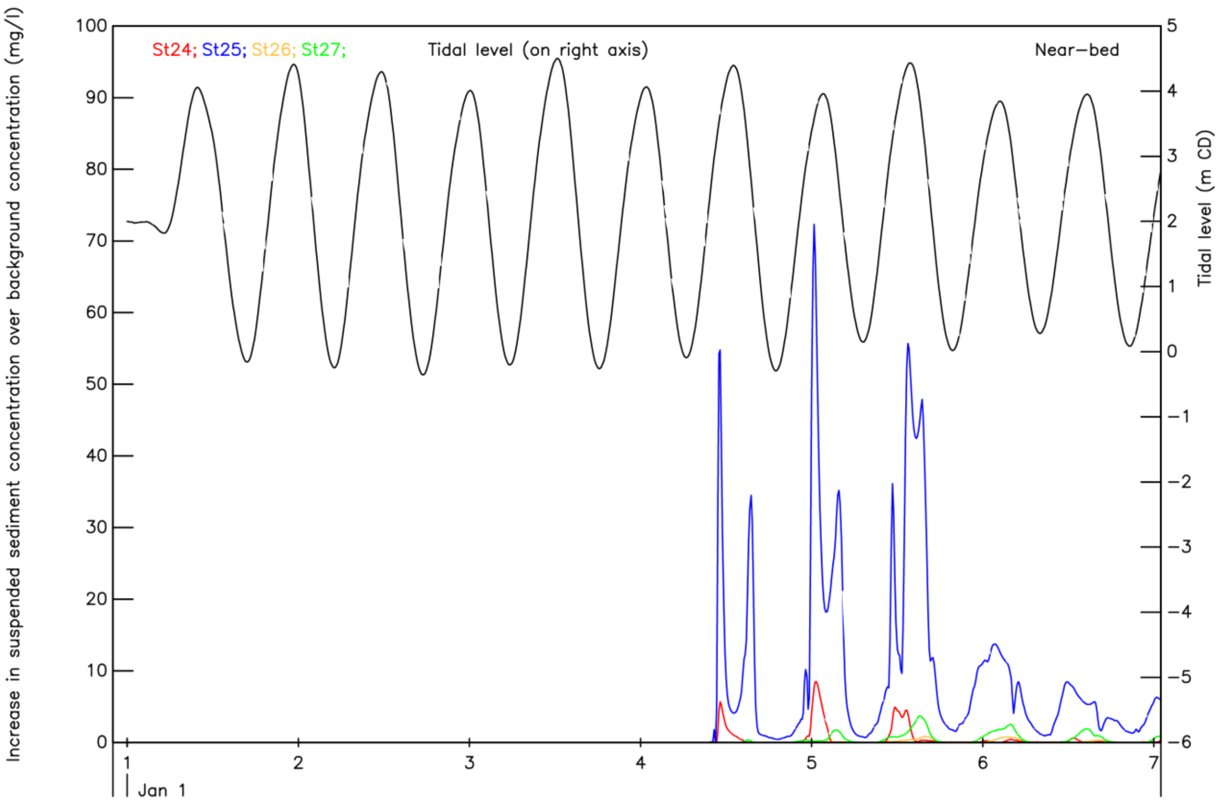

Figure B 59 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed during the campaign period at stations: St24, St25, St26 and St27.

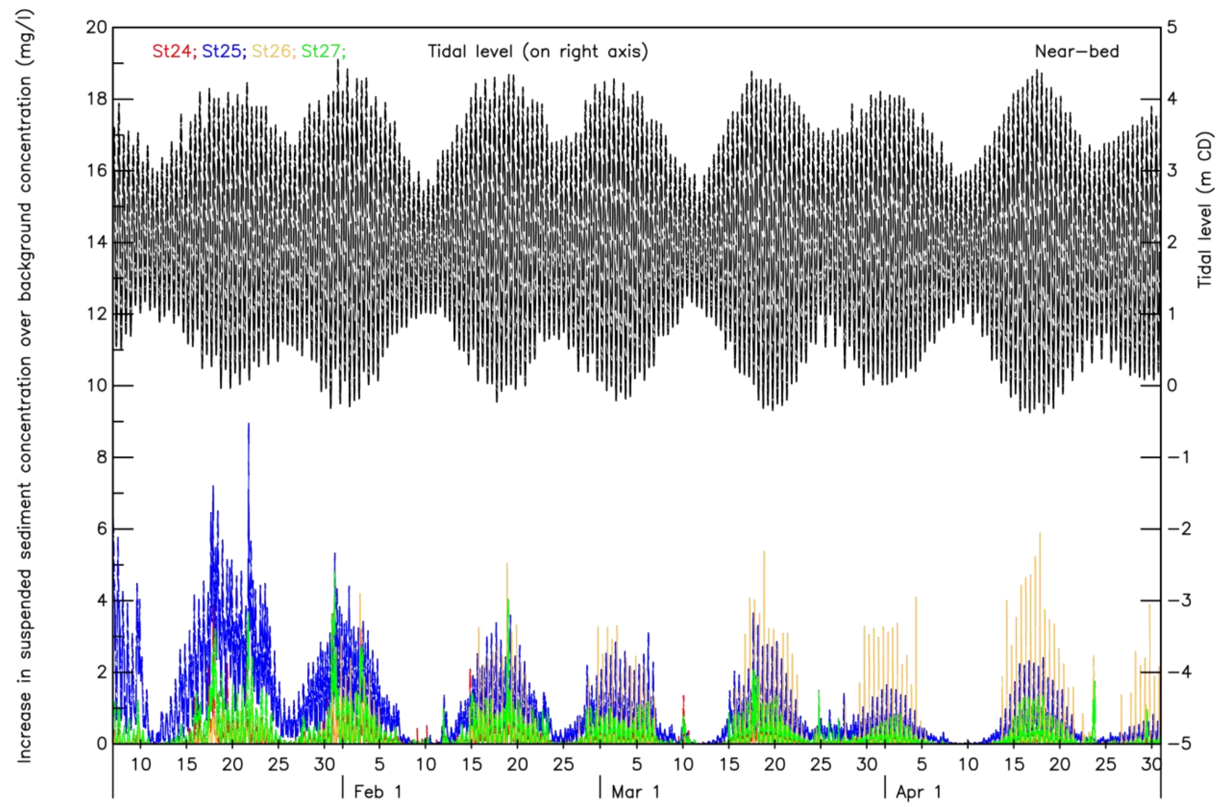

Figure B 60 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the three months following the campaign period at stations: St24, St25, St26 and St27.

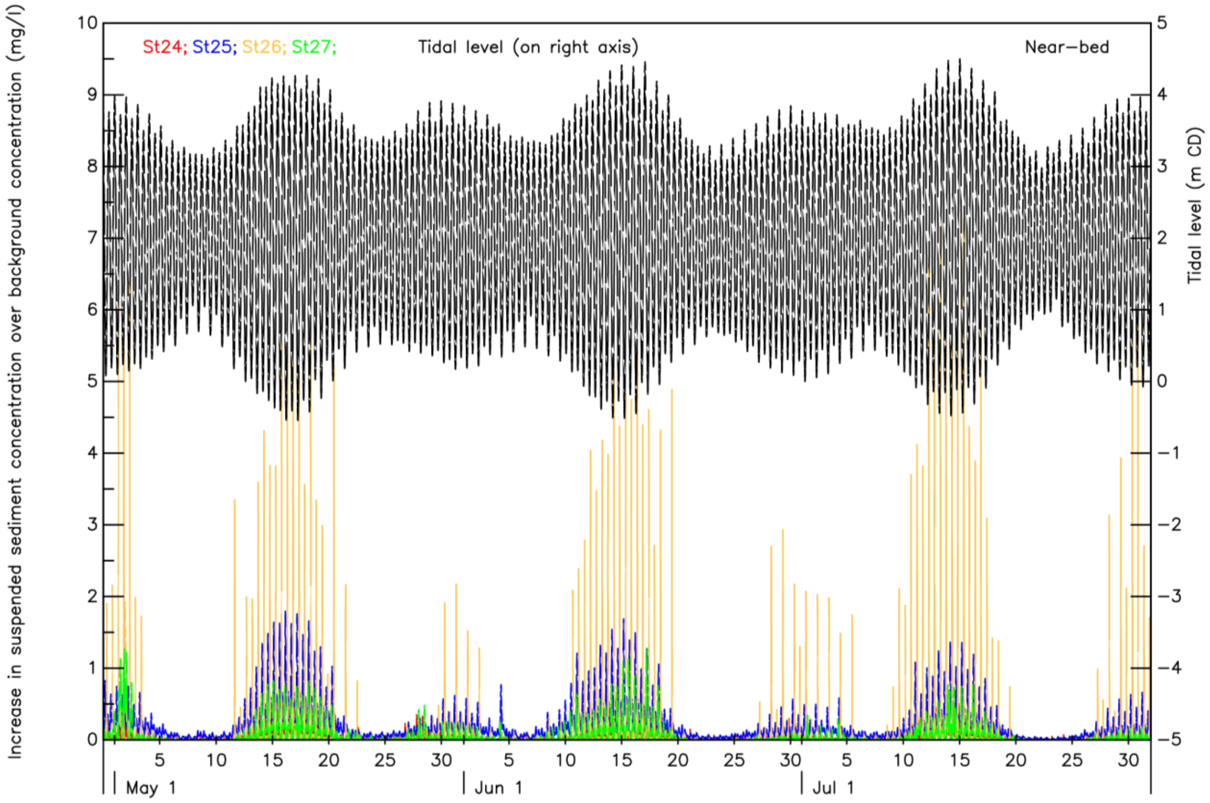

Figure B 61 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the four to six months following the campaign period at stations: St24, St25, St26 and St27.

Table B.8: **Scenario B: Statistical indicators for elevated suspended concentrations at the bed at stations St24, St25, St26 and St27.**

	Suspended sediment concentration at the bed			
	St24 (mg/l)	St25 (mg/l)	St26 (mg/l)	St27 (mg/l)
Peak	8.50	72.32	7.26	4.81
99th percentile	1.13	5.09	1.94	1.64
95th percentile	0.46	2.60	0.47	0.87
50th percentile	0.03	0.24	0.00	0.03
Mean	0.11	0.70	0.11	0.18

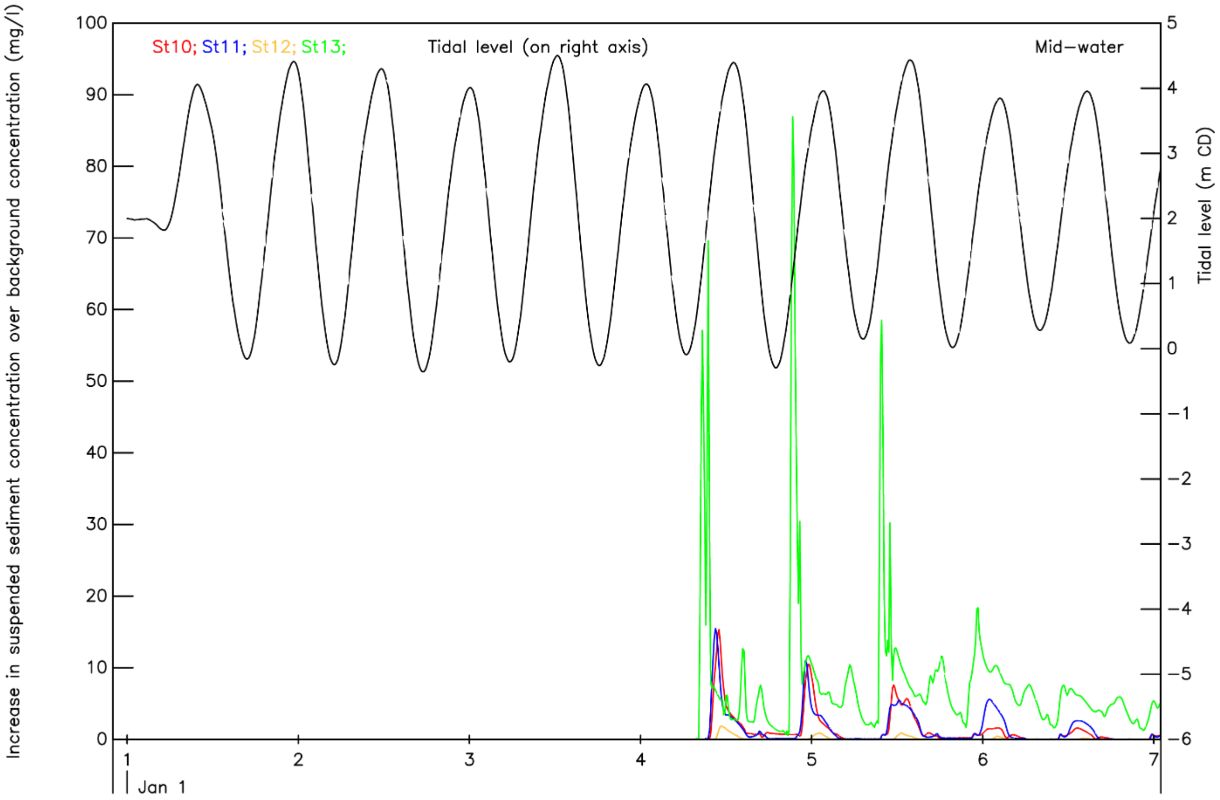

Figure B 62 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth during the campaign period at stations: St10, St11, St12 and St13.

