VIEWPOINT 3 RINGASKIDDY SHORELINE EXISTING VIEW

Recommended viewing distance when viewed with both eyes: 45 cm

Lens Focal Length:	50 mm
Camera Sensor:	Full Frame 14.8 mm x 22.2 mm
Camera Height:	1.7 m above ground level
Camera:	Canon EOS 1100D digital SLR

Date: 10-Jan-13
Time: 15:22

RPS

VIEWPOINT 3 RINGASKIDDY SHORELINE PROPOSED VIEW

Recommended viewing distance when viewed with both eyes: 45 cm

Lens Focal Length:	50 mm
Camera Sensor:	Full Frame 14.8 mm x 22.2 mm
Camera Height:	1.7 m above ground level
Camera:	Canon EOS 1100D digital SLR

Date: 10-Jan-13
Time: 15:22

RPS

VIEWPOINT 4 MARTELLO TOWER EXISTING VIEW

Recommended viewing distance when viewed with both eyes: 45 cm

Lens Focal Length:	50 mm
Camera Sensor:	Full Frame 14.8 mm x 22.2 mm
Camera Height:	1.7 m above ground level
Camera:	Canon EOS 1100D digital SLR

Date: 10-Jan-13
Time: 15:22

RPS

VIEWPOINT 4 MARTELLO TOWER PROPOSED VIEW

Recommended viewing distance when viewed with both eyes: 45 cm

Lens Focal Length:	50 mm
Camera Sensor:	Full Frame 14.8 mm x 22.2 mm
Camera Height:	1.7 m above ground level
Camera:	Canon EOS 1100D digital SLR

Date: 10-Jan-13
Time: 15:22

RPS

APPENDIX N

COASTAL PROCESSES STUDY

Haulbowline Island Remediation Project

Coastal Processes Study

DOCUMENT CONTROL SHEET

Client	Cork County Council					
Project Title	Haulbowline Island Remediation Project					
Document Title	Coastal Processes Study					
Document No.	IBE0759_Coastal_Processes_Study					
This Document Comprises	DCS	TOC	Text	List of Tables	List of Figures	No. of Appendices
	1	1	33	1	42	-

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
1	Draft	AG	NS	NS	Belfast	Mar 2013
2	Draft	AG	BB	NS	Belfast	Mar 2013
3	Approval	BB/MB	BB	NS	Belfast	28 Mar 2013
4	Approval	AG/BB	BB	AKB	Belfast	31 Mar 2013
5	Approval	AG/BB	BB	AKB	Belfast	03 April 2013
6	Final Draft	BB	BB	AKB	Belfast	03 April 2013
7	Final	AG	BB	AKB	Belfast	03 April 2013

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 MODELLING OVERVIEW

1.1 INTRODUCTION

In 2012 RPS were appointed by Cork County Council to prepare an Environmental Impact Statement for the proposed remediation of East Tip, Haulbowline Island, Co. Cork.

Haulbowline Island is located within Cork Harbour, between Cobh to the north and Ringaskiddy to the south. It is connected to the mainland at Ringaskiddy via a bridge which traverses Rocky Island. The Headquarters of the Irish Naval Service is situated on the western portion of the Island within the Naval Dockyard to the east. The East Tip site is situated to the east of the Naval Dockyard and is an area of land (approximately 9 hectares) reclaimed from the sea by infilling with processing waste, approximately 650,000 m^3 from a former steelworks located on Haulbowline Island.

The proposed remediation solution, as recommended in a Detailed Quantitative Risk Assessment (DQRA) completed on behalf of Cork County Council, was to provide a low permeability (maximum permeability of 10^{-9}m/s) *cover* system to minimise infiltration of surface water into the waste and underlying waters in combination with an engineered perimeter system with a maximum permeability of 10^{-5}m/s to reduce contaminant flux leaving the waste into the Cork Harbour waters and secondly to prevent erosion of the waste material into the sea.

The perimeter engineered system will incorporate works on and modifications to the existing foreshore at the East Tip site. Therefore hydrodynamic modelling was undertaken by RPS as part of a Coastal Processes Study to investigate the impact of proposed works on the hydrodynamic (current speed and direction) regime around Haulbowline Island. The numerical models also simulated changes to the sedimentation regime in the area as a result of the foreshore excavation operations. This modelling was used to investigate the potential impacts of:

- Alterations in foreshore bathymetry and construction of a perimeter rock armour revetment around Haulbowline Island East Tip on tidal flows and water levels, and
- The dispersion and fate of material excavated during the period of the Perimeter Engineers Structure (PES) construction.

The models simulated were based on the proposed works as described in the Environmental Impact Statement for the East Tip Remediation Project prepared by RPS on behalf of Cork County Council in 2013 (RPS Document Reference MCE0734RP0004).

1.2 COMPUTATION MODELS

Computational modelling techniques utilised modules from the MIKE 21 suite of coastal process modelling software. This modelling software is an industry standard tool developed by the Danish Hydraulics Institute and is used for the assessment of coastal processes.

The specific modules used in this study were:

- 2D hydrodynamic flow models;
- Dredged plume dispersion model.

1.3 MODELLING SOFTWARE

The tidal regime in Cork Harbour was simulated using the 2D depth averaged tidal flow model MIKE21 HD (hydrodynamic module). Bathymetric data for this model was taken from a number of hydrographic surveys including those relating to recent maintenance dredging completed by the Port of Cork within Cork Harbour. These surveys were supplemented with Admiralty Chart Data (as digitally supplied by C.Map of Norway). The base hydrodynamic flow model used in the study was a 2D MIKE21 nested HD flow model consisting of an outer model with a 30m grid resolution and a finer inner model at 10m resolution. Figure 1.1 shows the extent of the tidal models.

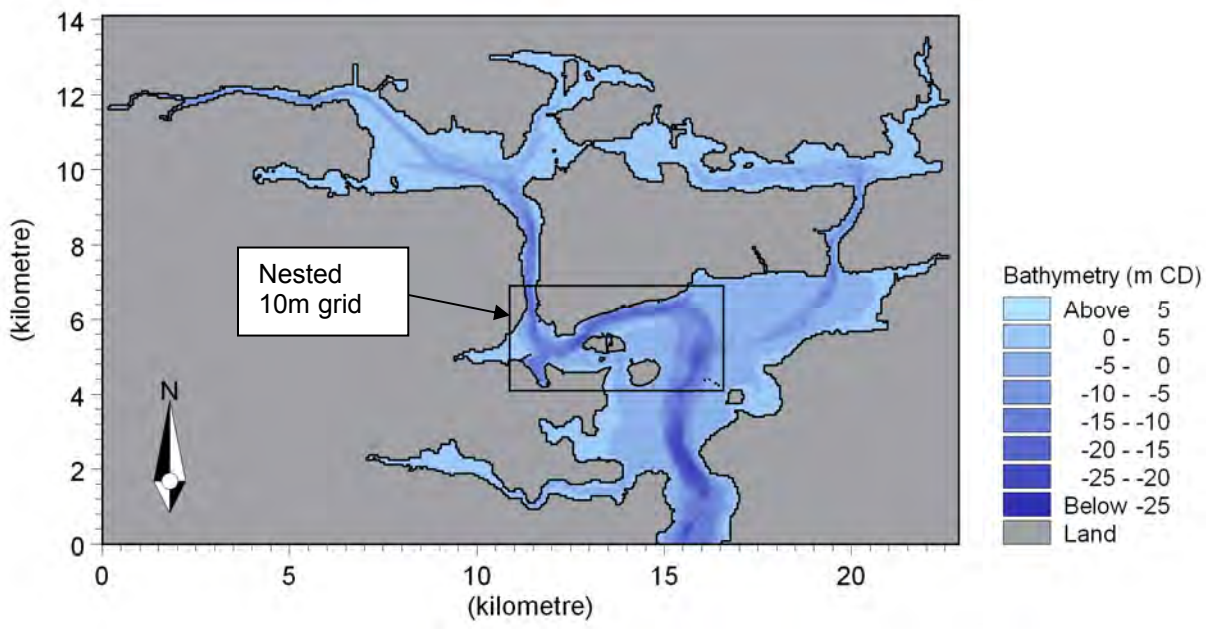


Figure 1.1: Tidal model domain 30m grid with nested 10m section

For the purposes of sediment plume modelling further refinement of the model resolution, to 3.3x3.3m grid, was required in the immediate area of Haulbowline Island. The extent of the 10m grid and inner 3.3m nested model is shown in Figure 1.2 below.

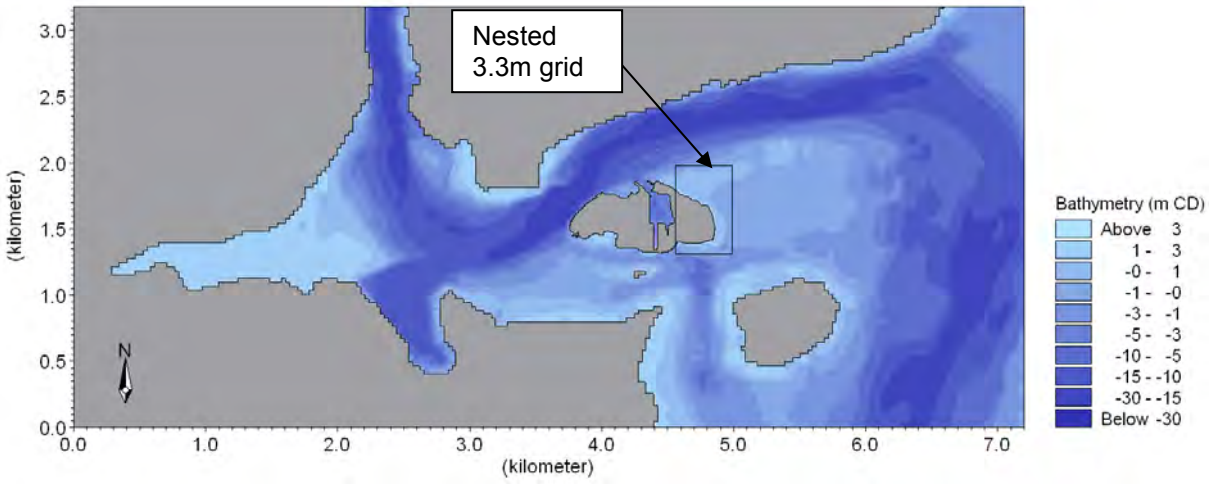


Figure 1.2: Bathymetry and the extent of the 10m nested model with detailed 3.33m area

The boundary conditions used for the model were tidal levels which were derived from harmonic constants for Roberts Cove and Cobh; as published in the Admiralty Tide Tables. The tidal model was calibrated and validated as part of previous studies completed on behalf

of the Port of Cork. For illustration purposes Figure 1.3 shows the model generated water surface elevation (tidal curve) at Haulbowline during a typical spring tide. Similarly, Figure 1.4 shows the water surface elevation for a typical neap tide.

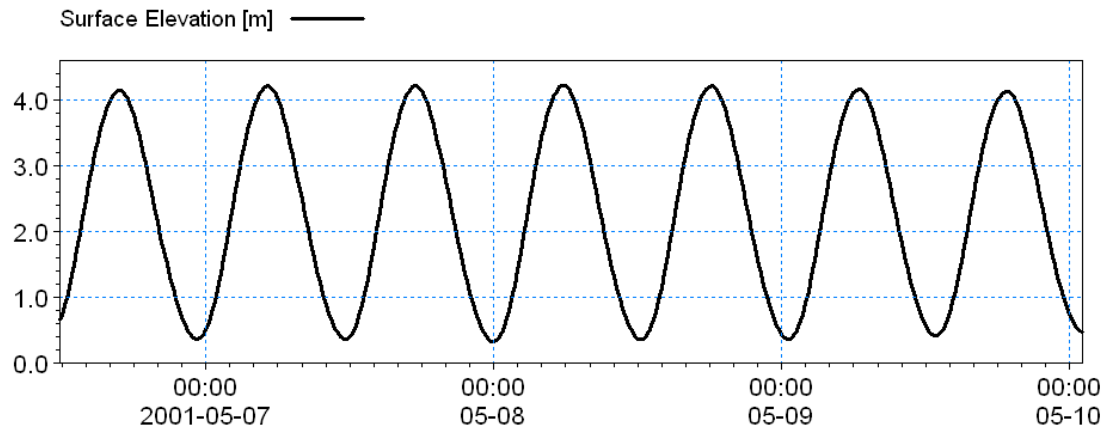


Figure 1.3: Simulated tidal elevations (m) for spring tide at Haulbowline

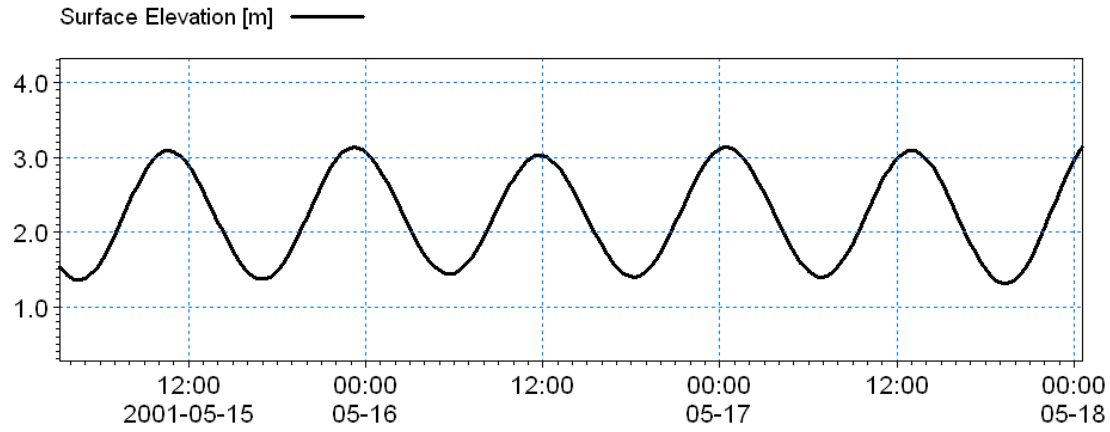


Figure 1.4: Simulated tidal elevations (m) for neap tide at Haulbowline

The modelling of sediment losses during the dredging/excavation process on the foreshore around Haulbowline Island was undertaken using the MIKE 321npa model. This is a particle tracking model that uses the hydraulic flow regime from the MIKE21 nHD model to simulate the transport and fate of material discharged to the water column. The model can include variable graded material and takes effect of re-erosion of deposited sediment so it is particularly suitable for the simulation of the disposal of dredged spoil. The model utilises 2D depth integrated hydrodynamic model data and simulates a vertical velocity profile to simulate velocity variations with depth i.e., lower near bed velocities and higher surface flows.