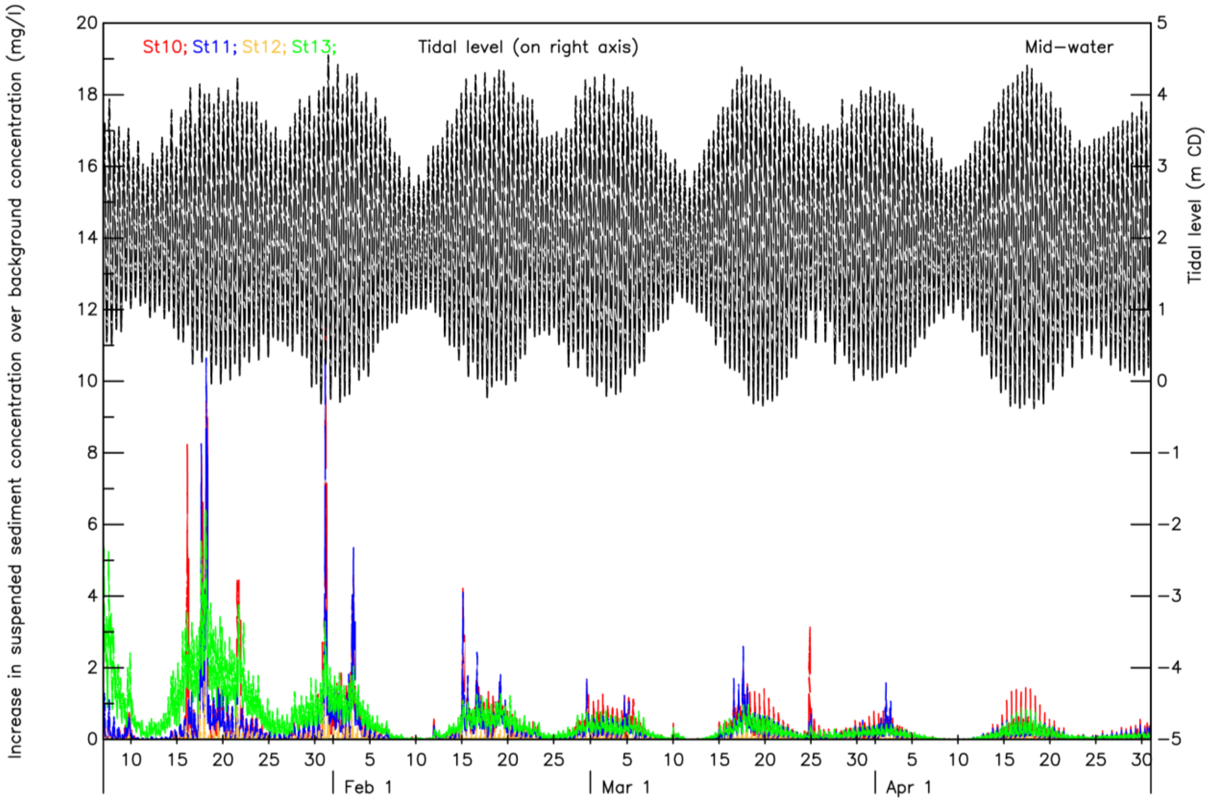

Figure B 63 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the three months following the campaign period at stations: St10, St11, St12 and St13.

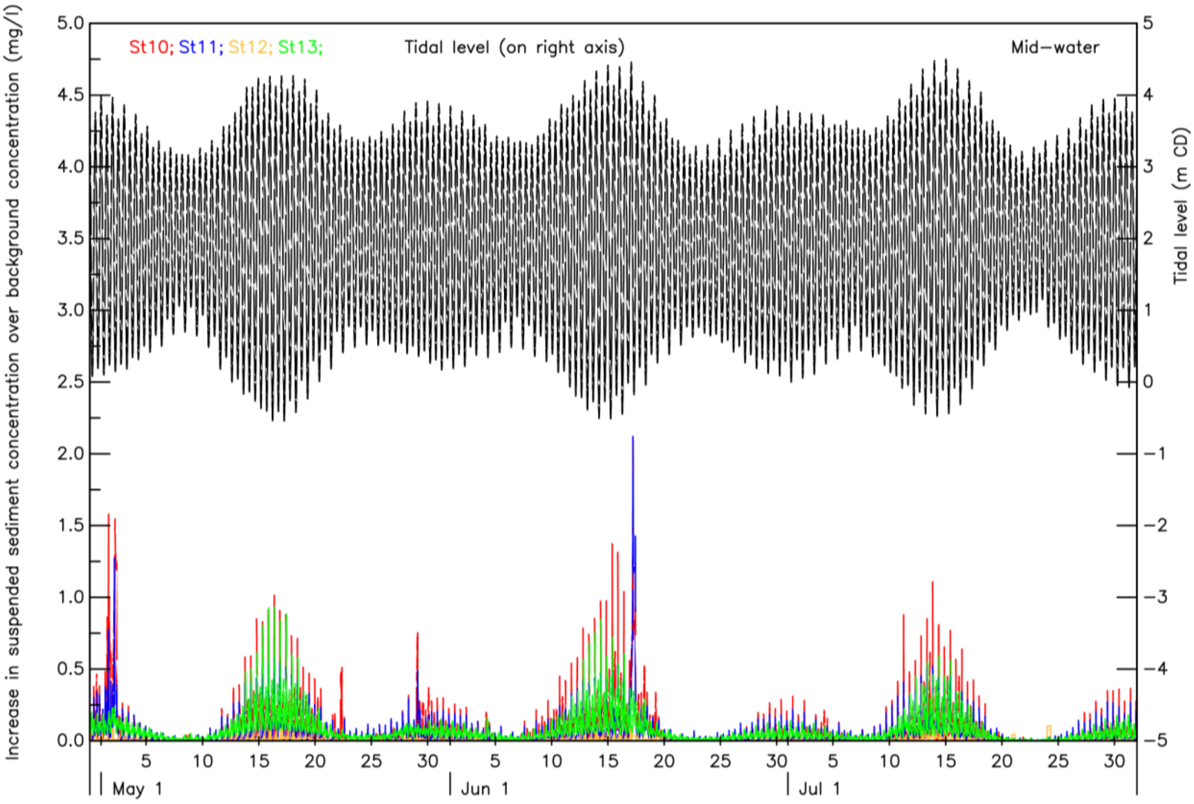

Figure B 64 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the four to six months following the campaign period at stations: St10, St11, St12 and St13.

Table B.9: **Scenario B: Statistical indicators for elevated suspended concentrations at mid-depth at stations St10, St11, St12 and St13.**

	Suspended sediment concentration at mid-depth			
	St10 (mg/l)	**St11 (mg/l)**	**St12 (mg/l)**	**St13 (mg/l)**
Peak	15.32	15.45	1.85	86.94
99th percentile	2.80	1.93	0.20	4.56
95th percentile	0.79	0.62	0.05	1.57
50th percentile	0.03	0.02	0.00	0.09
Mean	0.19	0.15	0.02	0.39

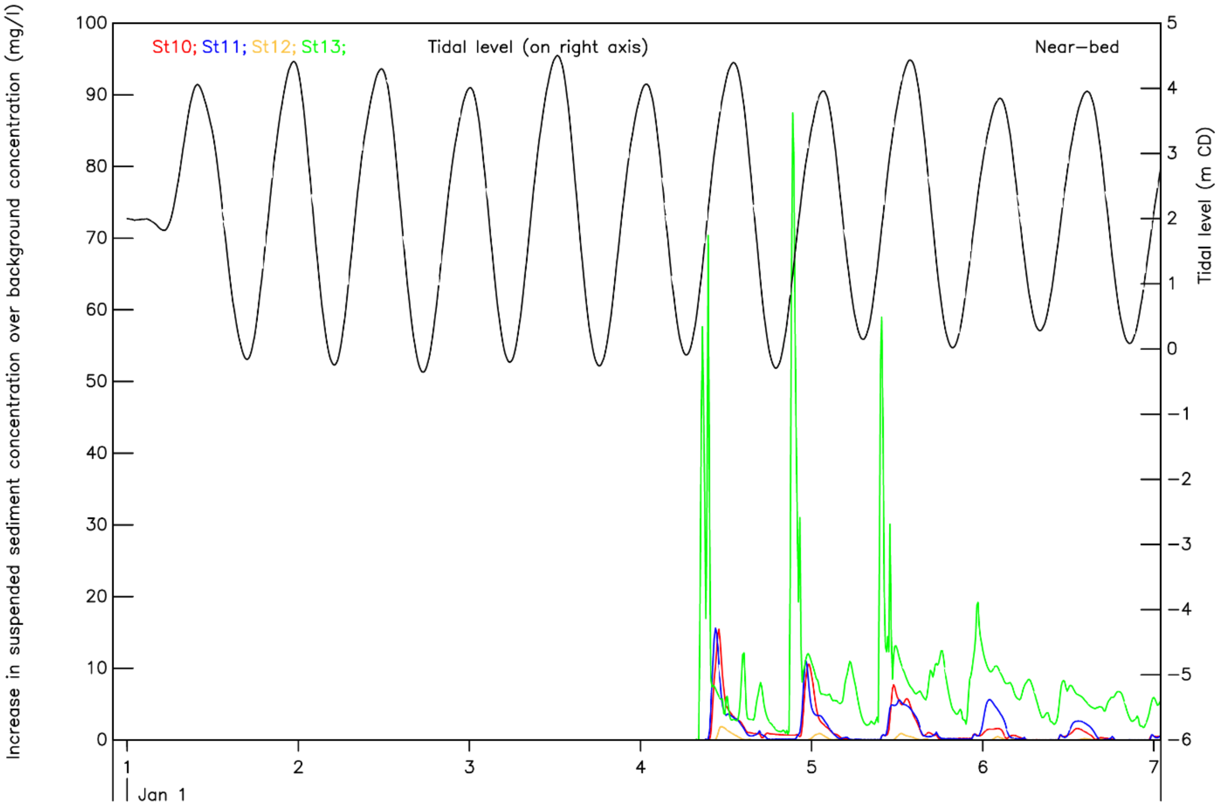

Figure B 65 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed during the campaign period at stations: St10, St11, St12 and St13.

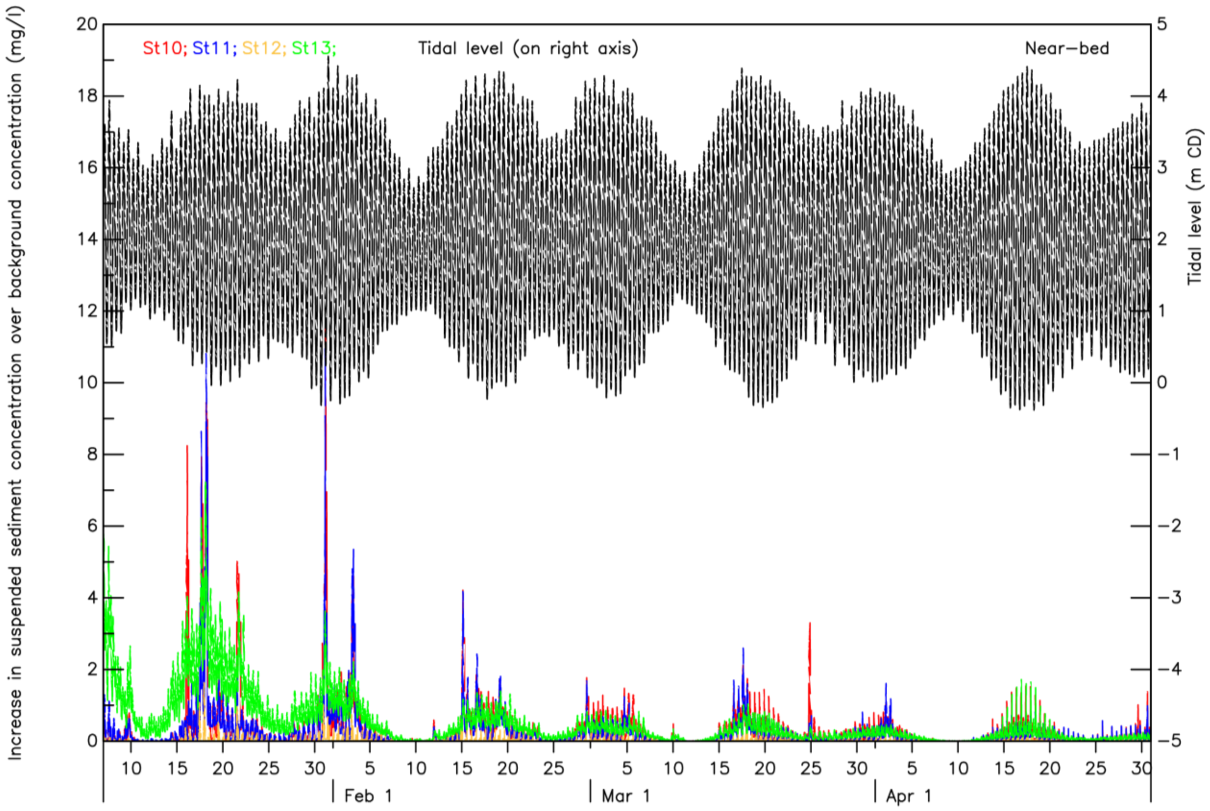

Figure B 66 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the three months following the campaign period at stations: St10, St11, St12 and St13.

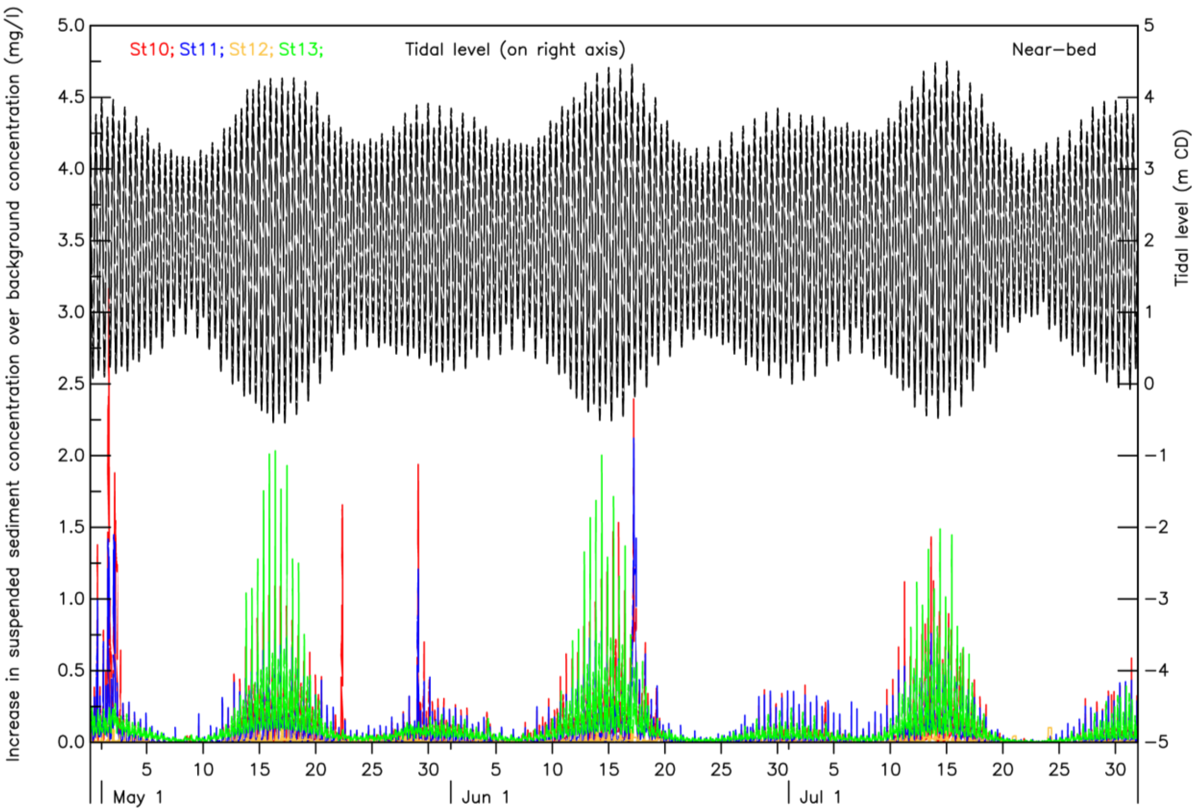

Figure B 67 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the four to six months following the campaign period at stations: St10, St11, St12 and St13.

Table B.10: **Scenario B: Statistical indicators for elevated suspended concentrations at the bed at St10, St11, St12 and St13.**

	Suspended sediment concentration at the bed			
	St10 (mg/l)	St11 (mg/l)	St12 (mg/l)	St13 (mg/l)
Peak	15.45	15.61	1.88	87.48
99th percentile	3.12	2.16	0.23	5.06
95th percentile	0.97	0.69	0.06	1.73
50th percentile	0.03	0.02	0.00	0.11
Mean	0.21	0.16	0.02	0.43

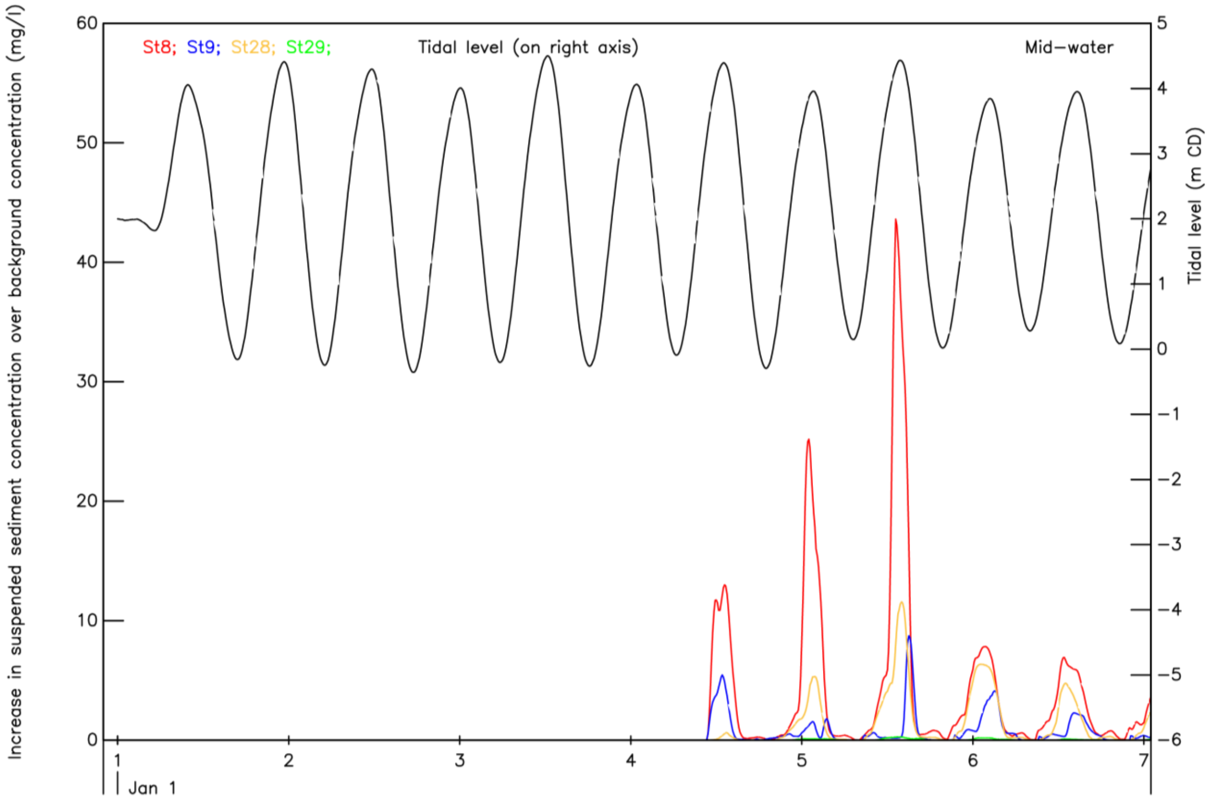

Figure B 68 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth during the campaign period at stations: St8, St9, St28 and St29.

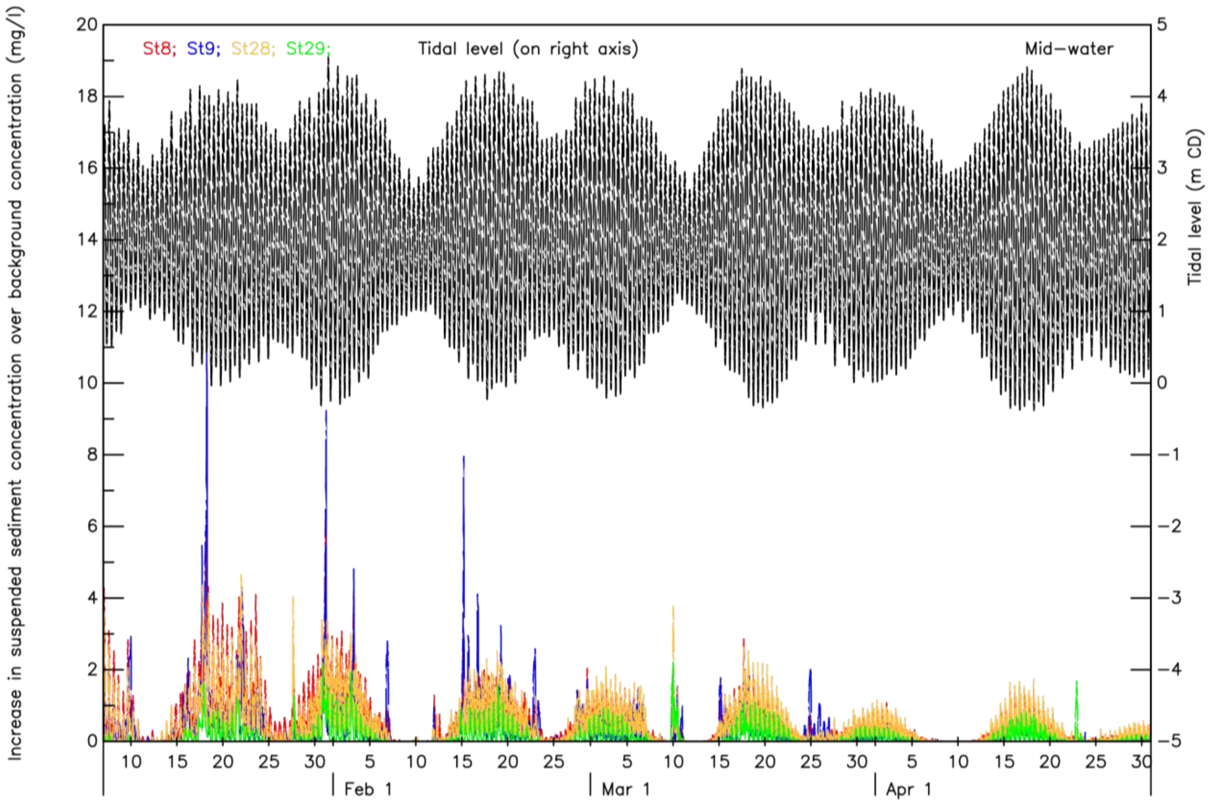

Figure B 69 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the three months following the campaign period at stations: St8, St9, St28 and St29.