1.4 MODELLING APPROACH

The overall aim of the project is the remediation of the East Tip at Haulbowline Island. This will include the construction of a Perimeter Engineered Structure (PES) including the construction of a rock armour revetment at the face of the structure. Although the horizontal alignment of the structure will largely follow the existing eastern extent of the island at the East Tip, the proposed PES alignment will modify the existing foreshore extent in some locations.

Additionally, the project may require the removal of contaminated material from the foreshore. Therefore computational modelling was undertaken to assess the potential long term impact of proposed alterations to the foreshore extent on the island on the hydrodynamic flow and sediment transport regime in the area around Haulbowline Island.

Modelling was also undertaken to assess the extent of sediment plumes that may occur during and immediately after the construction phase of the project.

In order to assess the above work 4 No. model scenarios were considered:

- **Scenario A** – The construction of the rock armour keystone trench to facilitate the construction of the PES and rock armour protection. This scenario is based on the assumption that a berm will be constructed on the landward side of the keystone trench to facilitate the excavation of that trench. Re-profiling works of the existing foreshore side slopes would be executed on the landward side of the berm and therefore would not result in any sediment mobilisation. Any potential for sediment mobilisation would be solely from the works associated with the excavation of the trench;

- **Scenario B** – the removal of contaminated material in the foreshore by bulk excavation prior to PES construction. This scenario considers, as a conservative worst case, the unlikely bulk excavation of waste from the foreshore area undertaken with no sediment control. Sediment losses are based on an assumed loss from a dredger/excavator undertaking the excavation activity;

- **Scenario C** – the construction of the PES and the bulk excavation in combination. This model assumes that the bulk excavation has been completed ahead of the PES works;

- **Scenario D** – all construction works carried out behind a coffer dam around the perimeter of the East Tip.

Hydrodynamic and sediment transport characteristics were assessed for all four scenarios. Sediment plume modelling was carried out for Scenarios A and B. The output from this modelling is discussed in more detail in the following sections of this report.

2 HYDRODYNAMIC MODELLING

2.1 HYDRODYNAMIC SCENARIOS

Hydrodynamic modelling was initially undertaken using the existing bathymetry to derive the current tidal pattern, pre-works.

The proposed PES alignment around Haulbowline Island (as indicated on Figure 6.1 and 6.2 of the Haulbowline Remediation Project EIS, RPS, April 2013) was then incorporated into the numerical models and the post works scenario simulated. The variations in tidal currents were then compared to assess the impact of the works on tidal current patterns.

The following hydrodynamic model scenarios were simulated:

1) **Scenario A**: One month of hydrodynamic model data (assumed construction period) was generated based on the existing bathymetry with a bund located on the landward side of the keystone trench. A 1.5m wide x 2m deep x 900m long excavation around the island was assumed giving 2700m^3 excavated material. The location of the trench is shown on Figure 2.1

Figure 2.1: Location of the keystone trench from Scenario A

Figure 2.2 illustrates the location of the trench a simulated in the nested 3.33m model with the updated bathymetry.

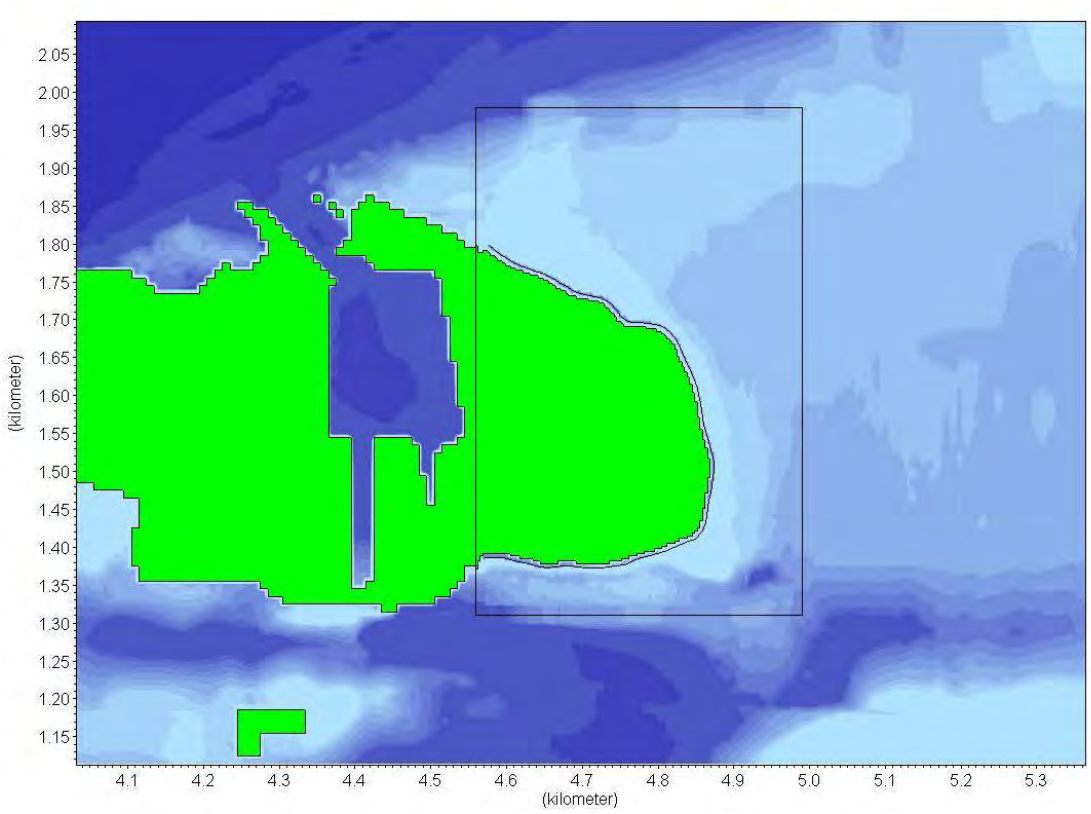


Figure 2.2: Updated bathymetry for the Scenario A with marked trench in 3.33m nested model

2) **Scenario B**: One month of hydrodynamic model data based on the existing bathymetry and incorporating an assumed bulk excavation from the foreshore area around the perimeter of the island. This excavation is assumed to have a maximum depth of 3m with an approximate trench width of 20m. Figure 2.3 below shows the extent of the bulk waste excavation and Figure 2.4 illustrates the updated bathymetry for this scenario within the 3.3m nested model extent.

Figure 2.3: Extent of the bulk excavation of waste from Scenario B

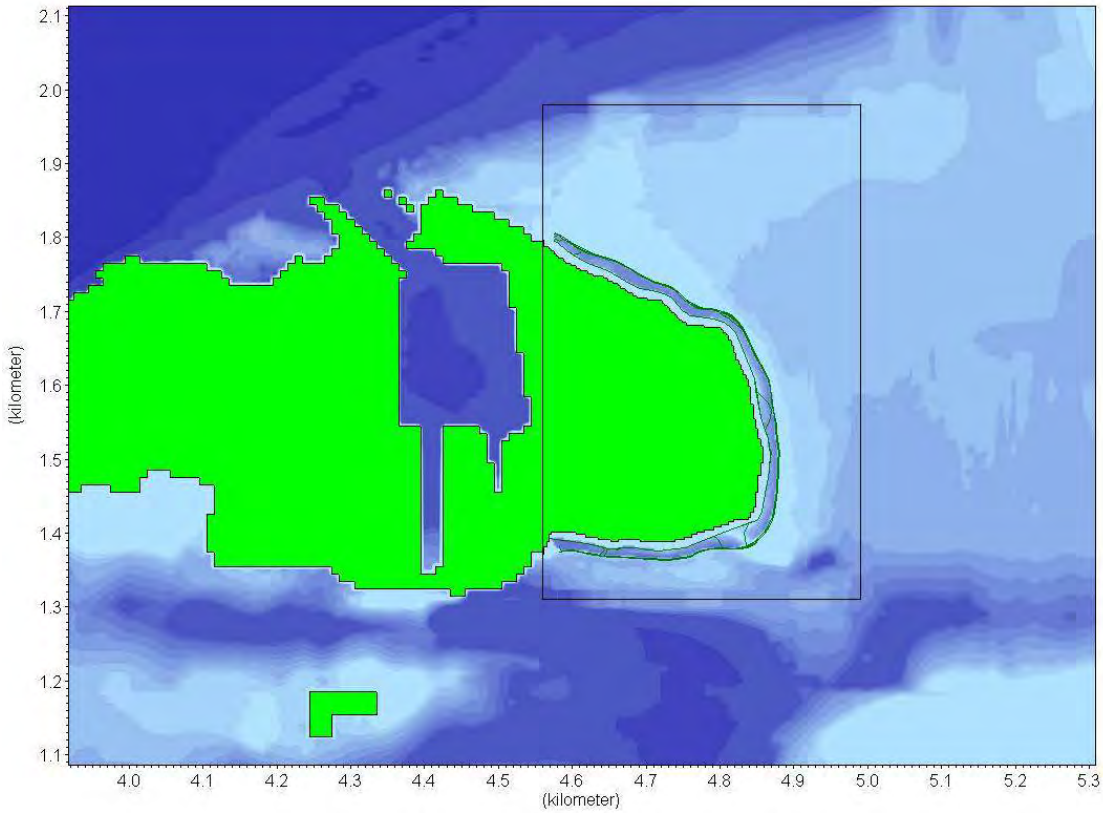


Figure 2.4: Updated bathymetry for the Scenario B with bulk excavation in 3.33m nested model

3) **Scenario C**: The hydrodynamic model simulated a typical spring to neap tidal cycle (17 days). This model incorporates a bulk excavation similar to Scenario B assuming that the proposed PES construction was complete.

Figure 2.5 below illustrates altered bathymetry in the nested 3.33m model and contours of the excavation for Scenario C.

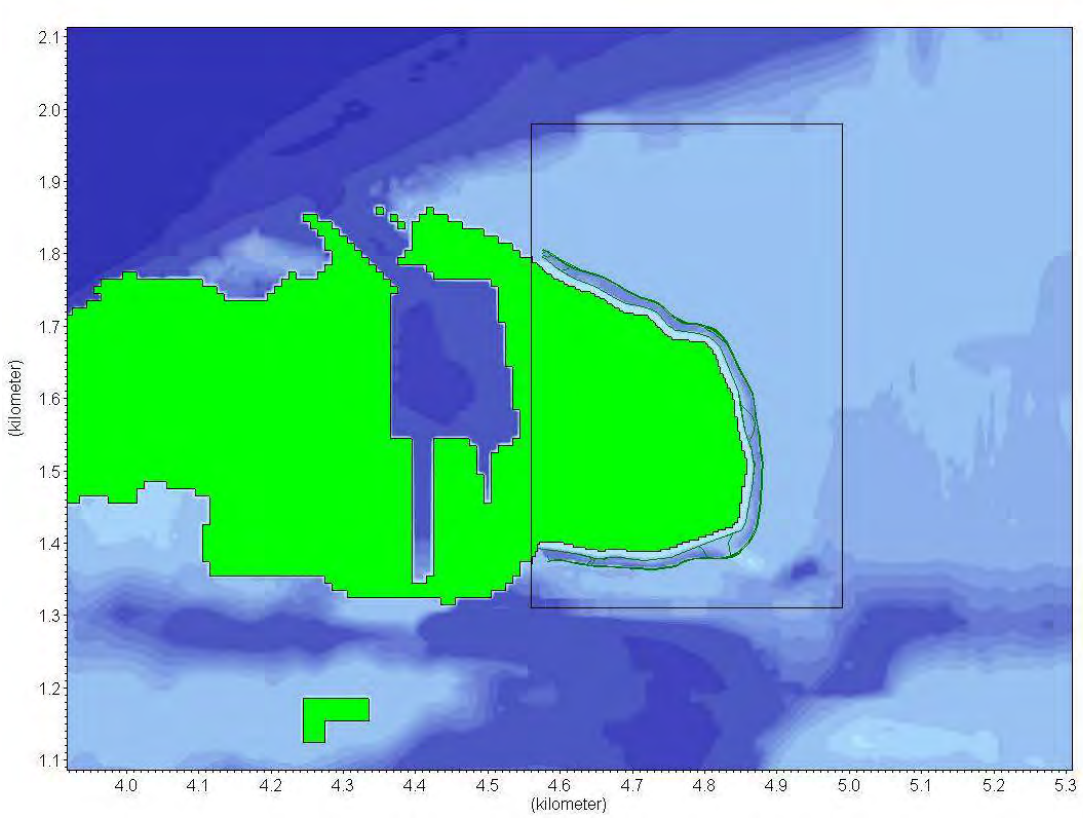


Figure 2.5: Updated bathymetry for the Scenario C with bulk excavation in 3.33m nested model

4) **Scenario D**: This simulation assumes that a cofferdam is located outside of the bulk excavation for full sediment containment purposes. For this scenario 17 days (neap to neap tidal cycle) of hydrodynamic currents were simulated.