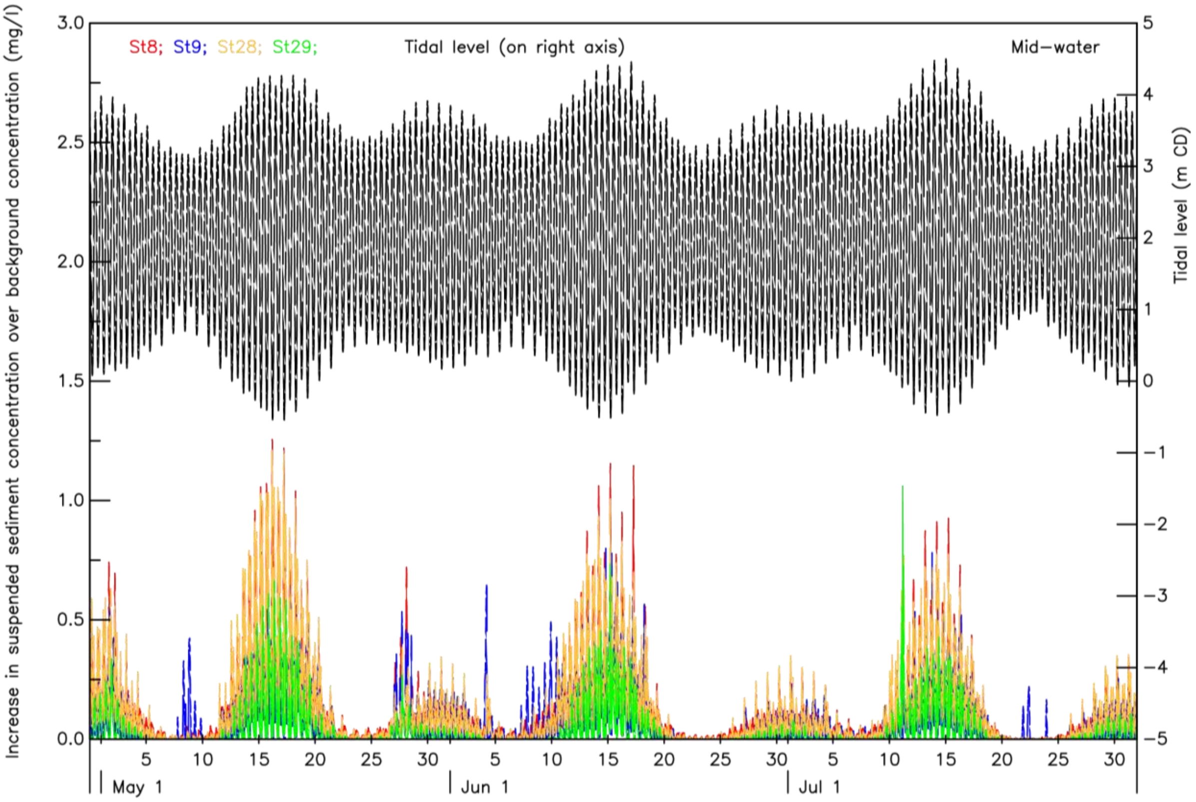

Figure B 70 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the four to six months following the campaign period at stations: St8, St9, St28 and St29.

Table B.11: **Scenario B: Statistical indicators for elevated suspended concentrations at mid-depth at stations St8, St9, St28 and St29.**

	Suspended sediment concentration at mid-depth			
	St8 (mg/l)	**St9 (mg/l)**	**St28 (mg/l)**	**St29 (mg/l)**
Peak	43.62	11.19	11.58	2.21
99^{th} percentile	3.25	2.38	2.65	0.99
95^{th} percentile	1.59	0.92	1.42	0.44
50^{th} percentile	0.12	0.03	0.10	0.00
Mean	0.40	0.21	0.33	0.08

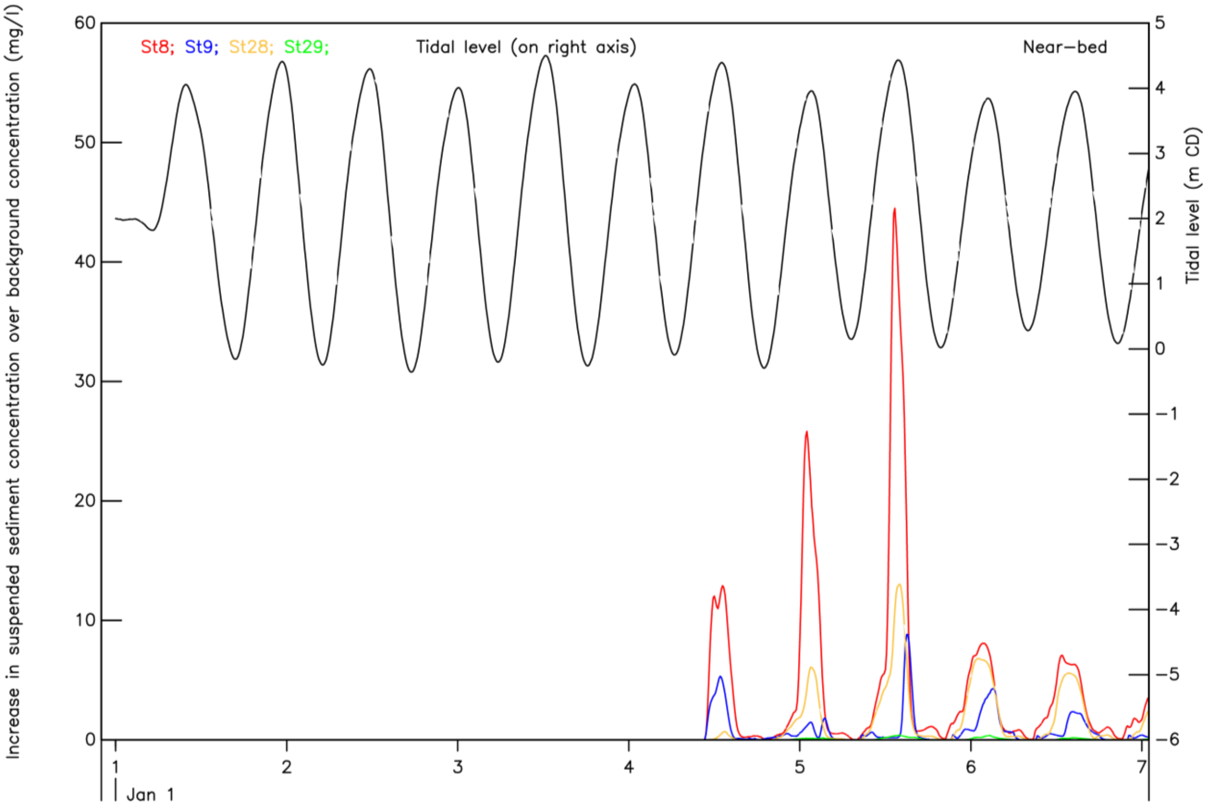

Figure B 71 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed during the campaign period at stations: St8, St9, St28 and St29.

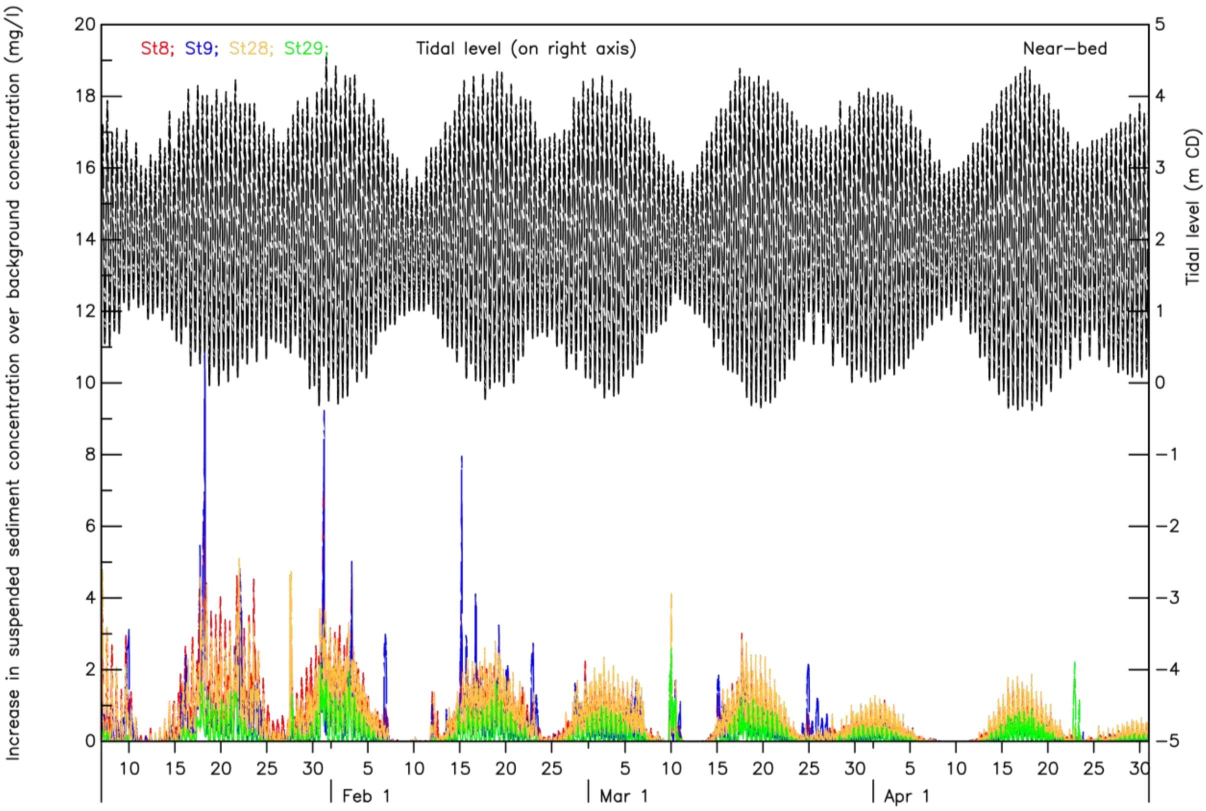

Figure B 72 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the three months following the campaign period at stations: St8, St9, St28 and St29.

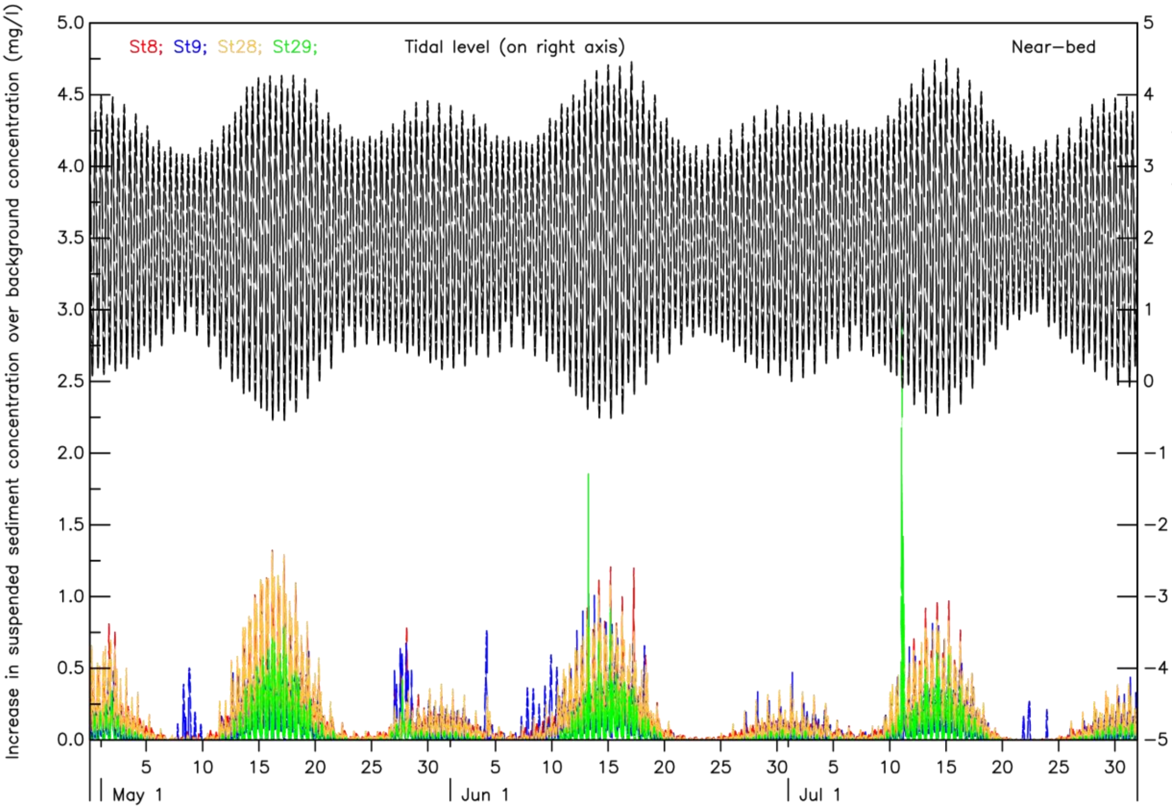

Figure B 73 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the four to six months following the campaign period at stations: St8, St9, St28 and St29.

Table B.12: **Scenario B: Statistical indicators for elevated suspended concentrations at the bed at stations St8, St9, St28 and St29.**

	Suspended sediment concentration at the bed			
	St8 (mg/l)	**St9 (mg/l)**	**St28 (mg/l)**	**St29 (mg/l)**
Peak	44.51	11.4	13.04	2.98
99th percentile	3.51	2.62	2.92	1.15
95th percentile	1.77	1.01	1.62	0.55
50th percentile	0.14	0.03	0.12	0.00
Mean	0.44	0.22	0.38	0.10

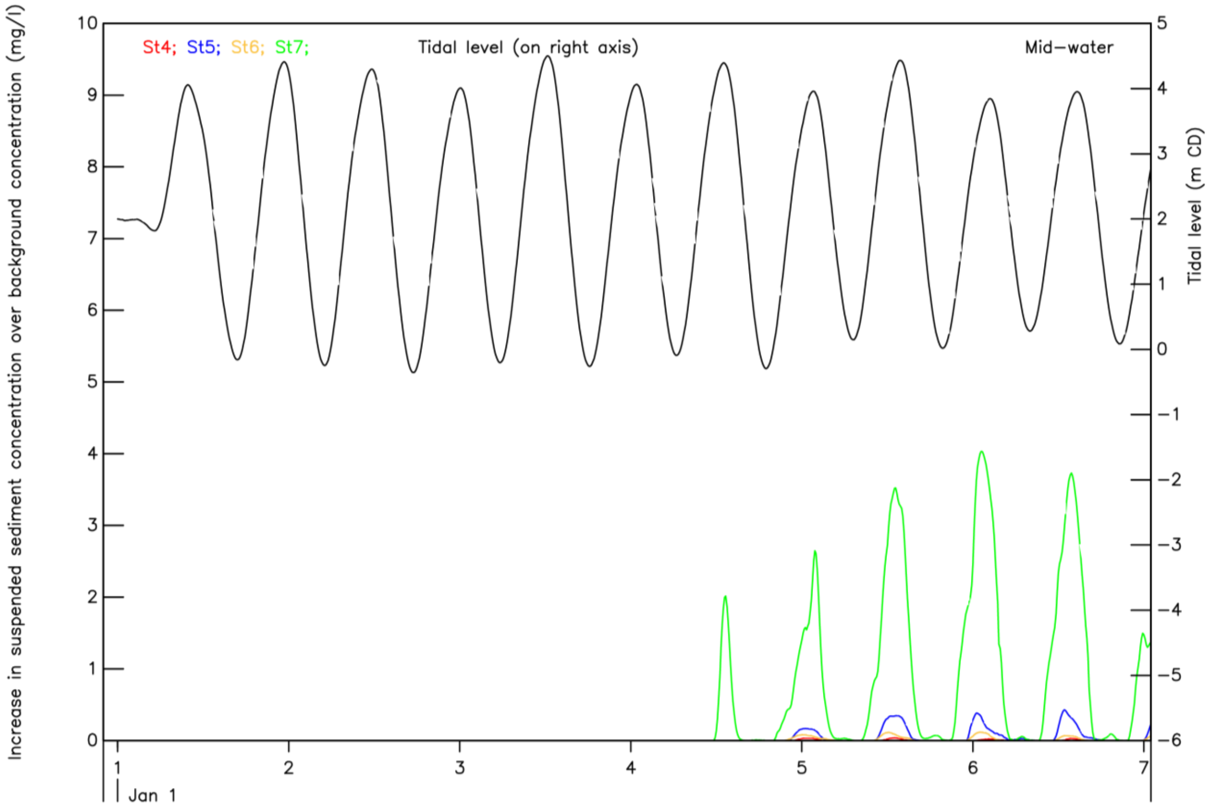

Figure B 74 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth during the campaign period at stations: St4, St5, St6 and St7.

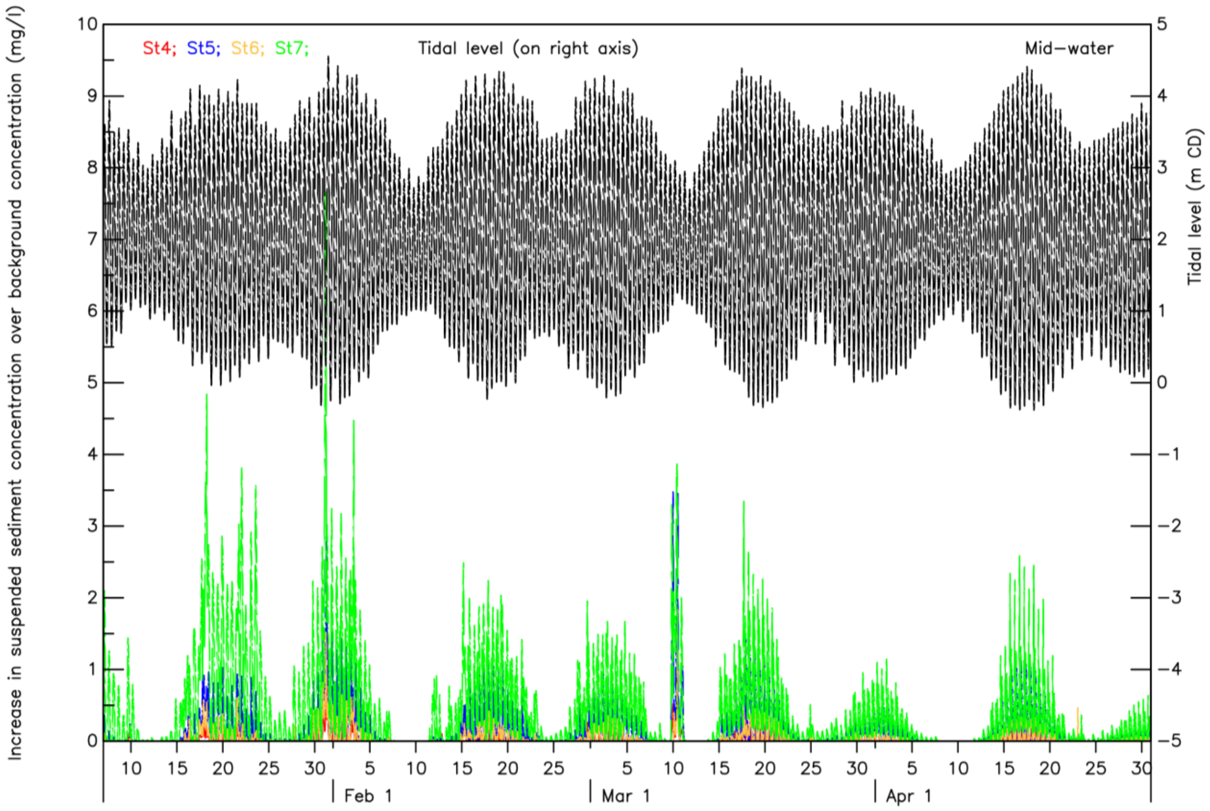

Figure B 75 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the three months following the campaign period at stations: St4, St5, St6 and St7.

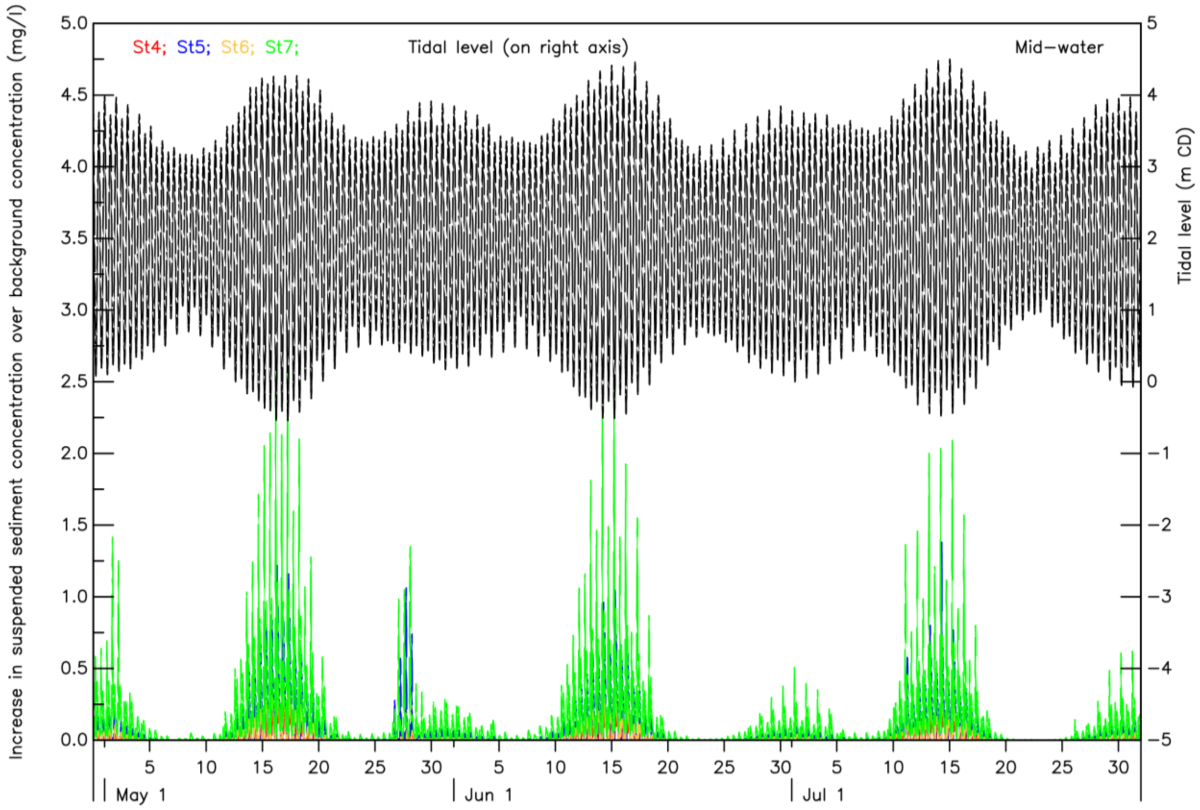

Figure B 76 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the four to six months following the campaign period at stations: St4, St5, St6 and St7.

Table B.13: **Scenario B: Statistical indicators for elevated suspended concentrations at mid-depth at stations St4, St5, St6 and St7.**

	Suspended sediment concentration at the bed			
	St4 (mg/l)	St5 (mg/l)	St6 (mg/l)	St7 (mg/l)
Peak	1.32	3.48	1.84	7.66
99th percentile	0.28	1.01	0.39	2.60
95th percentile	0.12	0.50	0.19	1.43
50th percentile	0.00	0.00	0.00	0.07
Mean	0.02	0.08	0.03	0.30

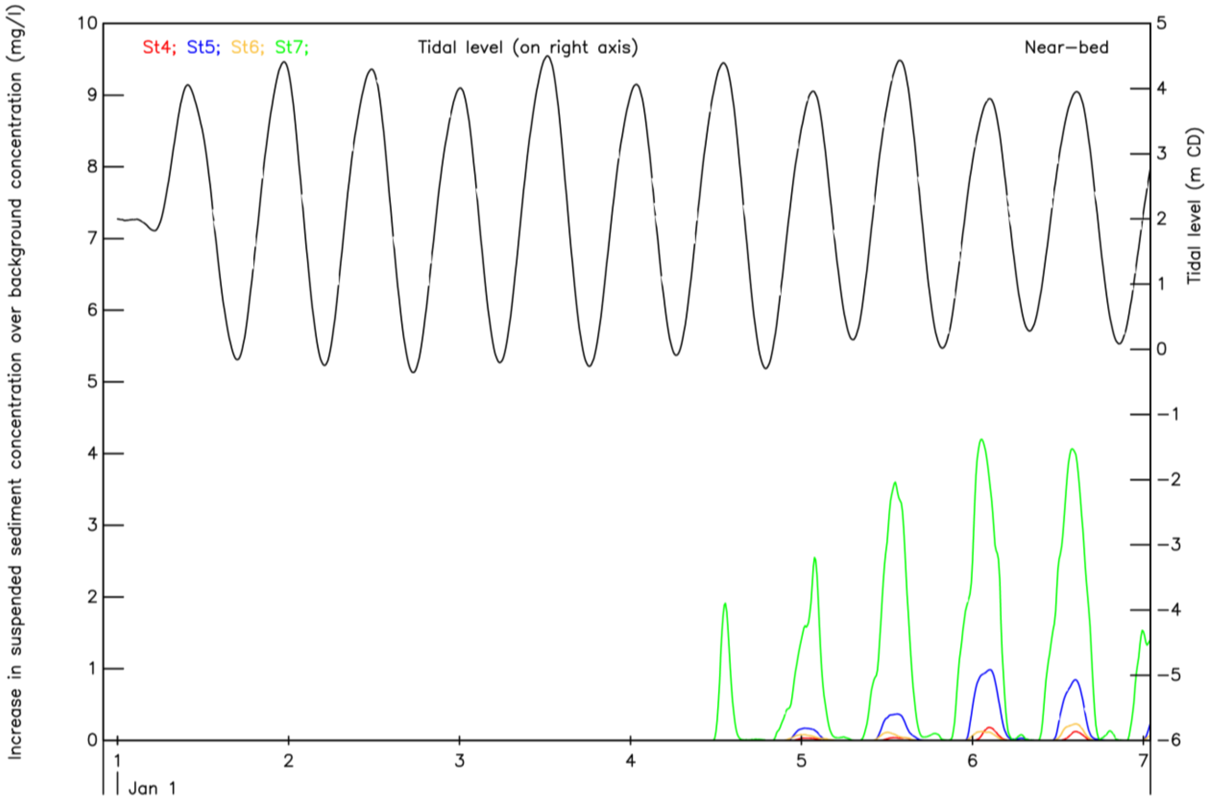

Figure B 77 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed during the campaign period at stations: St4, St5, St6 and St7.