Figure 2.6 below show extent of the bund which is the extent of the excavation.

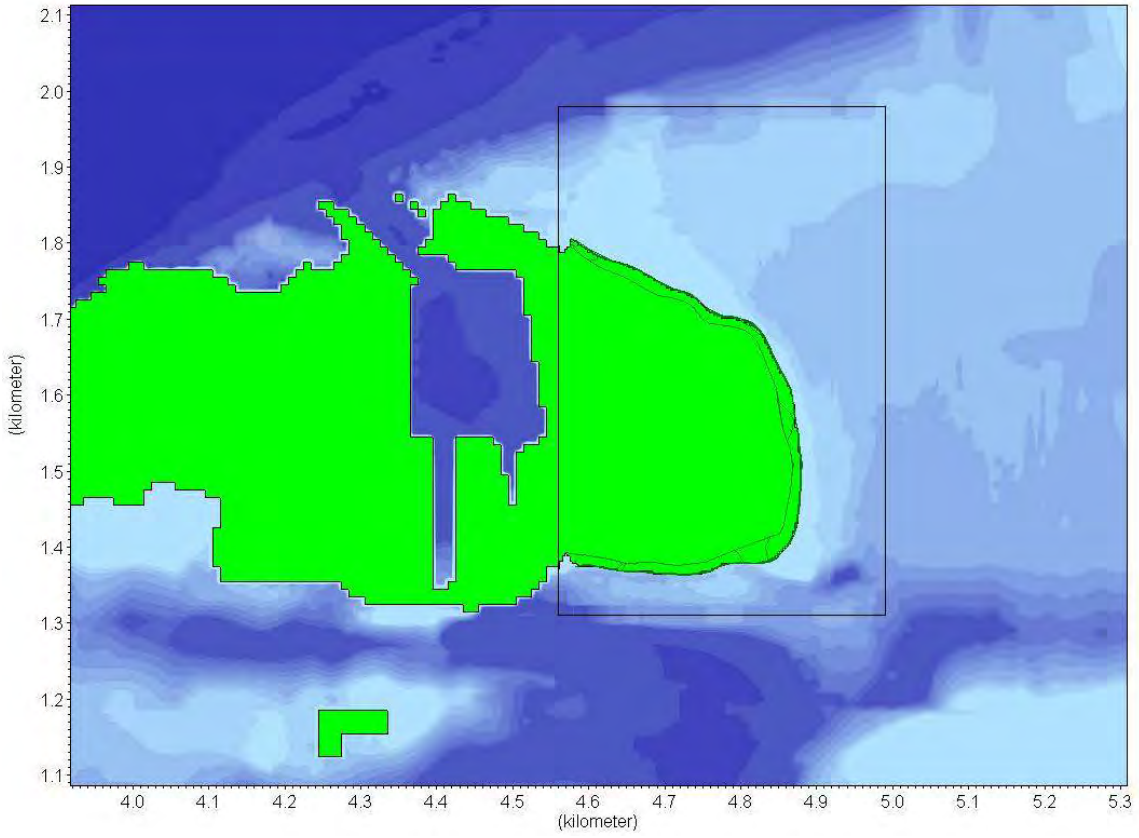


Figure 2.6: Updated bathymetry for the Scenario D with bulk excavation in 3.33m nested model

2.2 HYDRODYNAMIC MODELLING RESULTS

2.2.1 Existing tidal flow regime in Cork Harbour

The Spring to Neap Tidal cycle was simulated based on tidal data for May 2001. This month was selected for modelling purposes as it represented a period of average tidal conditions and would therefore be representative of the general range of tidal conditions. Typical tidal patterns are presented in Figure 2.7 and Figure 2.8 for mid-ebb and mid-flood respectively, both during spring tide conditions.

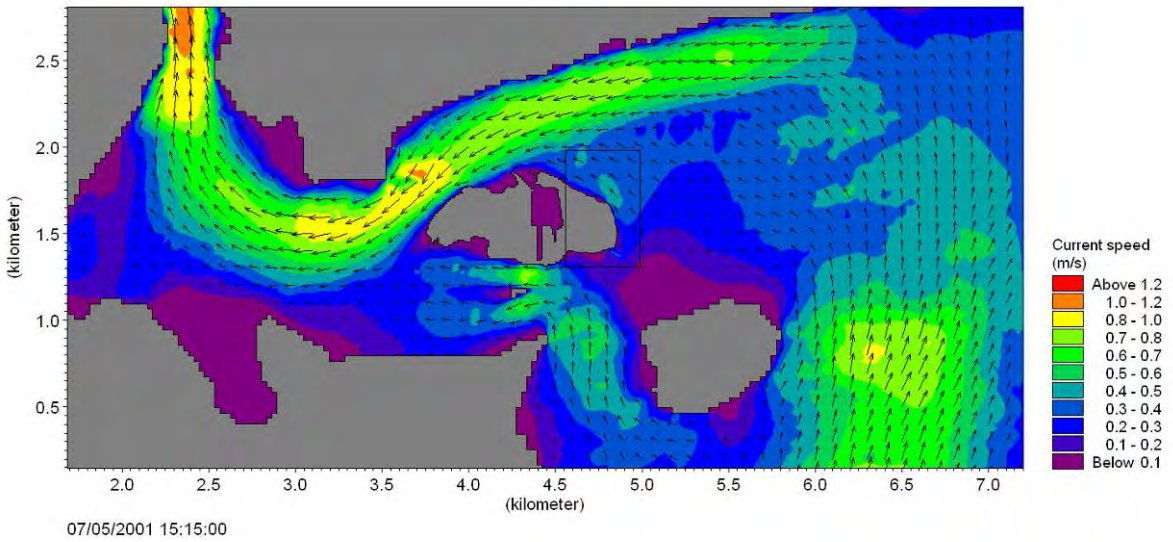


Figure 2.7: Existing Typical Spring Current Speed on Flood

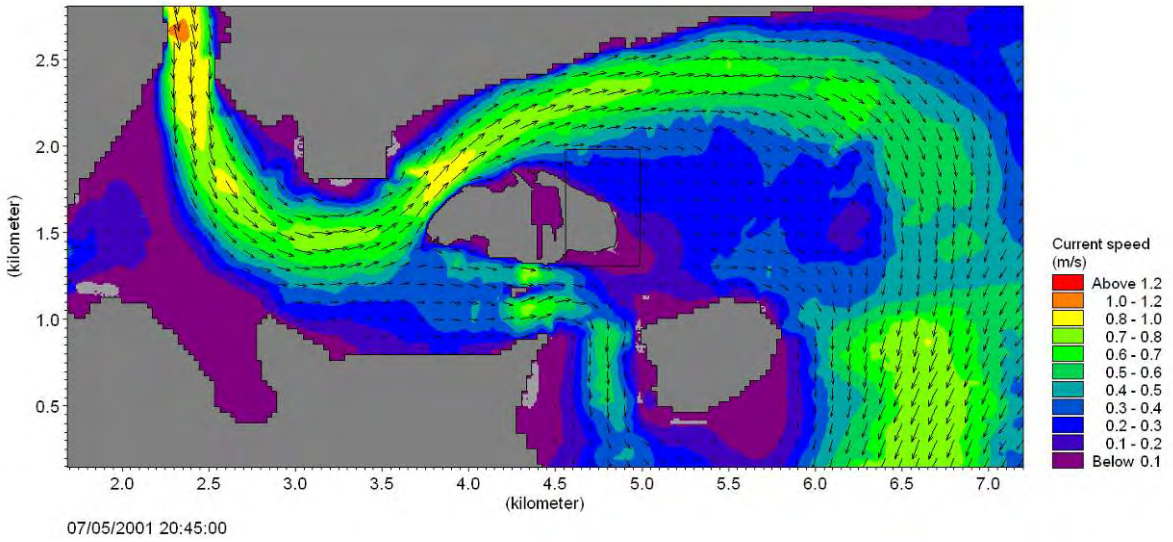


Figure 2.8: Existing Typical Spring Current Speed on Ebb

2.2.2 Impact of the Scenarios on the tidal flows

The impact of the proposed development was simulated by altering the tidal model bathymetry for the four scenarios outlined previously including the relevant modifications of the foreshore on the eastern end of the island. Comparisons of the tidal flow conditions throughout the area were then made to assess the impact of the development.

Figure 2.9 and Figure 2.11 respectively show the typical spring flood and ebb patterns following the trench excavation.

In order to evaluate the impact of the altered foreshore Figure 2.10 and Figure 2.12 illustrate the *change* in peak spring flood and ebb velocities between the existing and post keystone trench excavation (1.5m wide x 2m deep x 900m approx) works.