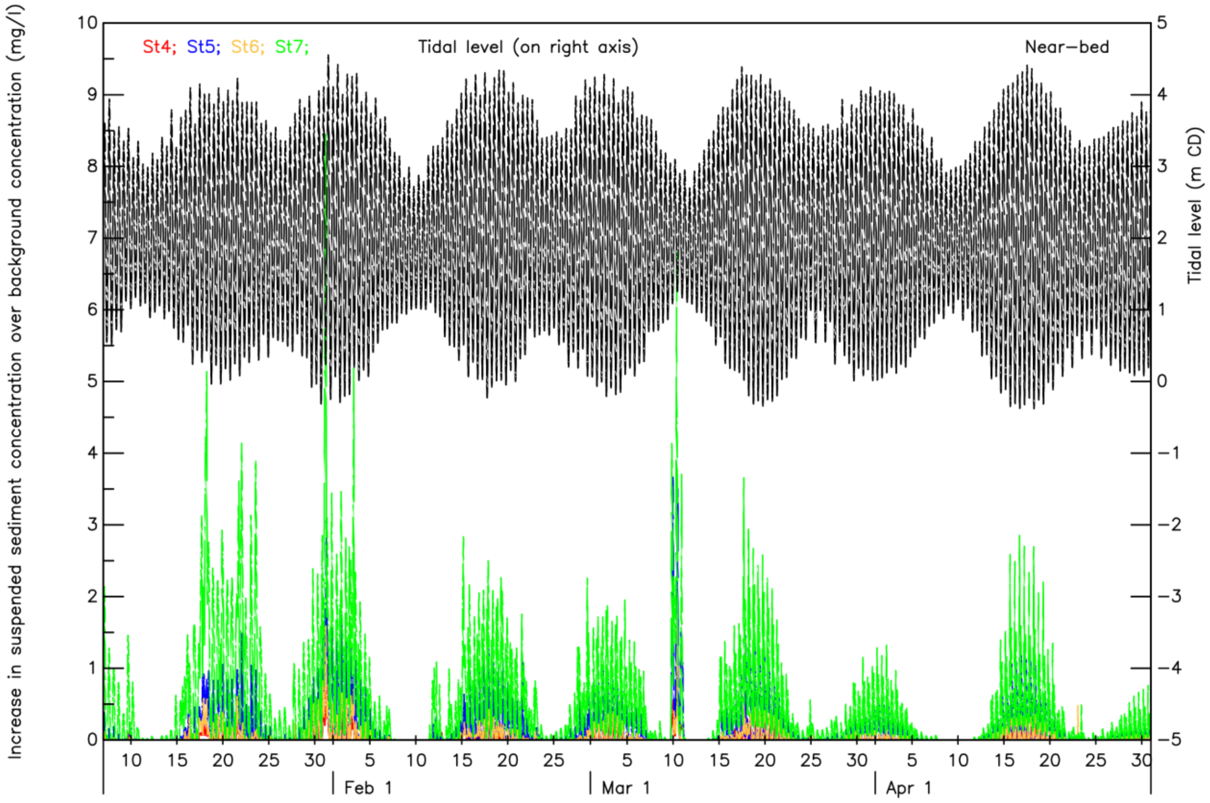

Figure B 78 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the three months following the campaign period at stations: St4, St5, St6 and St7.

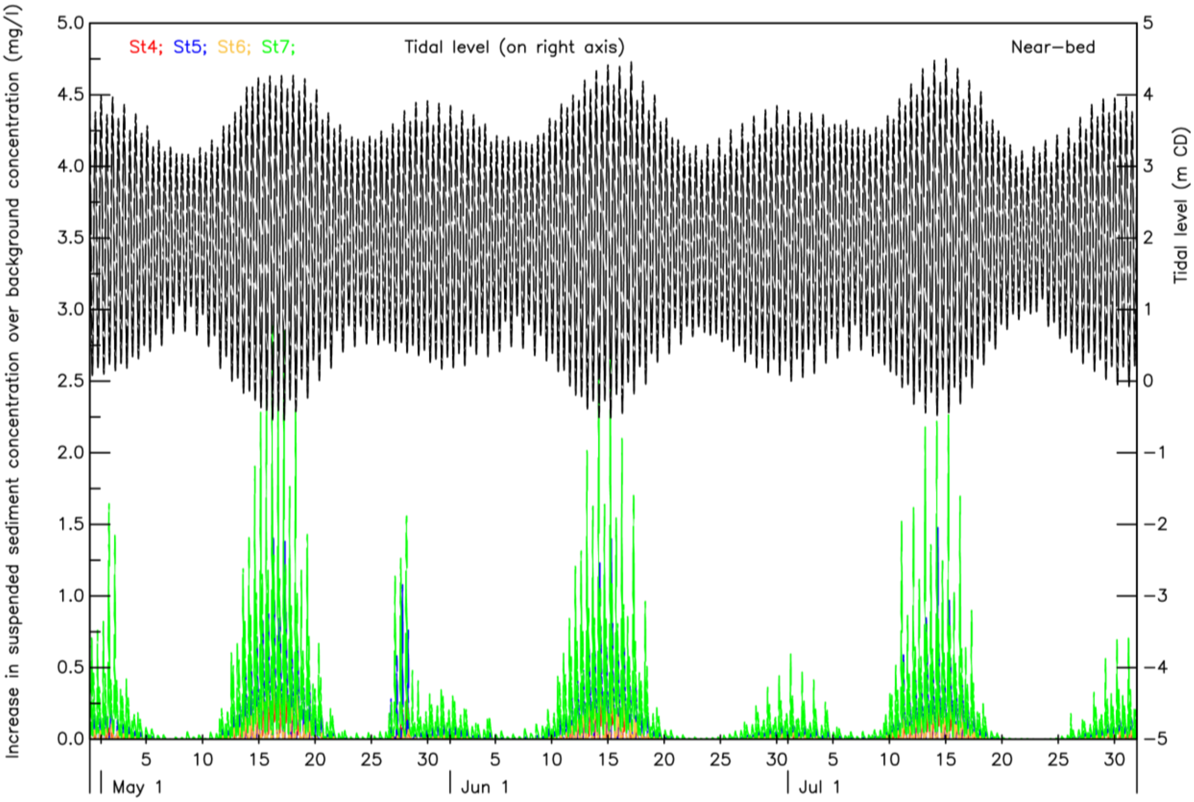

Figure B 79 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the four to six months following the campaign period at stations: St4, St5, St6 and St7.

Table B.14: **Scenario B: Statistical indicators for elevated suspended concentrations at the bed at stations St4, St5, St6 and St7.**

	Suspended sediment concentration at the bed			
	St4 (mg/l)	**St5 (mg/l)**	**St6 (mg/l)**	**St7 (mg/l)**
Peak	1.45	3.66	1.90	8.45
99th percentile	0.32	1.11	0.43	2.85
95th percentile	0.15	0.59	0.21	1.58
50th percentile	0.00	0.00	0.00	0.08
Mean	0.02	0.10	0.04	0.34

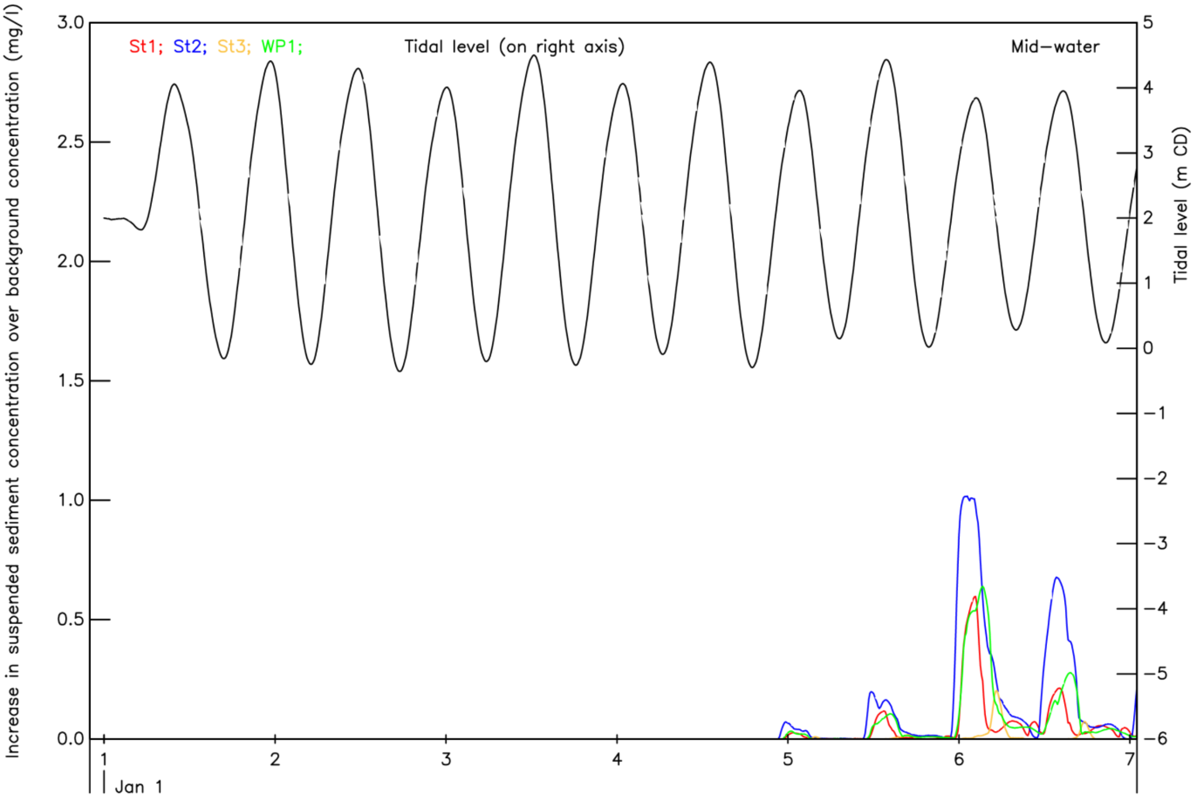

Figure B 80 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth during the campaign period at stations: St1, St2, St3 and WP1.