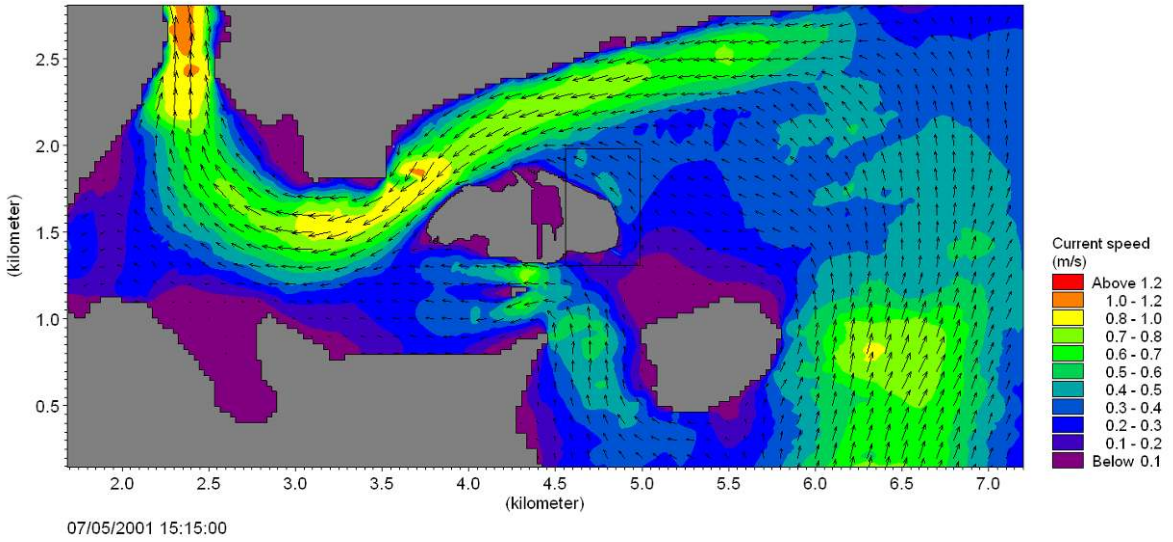


Figure 2.9: Scenario A: Spring Current Speed on Flood tide

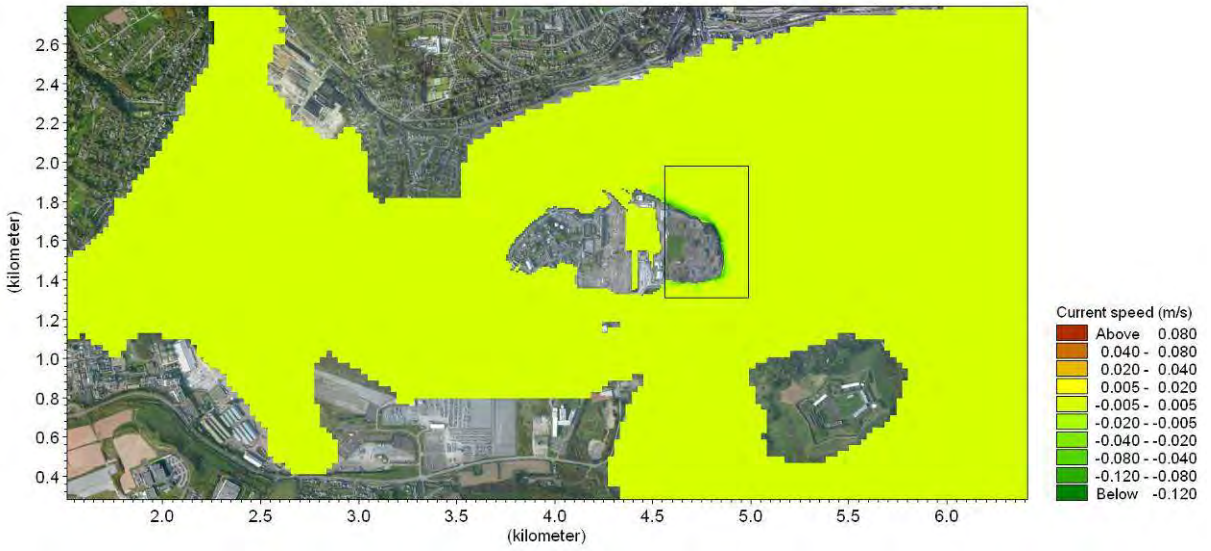


Figure 2.10: Scenario A: Change (pre-post works) in Current Speed on Flood tide

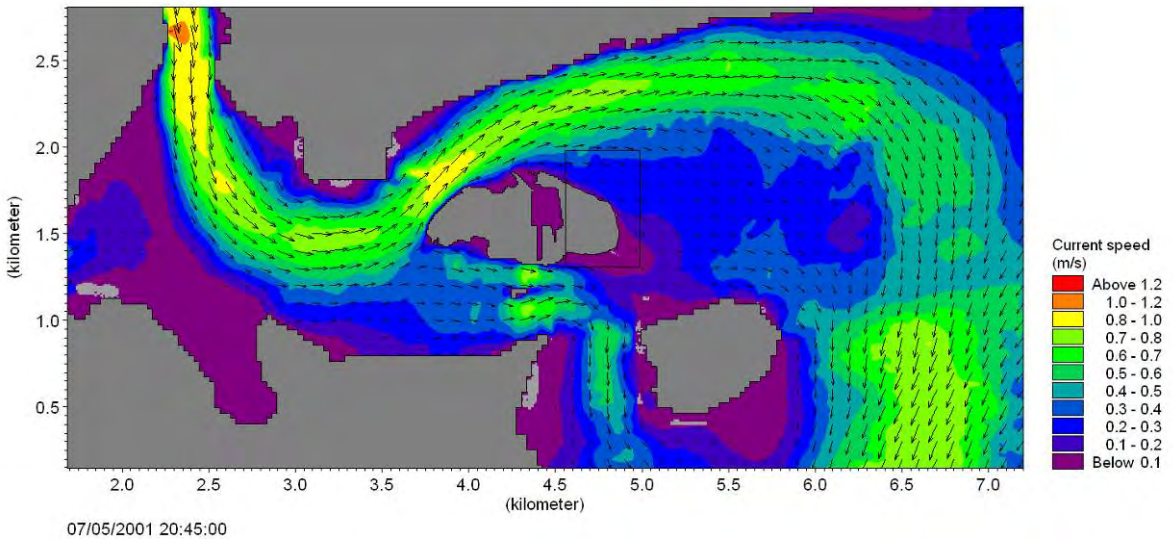


Figure 2.11: Scenario A: Spring Current Speed on Ebb tide

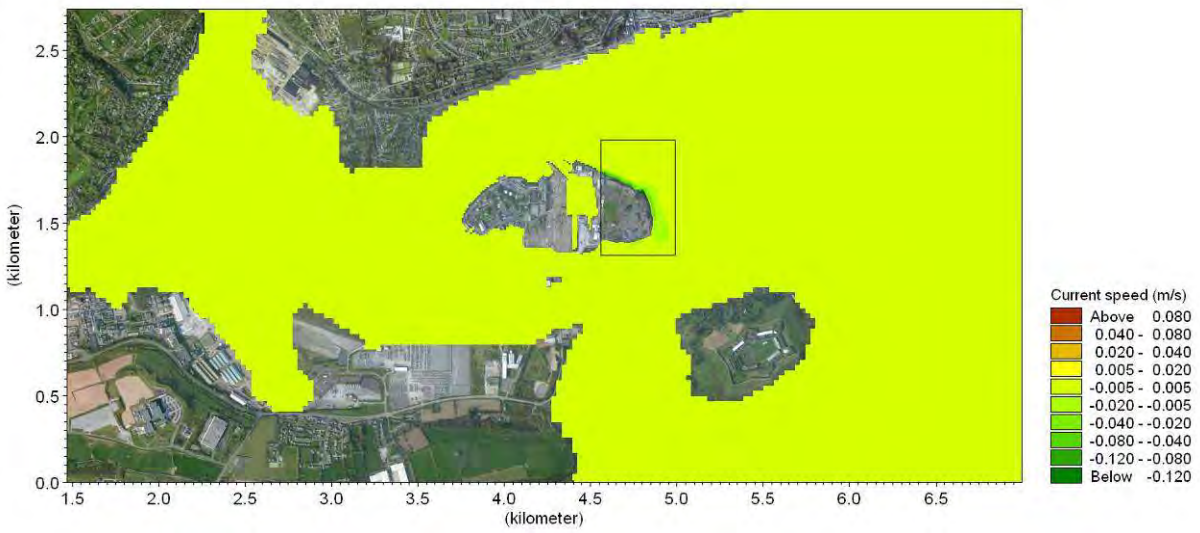


Figure 2.12: Scenario A: Change (pre-post works) in Current Speed on Ebb tide

From the above tidal velocity difference plots it can be seen that there are small changes in the current velocity in the area of the proposed works. The maximum change in the peak velocities are approximately -0.04m/s. This occurs in the immediate vicinity of the trench and is not considered to be significant. Away from the trench location no significant / negligible changes to the flood or ebb tidal flows are predicted.

Figure 2.13 to Figure 2.20 below illustrate peak spring current speed on flood and ebb for Scenario B and associated plots of the change in current speed with the completed bulk excavation. From these plots it can be seen that the change in current speed on flood is in

range of -0.04 to 0.08 m/s localised to the immediate vicinity of the works and does not have any impact on tidal regime further away from the proposed works.

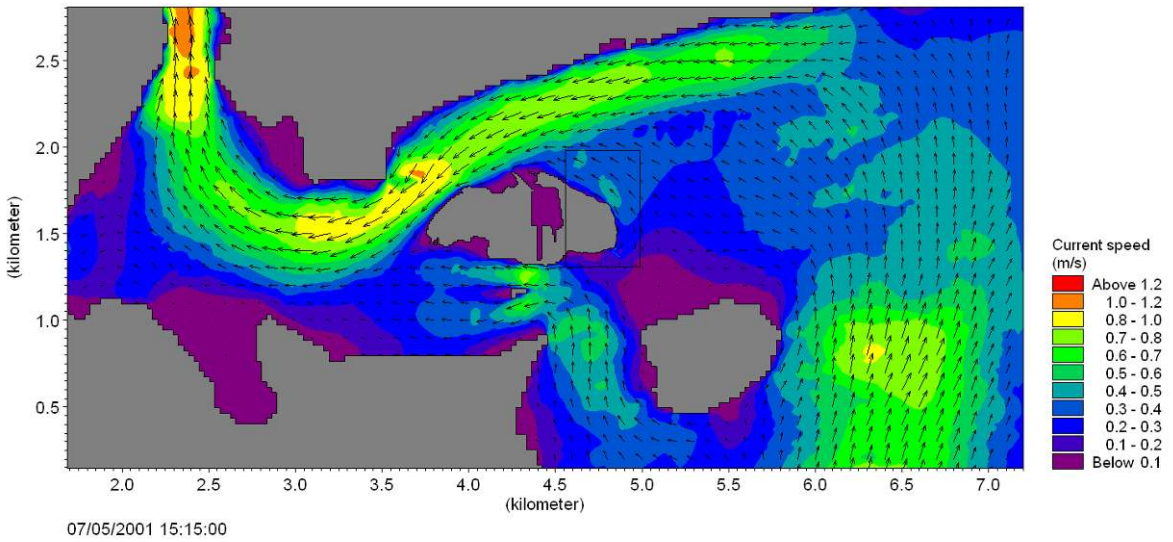


Figure 2.13: Scenario B: Spring Current Speed on Flood tide

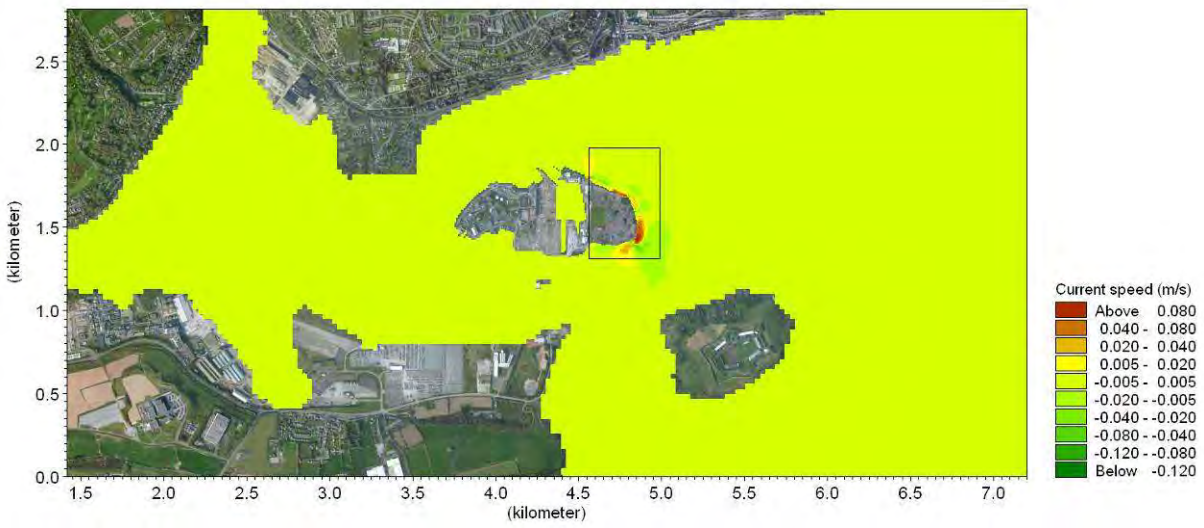


Figure 2.14: Scenario B: Change in Current Speed on Flood tide

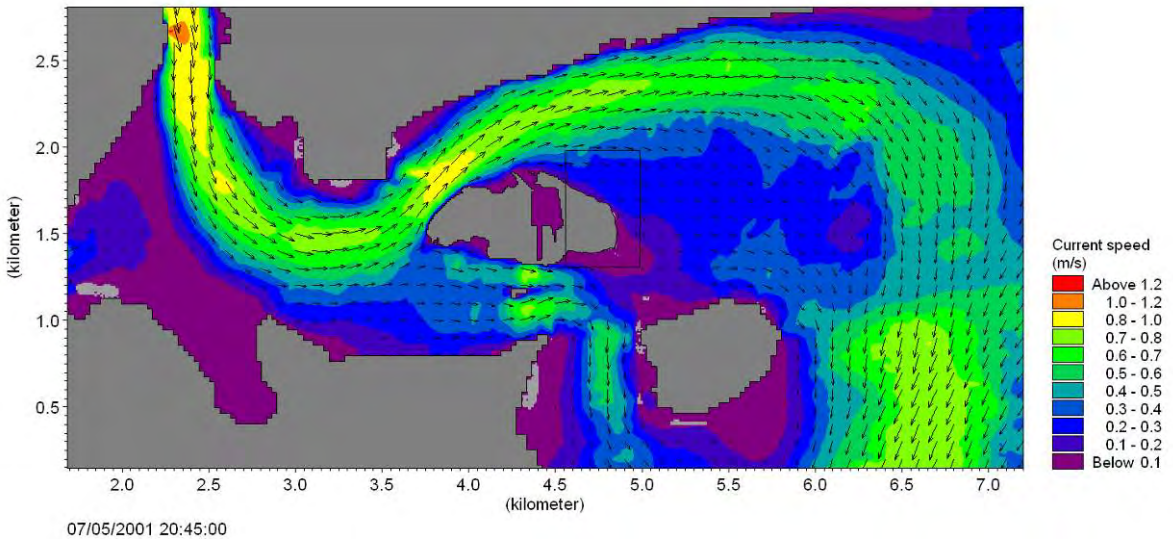


Figure 2.15: Scenario B: Spring Current Speed on Ebb tide

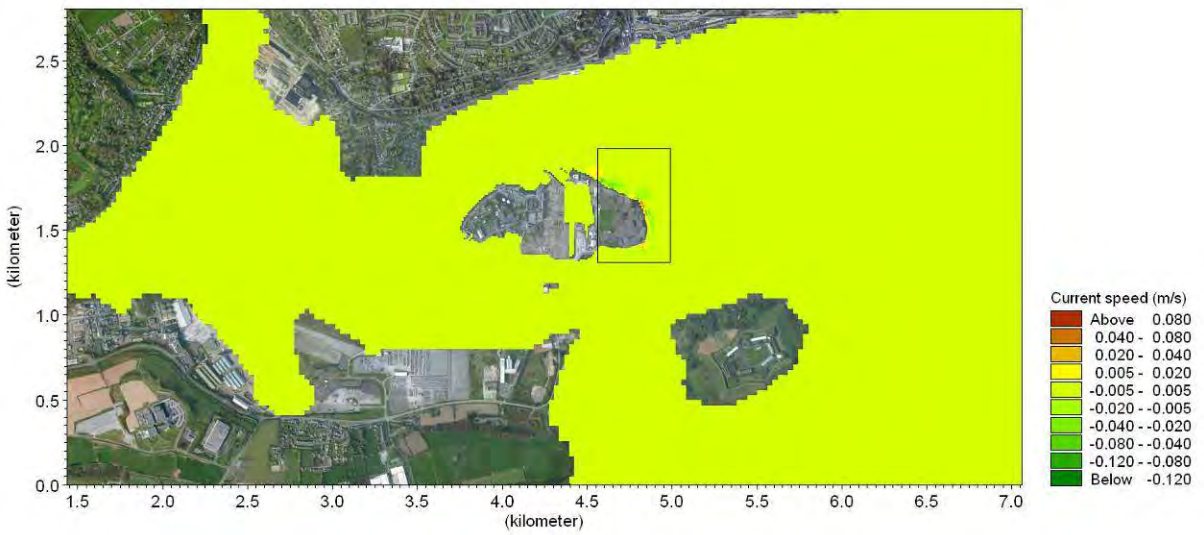


Figure 2.16: Scenario B: Change in Current Speed on Ebb tide

Peak flood and ebb current speed plots (Figure 2.17 & Figure 2.19) and difference plots (Figure 2.18 & Figure 2.20) are presented for Scenario C. It can be seen that the difference in current speed both on flood and ebb for this scenario, as in two previous scenarios, is very localised and changes in velocity variations, range -0.04 to +0.08 m/s, are not considered to be significant and can only be discerned on the flood tide.

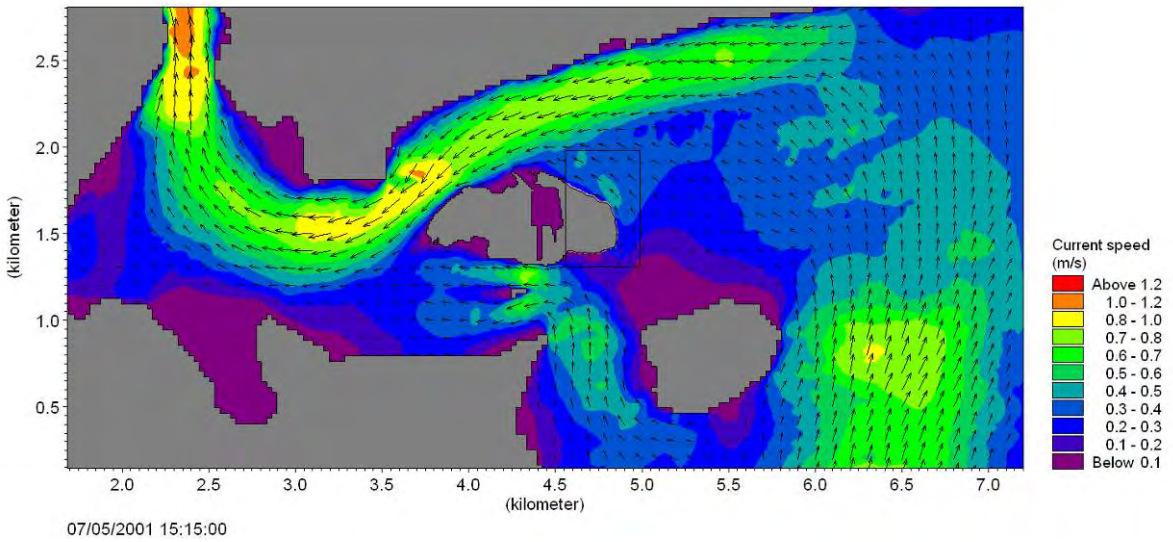


Figure 2.17: Scenario C: Spring Current Speed on Flood

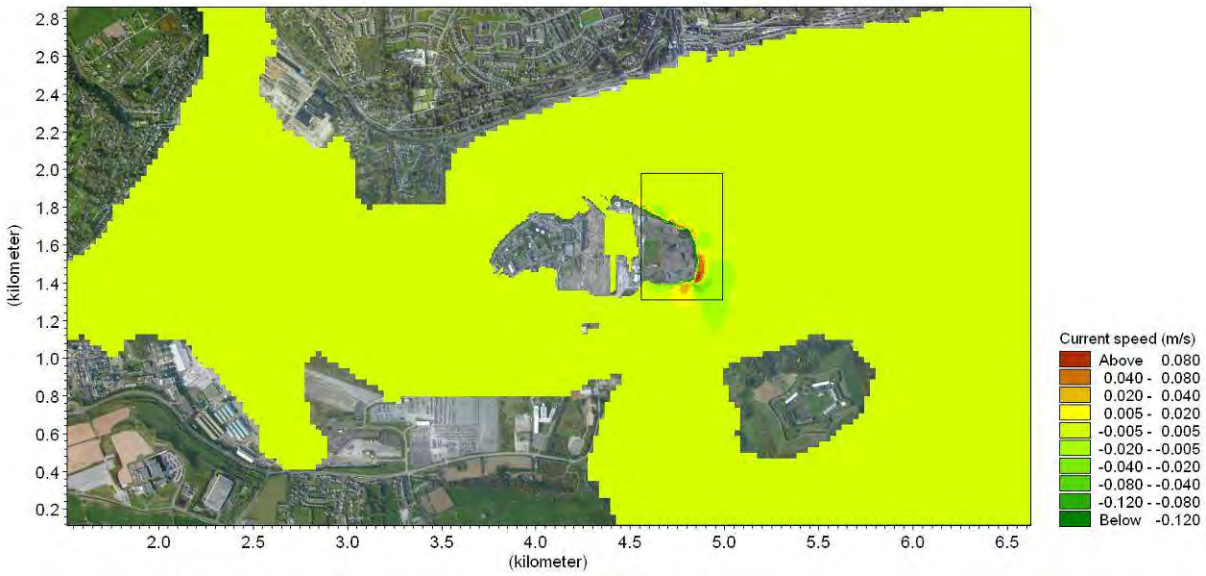


Figure 2.18: Scenario C Change in Current Speed on Flood

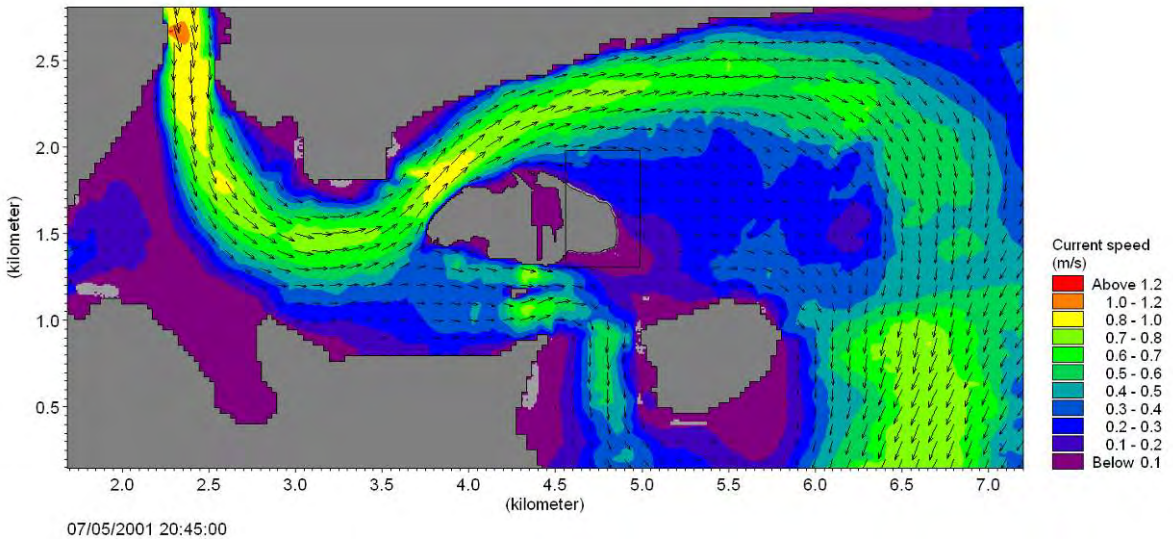


Figure 2.19: Scenario C Spring Current Speed on Ebb tide

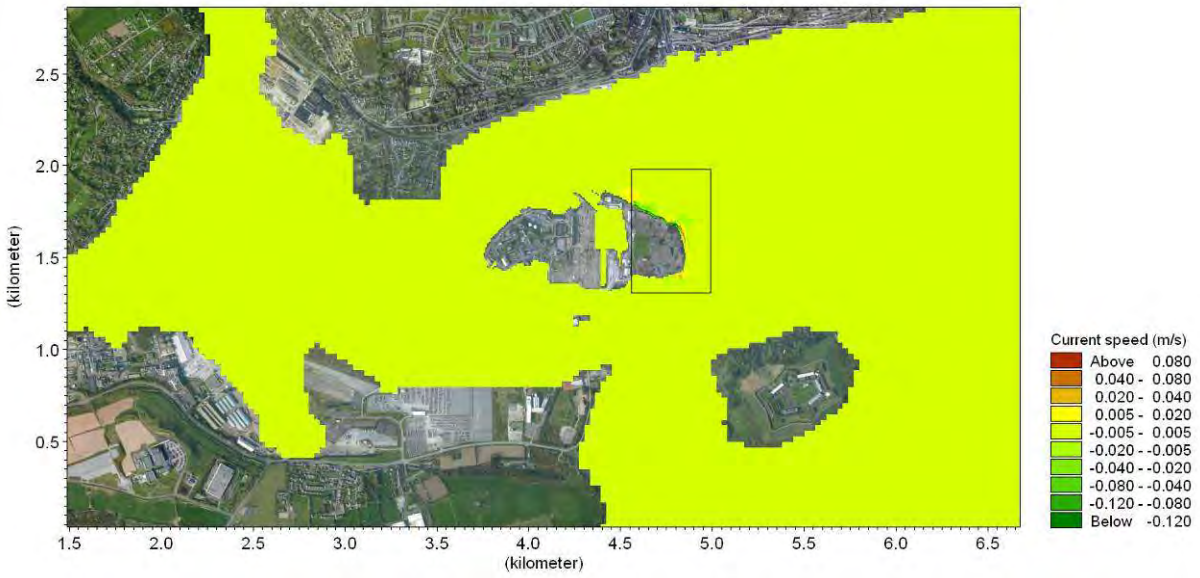


Figure 2.20: Scenario C: Change in Current Speed on Ebb tide

Figures 2.21 and 2.23 present peak velocities for flood and ebb tides for Scenario D. Pre and post works differences are limited to a small area with the change in peak current speed as illustrated in Figure 2.22 and Figure 2.24 for flood and ebb respectively.