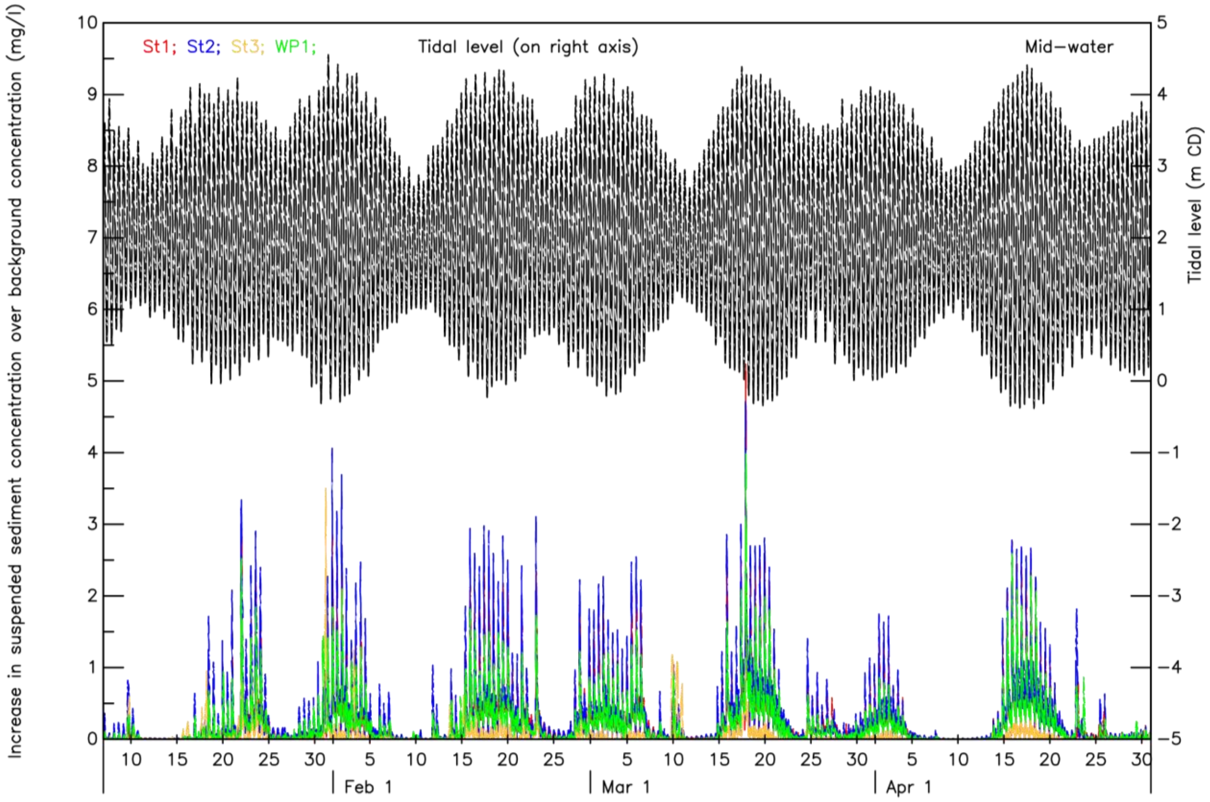

Figure B 81 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the three months following the campaign period at stations: St1, St2, St3 and WP1.

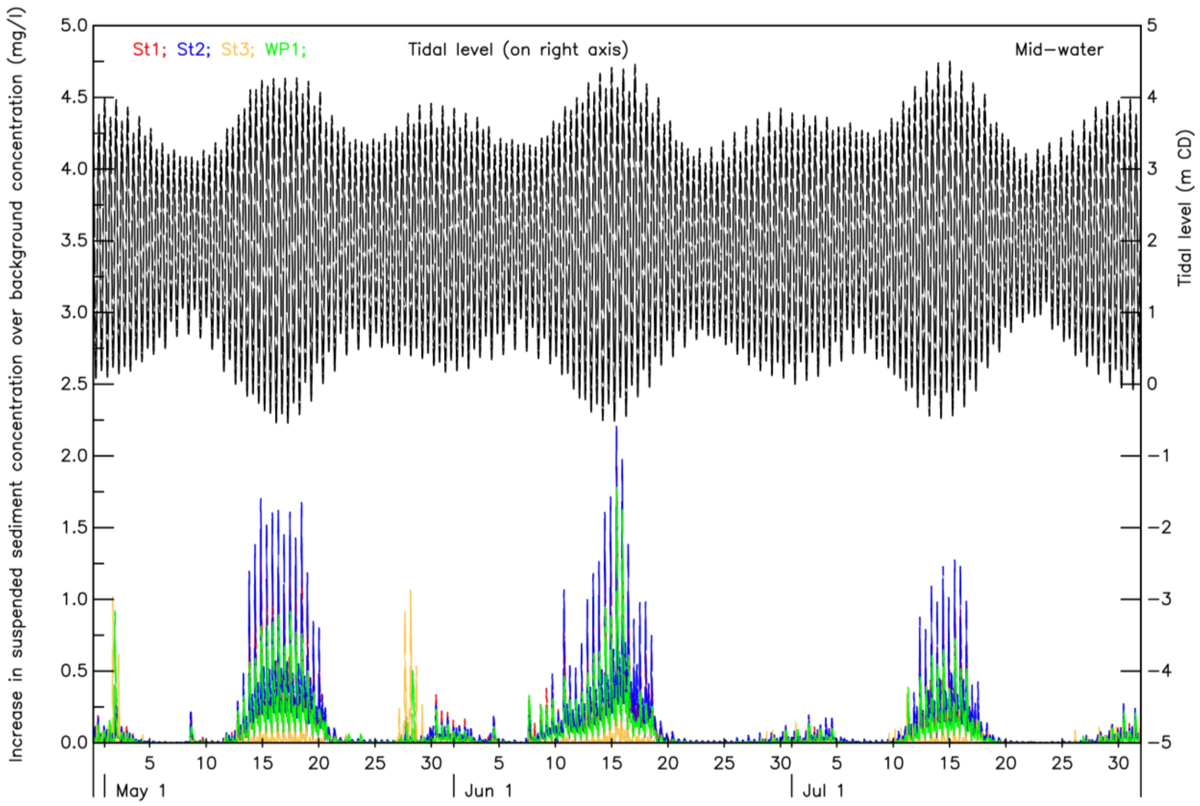

Figure B 82 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at mid-depth for the four to six months following the campaign period at stations: St1, St2, St3 and WP1.

Table B.13: **Scenario B: Statistical indicators for elevated suspended concentrations at mid-depth at stations St1, St2, St3 and WP1.**

	Suspended sediment concentration at the bed			
	St1 (mg/l)	**St2 (mg/l)**	**St3 (mg/l)**	**WP1 (mg/l)**
Peak	4.24	4.71	3.50	3.98
99th percentile	1.83	2.15	0.49	1.43
95th percentile	0.76	0.96	0.14	0.72
50th percentile	0.04	0.05	0.00	0.03
Mean	0.17	0.21	0.03	0.15

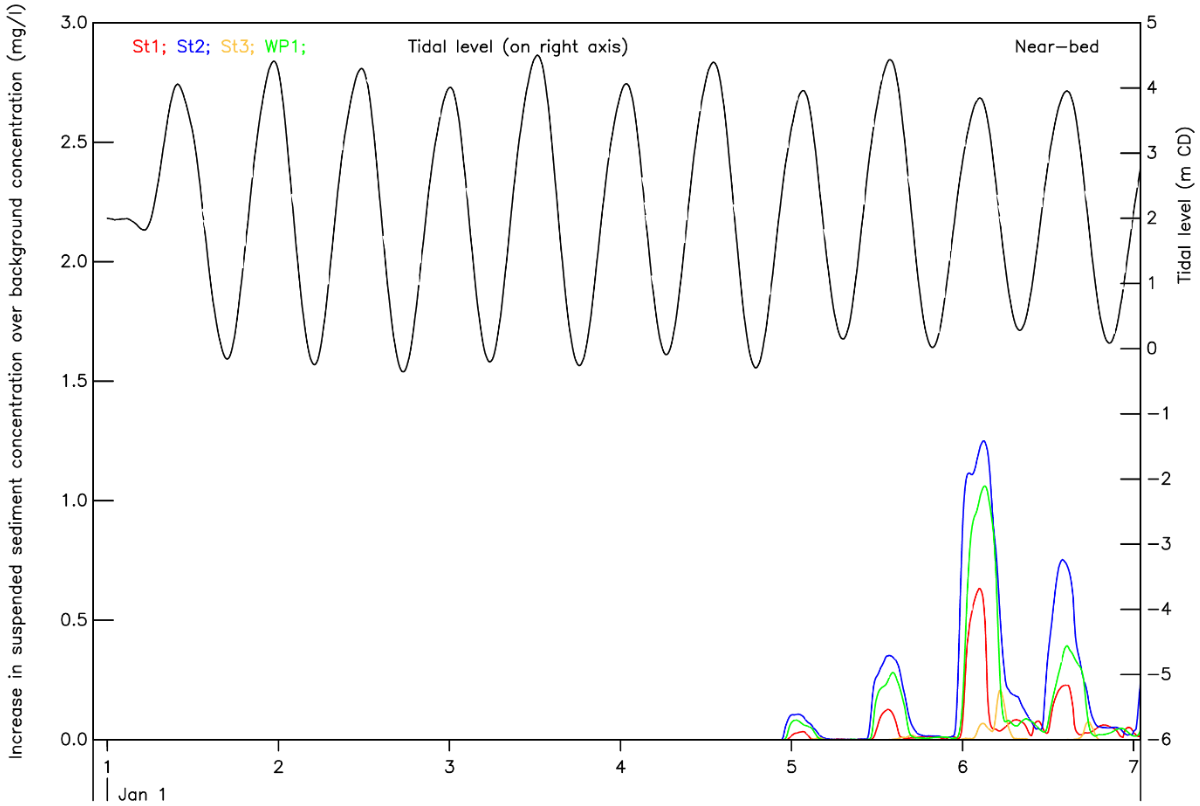

Figure B 83 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed during the campaign period at stations: St1, St2, St3 and WP1.

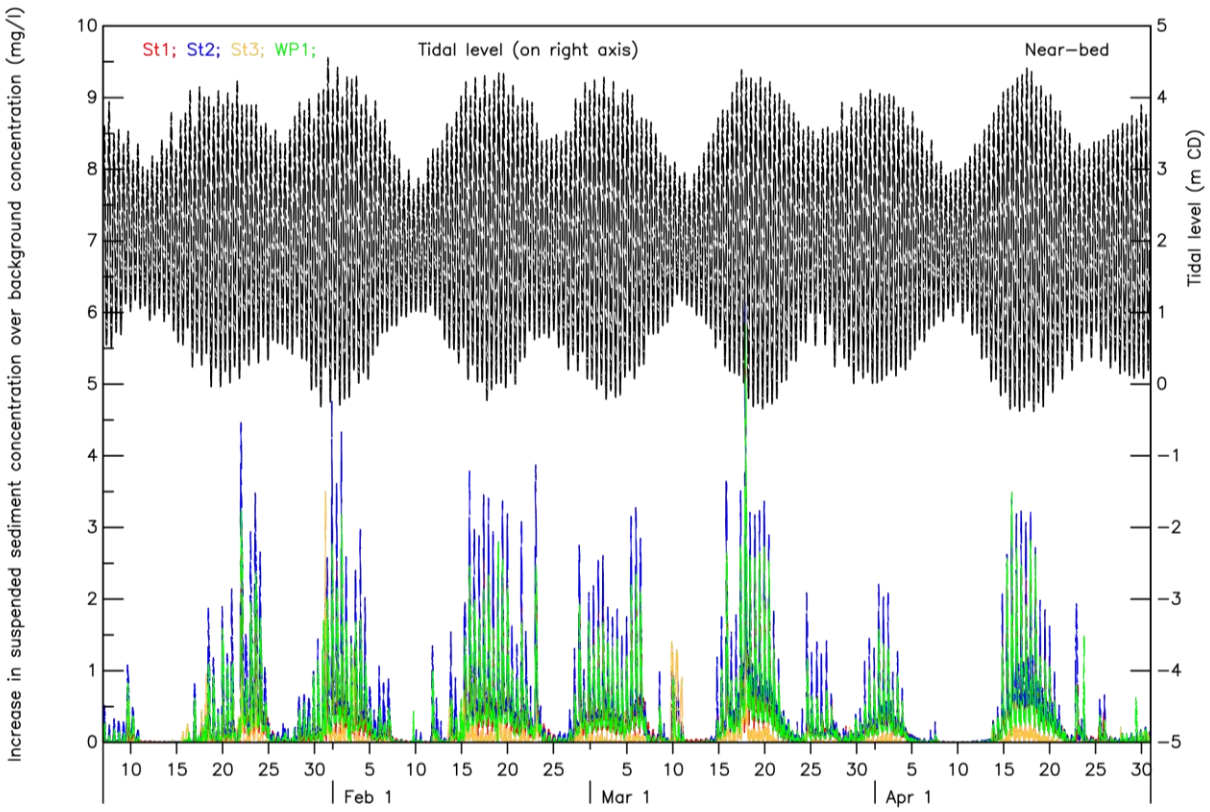

Figure B 84 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the three months following the campaign period at stations: St1, St2, St3 and WP1.

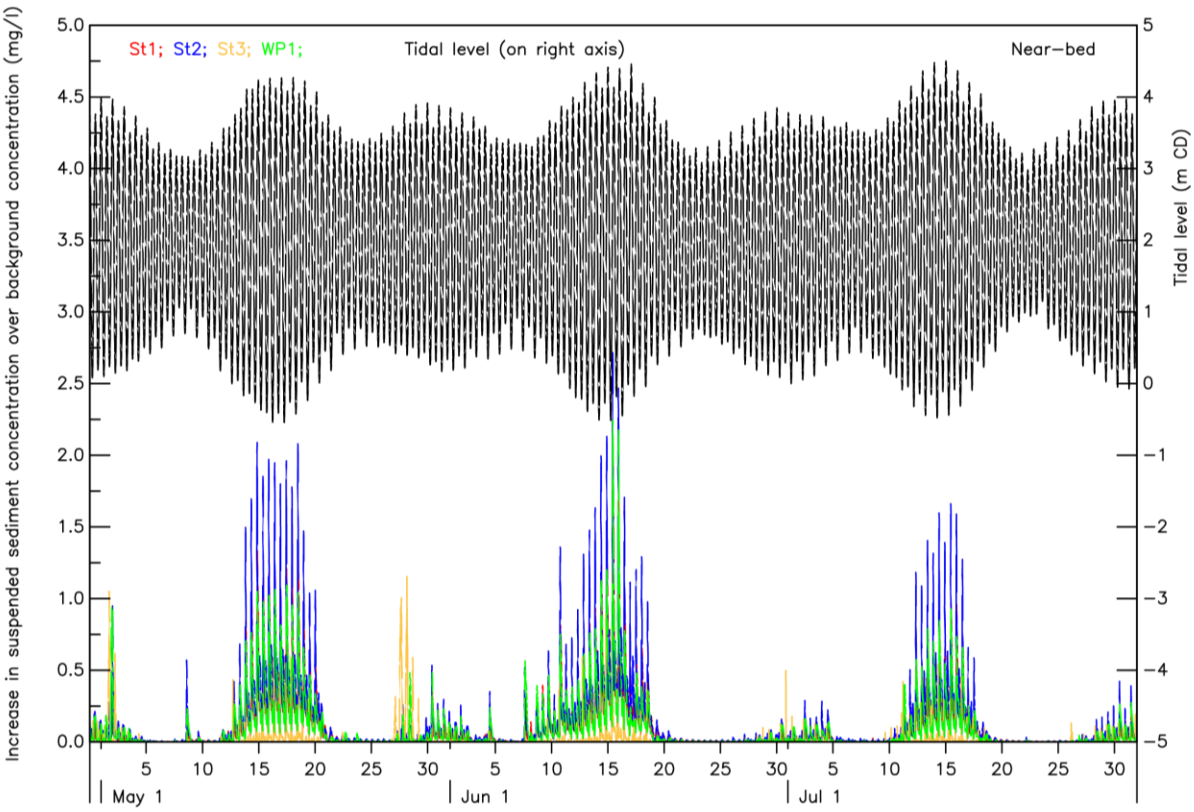

Figure B 85 – Scenario B: Increased suspended sediment concentration (on the left vertical axis) and tidal levels (on the right vertical axis) at the bed for the four to six months following the campaign period at stations: St1, St2, St3 and WP1.

Table B.14: **Scenario B: Statistical indicators for elevated suspended concentrations at the bed at St1, St2, St3 and WP1.**

	Suspended sediment concentration at the bed			
	St1 (mg/l)	**St2 (mg/l)**	**St3 (mg/l)**	**WP1 (mg/l)**
Peak	5.47	6.14	3.50	5.84
99th percentile	1.97	2.70	0.56	2.10
95th percentile	0.83	1.25	0.15	1.01
50th percentile	0.04	0.07	0.00	0.04
Mean	0.18	0.28	0.03	0.21

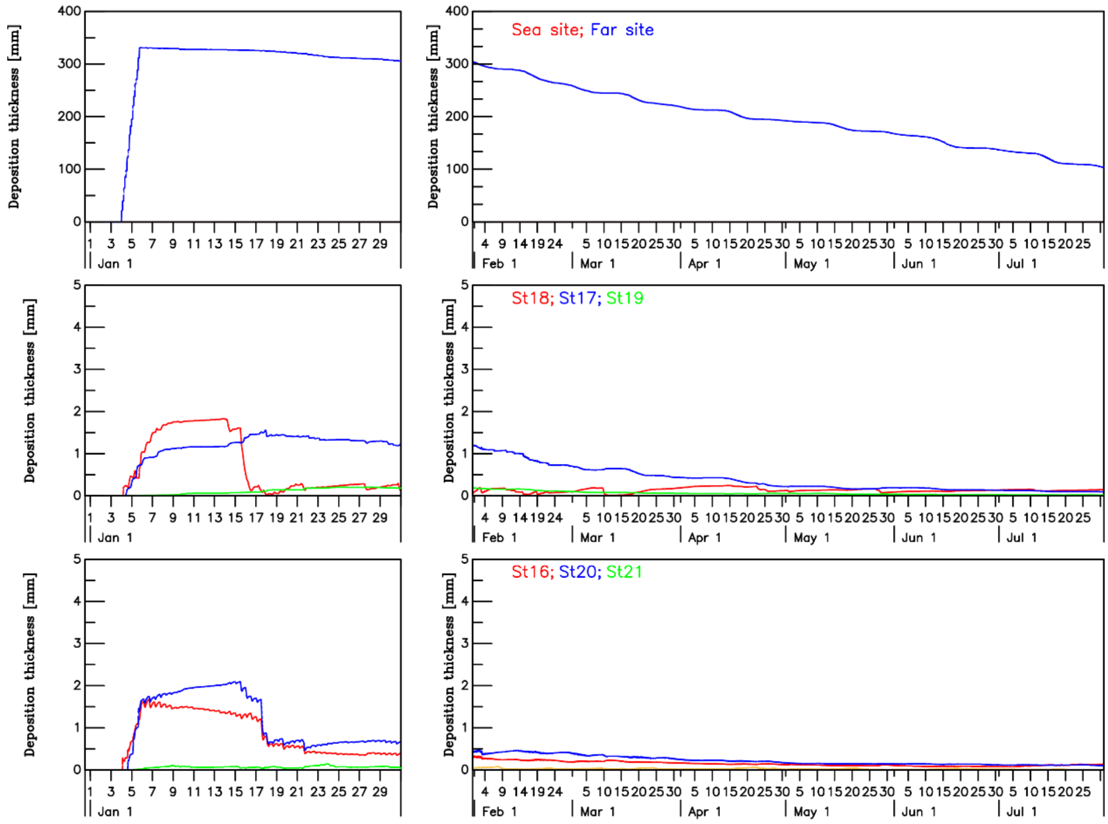

Figure B 86 – Scenario B: Sediment deposition during the campaign month (left) and for six months after the campaign (right) at the disposal and surrounding sites.

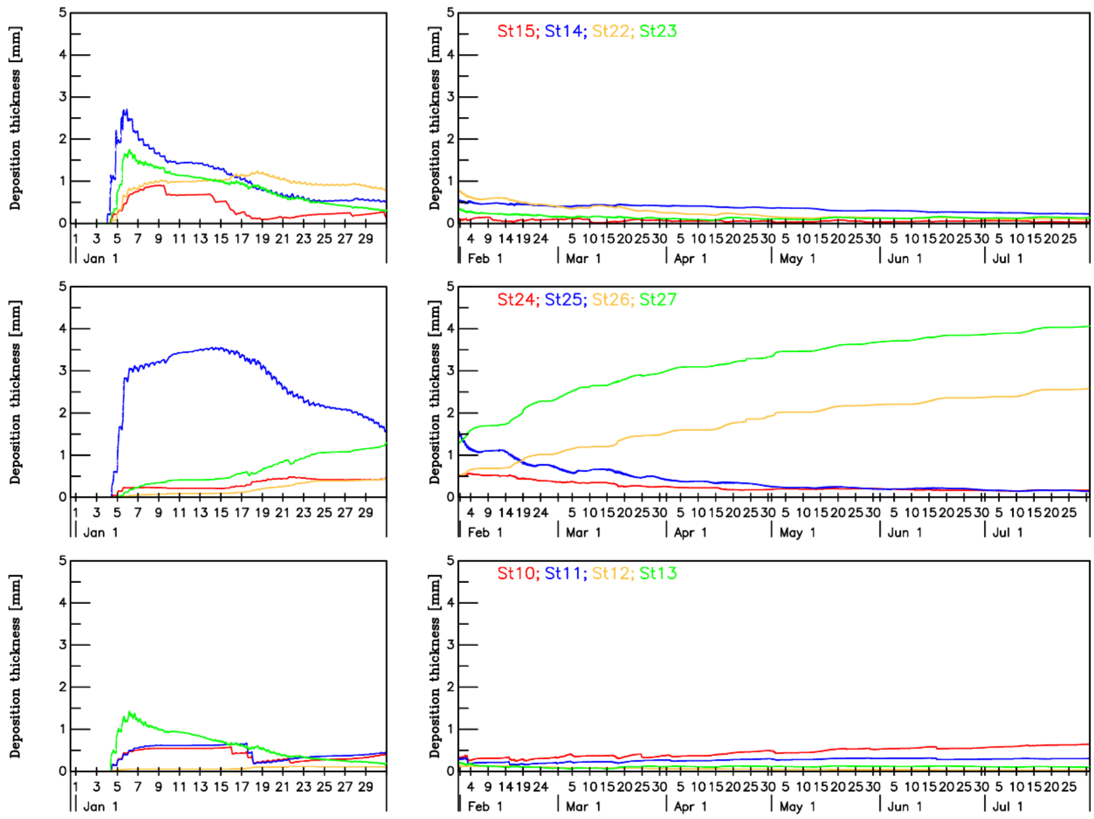

Figure B 87 – Scenario A: Sediment deposition during the campaign month (left) and for six months after the campaign (right) at sites near the centre of the lough.

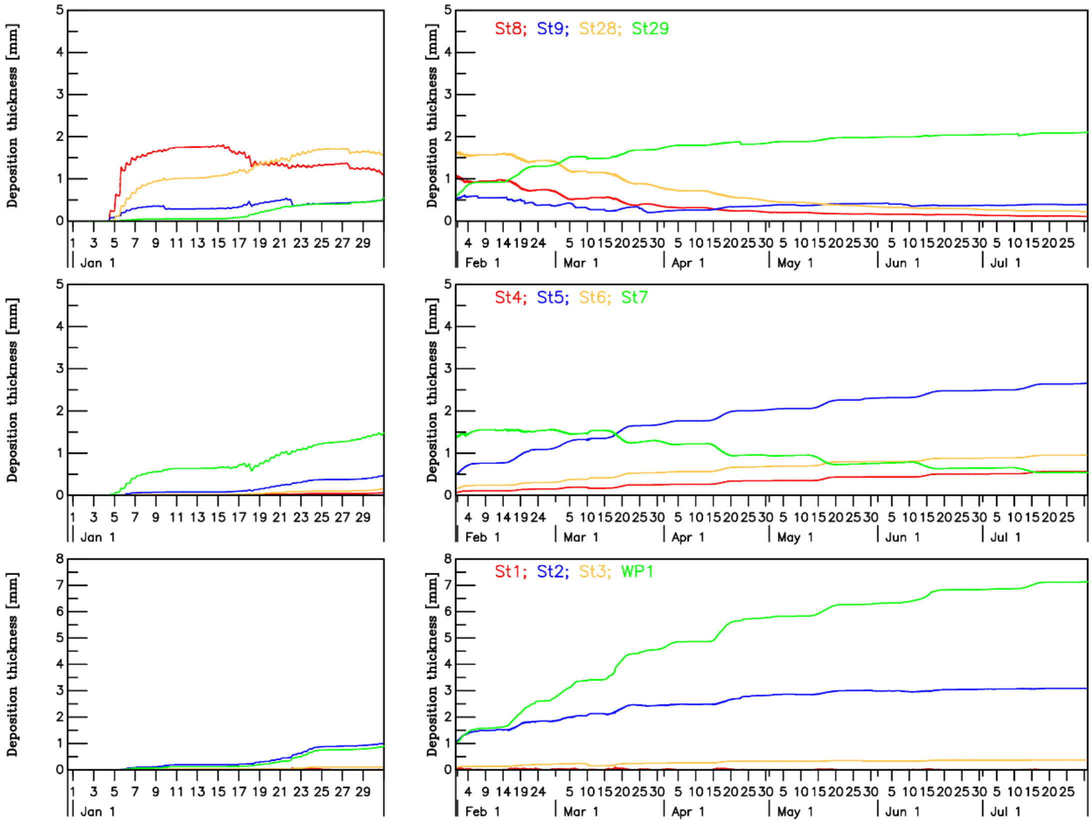

Figure B 88 – Scenario B: Sediment deposition during the campaign month (left) and for six months after the campaign (right) at sites in the upper part of the lough.