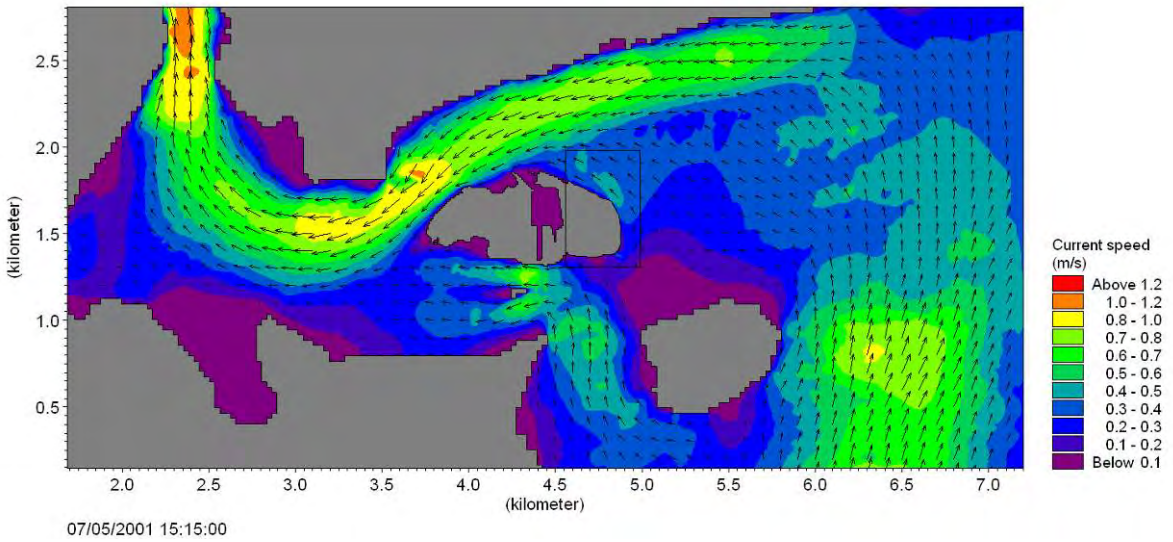


Figure 2.21: Scenario D: Spring Current Speed on Flood tide

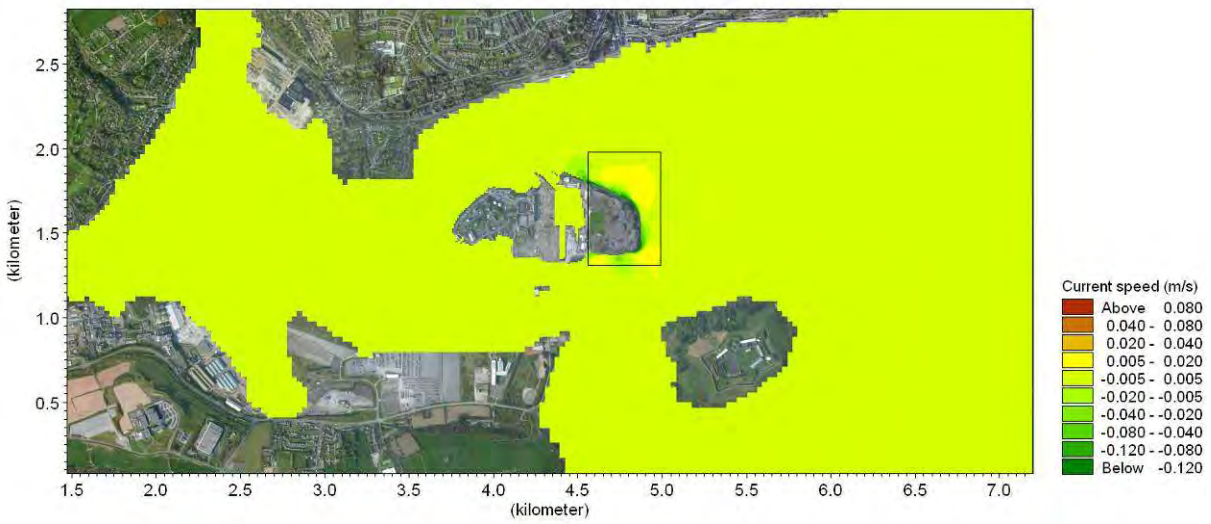


Figure 2.22: Scenario D: Change in Current Speed on Flood tide

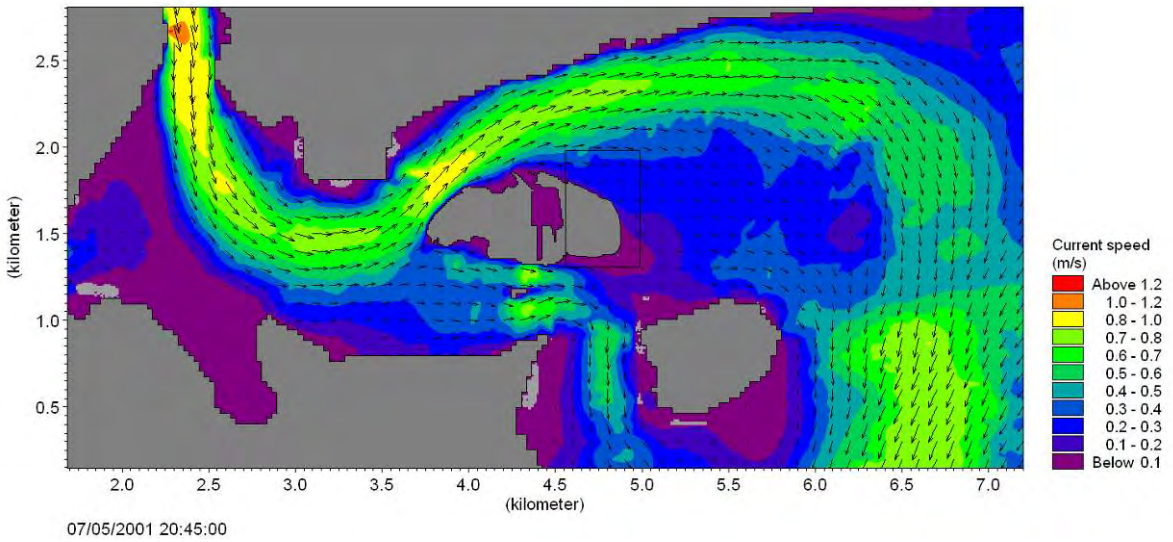


Figure 2.23: Scenario D: Spring Current Speed on Ebb tide

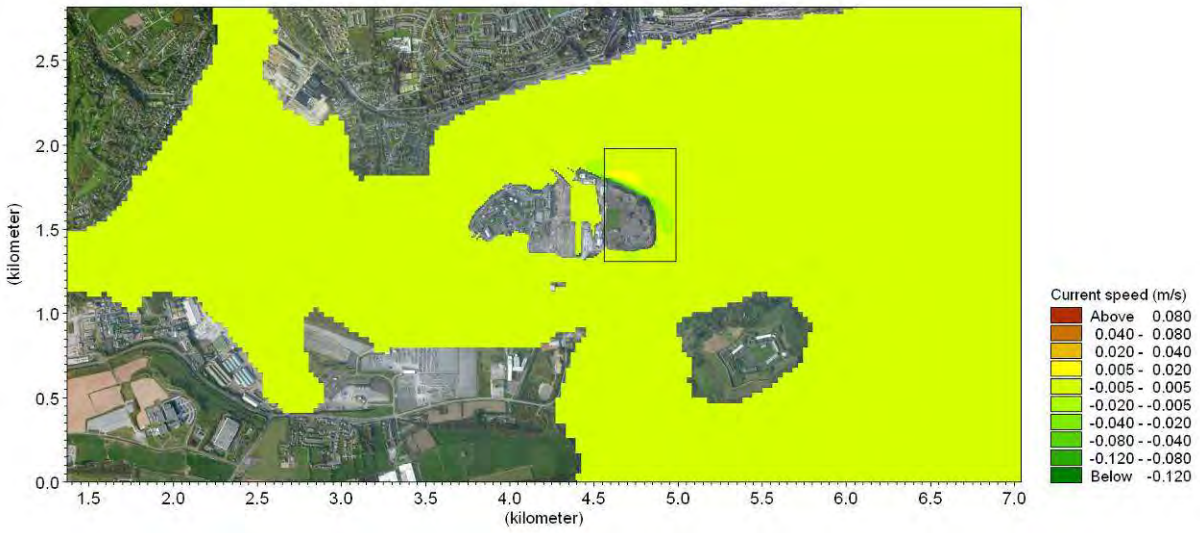


Figure 2.24: Scenario D: Change in Current Speed on Ebb tide

2.2.3 Impact of Scenarios on Sediment Transport

The residual current is the average current over the tidal cycle and will determine the net sediment transport due to tidal forcing.

Therefore an evaluation of residual currents can be used to assess the impact of any change in bathymetry on the longer term sediment transport regime. The residual current for the existing bathymetry is presented in Figure 2.25.

Changes in residual current speed for each of the scenarios A, B, C, and D respectively are shown below on Figure 2.27 to Figure 2.29. For Scenarios B and C, i.e. including the bulk excavation in the foreshore, the change is in range of -0.03 m/s to +0.03m/s. For the keystone trench (Scenario A) and the cofferdam along the line of the outer edge of the bulk excavation (Scenario D) a change of -0.03 m/s to +0.01m/s range can be seen. These changes have a very small magnitude and would not affect areas outside the immediate vicinity of the works.

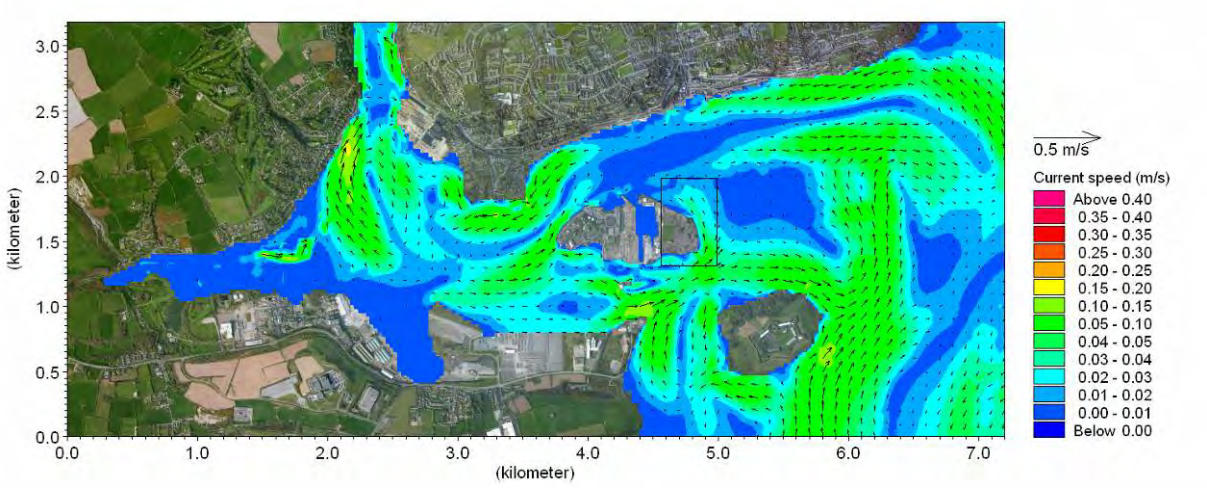


Figure 2.25: Residual spring tidal flow regime - Existing bathymetry at Haulbowline

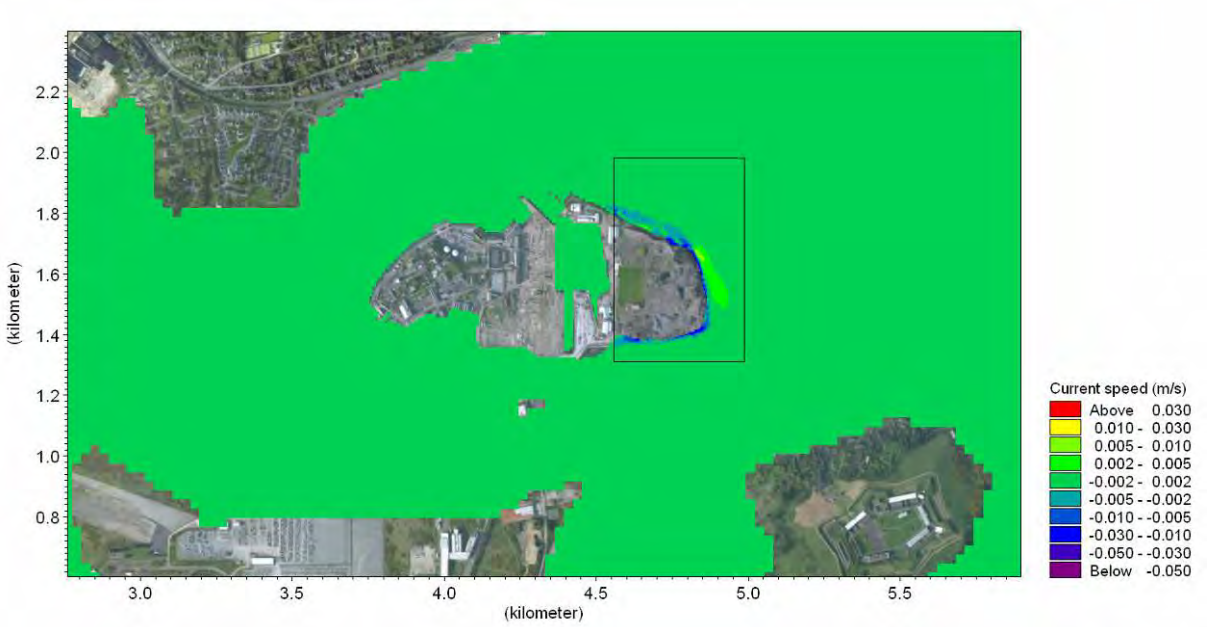


Figure 2.26: Scenario A: Difference in spring residual tidal regime – with development minus existing

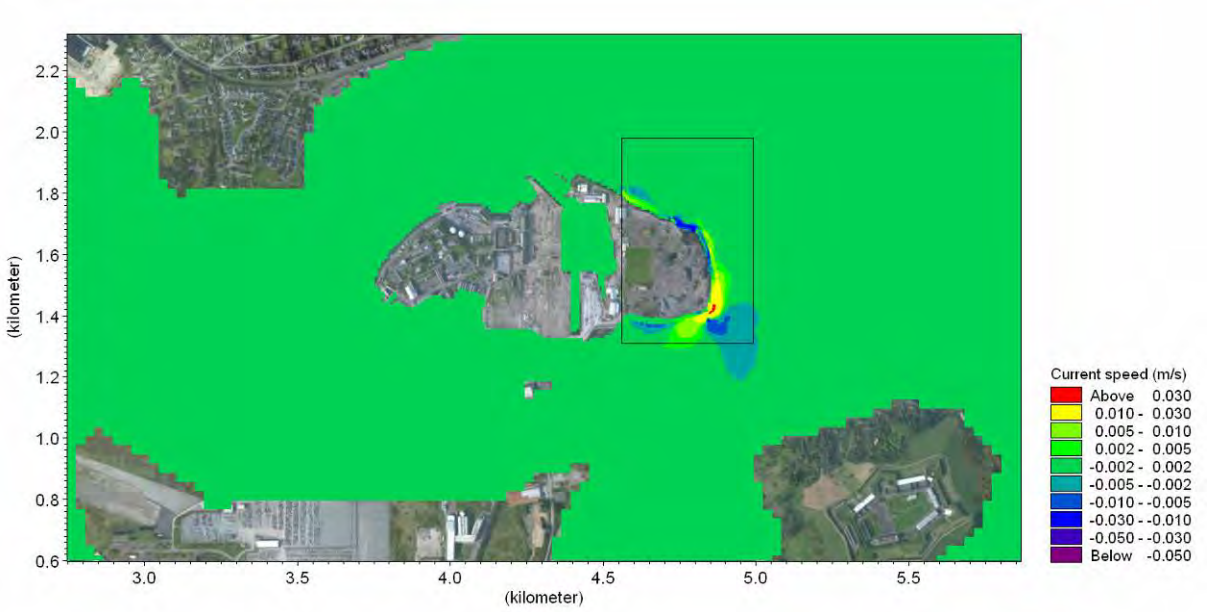


Figure 2.27: Scenario B: Difference in spring residual tidal regime – with development minus existing

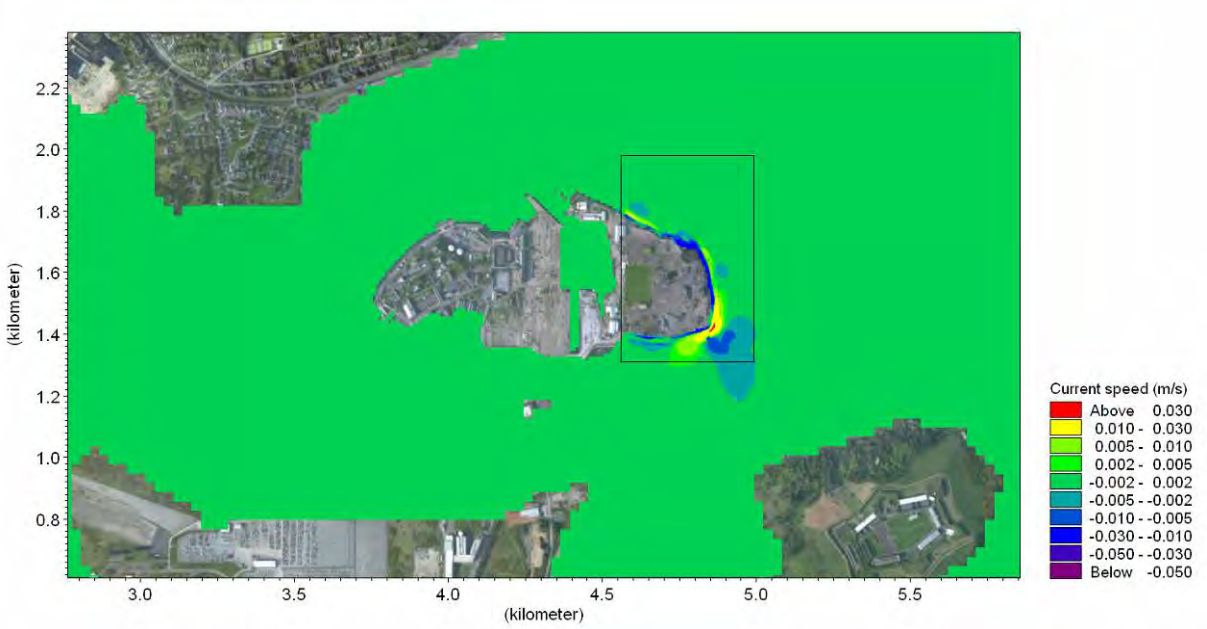


Figure 2.28: Scenario C: Difference in spring residual tidal regime – with development minus existing

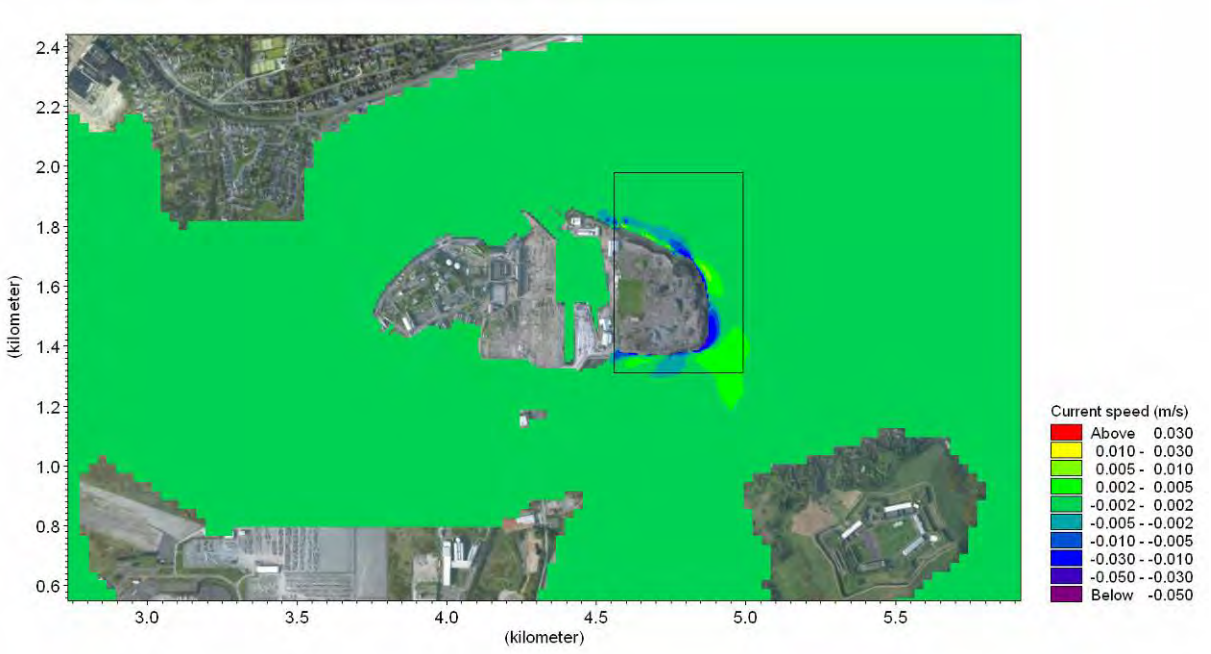


Figure 2.29: Scenario D: Difference in spring residual tidal regime – with development minus existing

2.2.4 Wave Climate

The proposed PES and associated rock armour revetment are on a "lee shore" in relation to the wave climate within Cork Harbour. Therefore the PES and rock armour will not significantly affect either the wave generation or propagation within the harbour area. In addition the Haulbowline Island East Tip area is not subjected to significant long period wave disturbance. Consequently the proposed development would not have a significant impact on either the wave climate or wave driven currents in the Cork Harbour area.

The sediment transport regime around the Haulbowline area of Cork Harbour is governed by the interaction of the tidal currents and waves with sediment material on the sea bed. As the examined scenarios have no significant impact on either the waves or the tidal currents away from the immediate area of the construction, the proposed land reclamation and revetments will have no impact on the sediment transport regime of Cork Harbour. It is expected that there will be some minor redistribution of sediments in the immediate area around the site.

3 SEDIMENT PLUME MODELLING

Sediment plume dispersion modelling was undertaken for this study using the MIKE 321npa model. This is a quasi 3-D particle tracking model that uses the depth integrated (2-D) hydraulic flow regime generated by the hydrodynamic module, MIKE21 nHD (see Section 2 of this report) to simulate the transport and fate of material discharged to the water column. The model can include variable graded material and simulates the re-erosion of deposited sediment so it is particularly suitable for the simulation of sediment losses from dredging and foreshore excavation operations.

3.1 SEDIMENT MODELLING SCENARIOS

The sediment transport simulations were carried out over a period a conservatively short construction period of 29 days. This period was also sufficient to assess the impact of the construction activities over the full lunar cycle tidal cycle. This assumed 'short' construction period also ensured that both the largest suspended sediment concentrations within the plume, occurring during neap tide, and the widest sediment plume, occurring at spring tide, were modelled. The tidal flows for the Scenario A and B provided the hydraulic input data relevant to the completed excavation work.

In these simulations the sediment was assumed to be released at 1m above the bed level. The sediment sources were modelled by releasing discrete particles during the excavation cycle and tracking their progress/fate within the model domain to produce predicted sediment plume concentrations and identify area of potential sediment deposition.

The physical parameters for the sediment was determined based on an analysis of twelve seabed sediment samples from the Haulbowline East Tip site. These samples were analysed by Glantreo Physical Testing Laboratory in Cork as part of the study. The information from the various samples shows consistently that the material to be excavated is predominantly fine grey silty sand. The results from the sample analysis were used in the model in order to derive the typical sediment grading of the dredged material, shown in Table 3.1.

Table 3.1: Grain size distribution and occurrence

Grain Dia [mm]	% Occurrence
3	8.6
1.5	18.5
0.667	11.2
0.333	10
0.133	17.5
0.083	23
0.02	11.2

For the purposes of this study sediment plume modelling simulations predict the dispersion and fate of sediments released to the water column during the excavation for **Scenarios A** and **Scenario B**.

Excavation of the keystone trench (Scenario A) would require approximately 2700m^3 material to be removed to achieve a 2m deep and 900m long and 1.5m wide trench. The quantity of sediment released into the water column during one month continuous excavation period was conservatively estimated as 10%, giving 270m^3 of sediment released into the water column. This estimated sediment loss was based on typical marine dredging operations with and additional allowance for washout. For the purposes of modelling it was conservatively assumed that two dredgers/excavators moving from either end of the trench would be used giving an average release of 0.144kg/s of sediment from each source. This assumption minimises the assumed construction period and thereby maximises the rate of sediment release into the water column during the construction process.

Sediment transport modelling for the Scenario B assumed that approx. 23,900m^3 of material would be excavated from the foreshore area. As in the case of Scenario A the excavation work activity was assumed to last 29 days (worst case assumption for maximum concentration of sediment loss) with two excavation crews simultaneously moving from either end of the trench over this period. Therefore the modelling encompassed the entire zone of the excavation, with the discharge source moving across the width of the excavation. In this case the washout rate was assumed to be restricted with each source releasing an average 0.64 kg/s of material based on a 5% volume release. This gave in total 1,195m^3 of released material during the excavation activity.

3.2 RESULTS OF THE SEDIMENT DISPERSION SIMULATIONS

Evaluation of the hydrodynamic results indicated that sediment dispersion and deposition was expected to be limited to the immediate vicinity of the excavation. Other areas in Cork Harbour remote from the works site are expected to remain largely unaffected by the PES construction.

The results of the excavation simulations for both Scenario A and Scenario B are shown graphically by a series of model output diagrams. The figures show the sediment deposition depths at the completion of the dredging as well as the average value envelopes for the suspended sediment concentrations. The maximum sediment deposition depth envelopes are also shown for the deposition of sediment during the dredging for both Scenarios. For the sedimentation plots the layer thickness takes account of the relatively high void ratio of the deposited material, which would not be consolidated in the short term.

Figure 3.1 and Figure 3.3 illustrate the maximum sediment deposition for Scenario A and Scenario B respectively. Maximum values of the sediment deposition on the figures represent peak value at each grid point in the model at any time during the simulation period even if the period of that peak value is very short. Figure 3.2 and Figure 3.4 show sediment deposition at the end of excavation process.

When comparing these plots it can be seen that sediment accumulates over the course of the dredging activity and remains in-situ following completion. It can also be seen that sediment depth for scenario B as expected is greater than for Scenario A. Sediment is temporarily deposited along the north shore of the Haulbowline Island and reaches a maximum depth of 50mm for Scenario A and 120mm for Scenario B at the entrance to the Haulbowline Island Harbour Basin. Much smaller levels of sedimentation are also experienced at shoreline locations where the tidal currents are much reduced. Away from these areas the deposition depth is very small and should not exceed 3mm. Negligible levels of sediment deposition may occur on the banks of the Oyster Bank. It should be noted that the modelling completed as part of this study adopted a conservative approach in that it does not include wave effects. Many of these inter-tidal locations would experience some level of sediment dispersion due to wave induced currents leading to lower levels of sedimentation than those predicted by this study.

It should be also noted that these peak values can be of a short duration and tend to occur during the turn of the tide and that the material can be re-suspended as the tidal currents pick up.

Where there is a significant concern in relation to potential deposition pre-works ‘in-survey’ followed by a post-works ’out-survey’ is recommended.

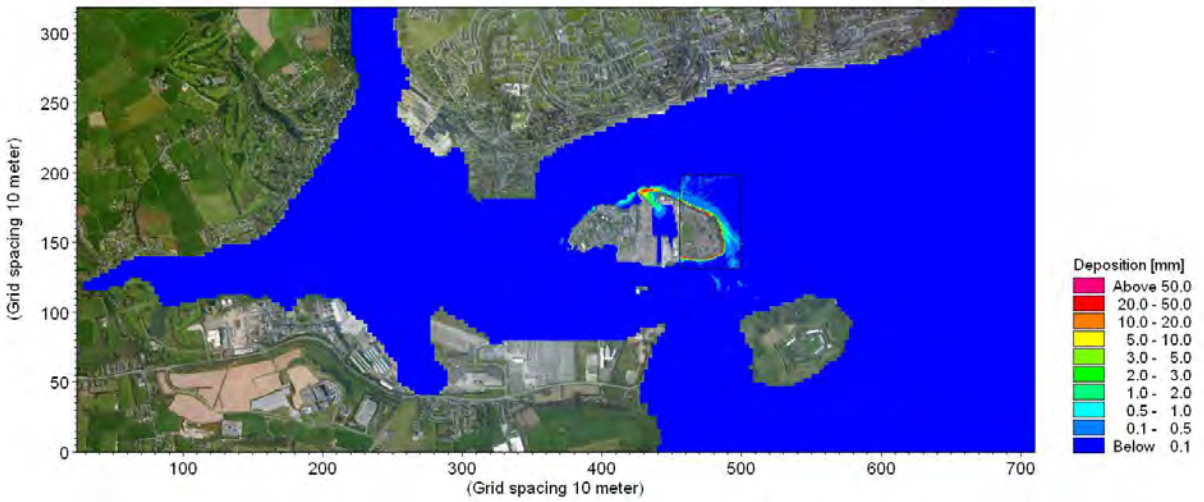


Figure 3.1: Scenario A: Maximum sediment deposition

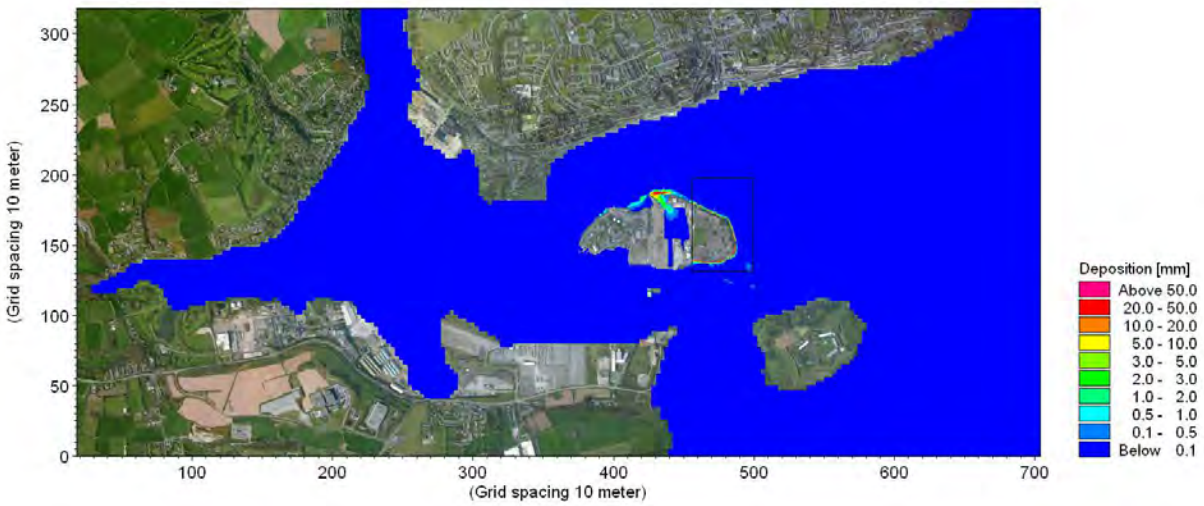


Figure 3.2: Scenario A: Sediment deposition at the end of the excavation activity

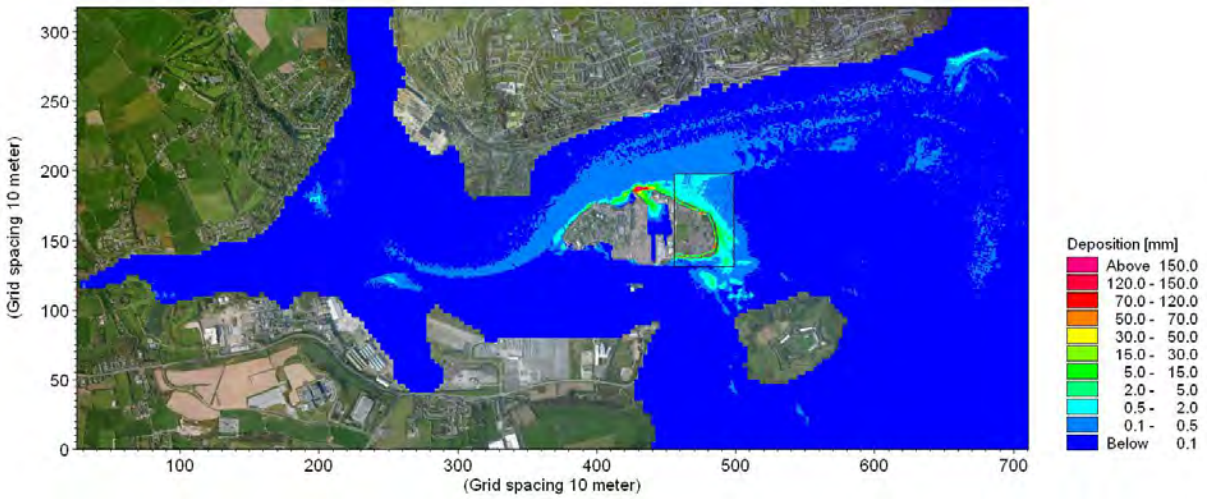


Figure 3.3: Scenario B: Maximum Sediment deposition

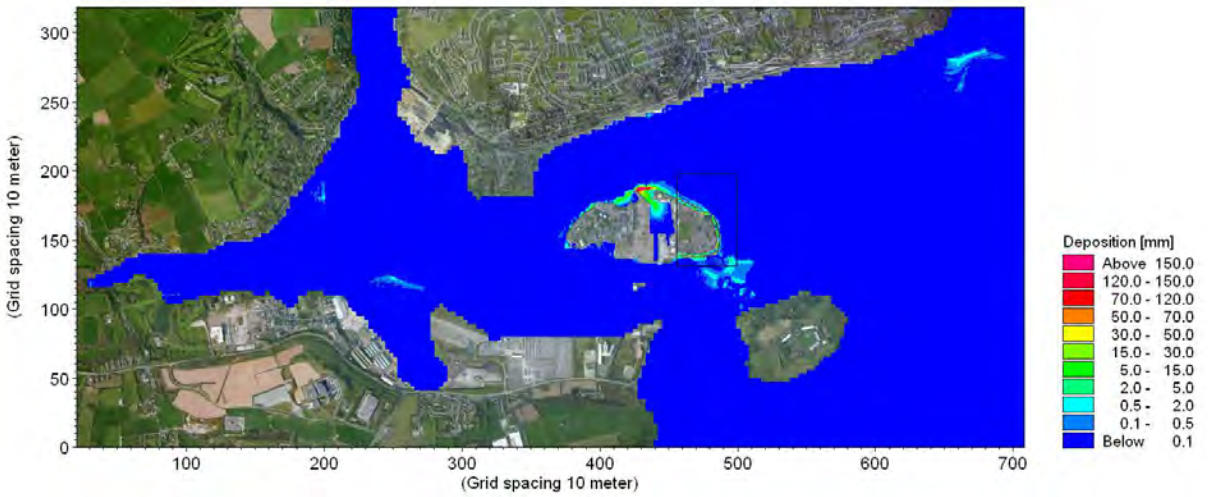


Figure 3.4: Scenario B: Sediment deposition at the end of the excavation activity

The concentration of suspended sediment within the water column during the course of the dredging was examined. Maximum sediment concentrations in the water column are shown in Figure 3.5 and Figure 3.6 below for Scenarios A and B respectively. The plume from the excavated material extending from the site is clearly visible with a reduced concentration at increased distances from the works area. These maximum levels are in the immediate vicinity of the works and generally remain less that 0.5 kg/m^3 (500mg/l) for Scenario A and 2 kg/m^3 (2000mg/l) for Scenario B.

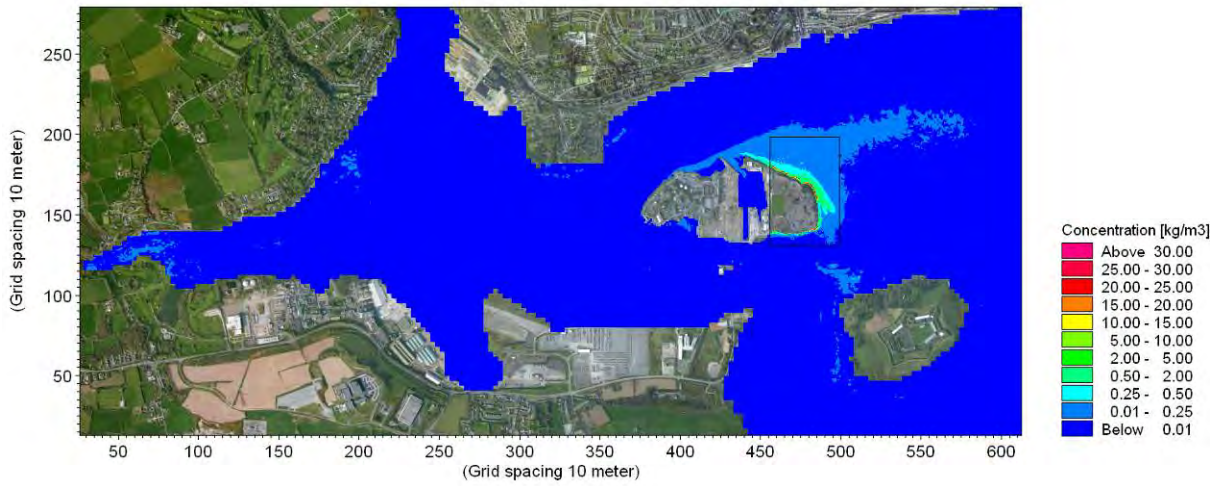


Figure 3.5: Scenario A: Maximum suspended solids concentration - water column

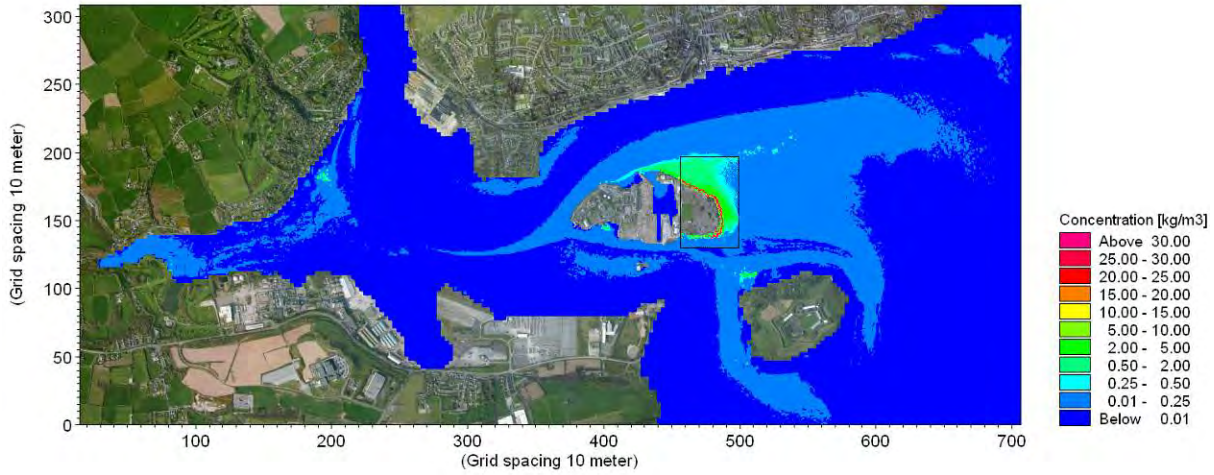


Figure 3.6: Scenario B: Maximum suspended solids concentration - water column

Similarly, Figure 3.7 and Figure 3.8 show peak suspended solids concentration at the bottom 0.5m of the water column. The extent of the plume in the bottom 0.5m is, as expected, larger than in the water column but the concentration reaches similar values.

It should be noted that 'peak' sediment concentration means the model predicted maximum concentration within the plume during the simulation period. This is a conservative concentration as the 'peak' may occur only for a short period of time and may over-estimate the longer term concentration in the sediment plume.

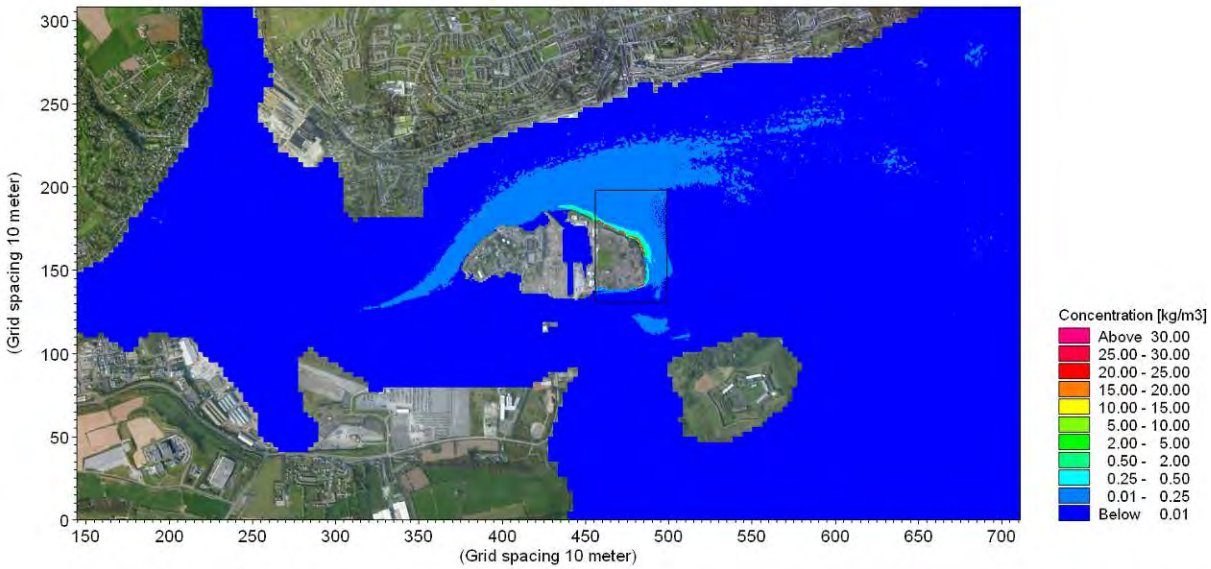


Figure 3.7: Scenario A: Maximum suspended solids concentration - bottom 0.5m

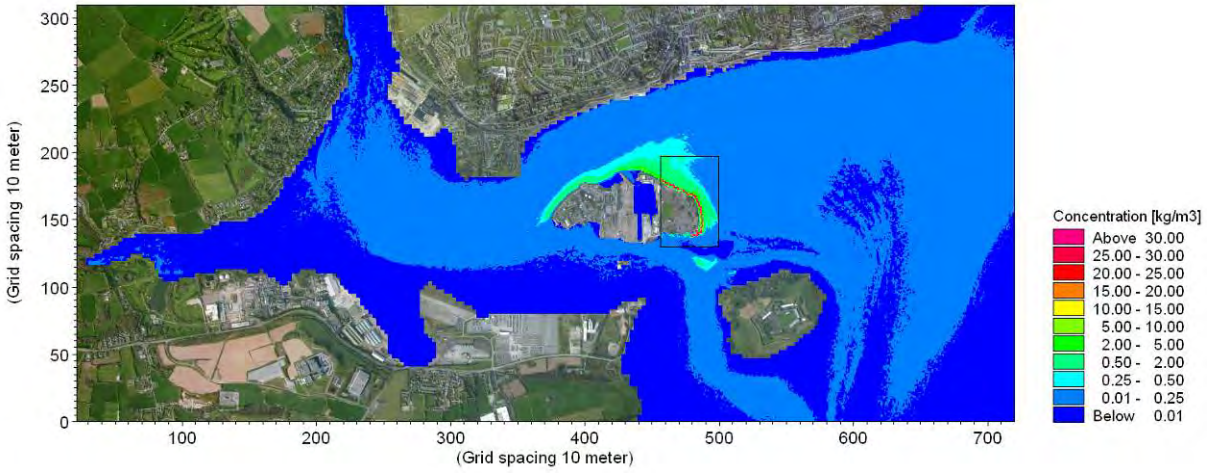


Figure 3.8: Scenario B: Maximum suspended solids concentration - bottom 0.5m

Figure 3.9 and Figure 3.10 illustrate average plume concentration in the water column respectively for Scenarios A and B. Average suspended solids concentrations for Scenario A remain less then 0.02 kg/m^3 (20mg/l) and less than 0.1 kg/m^3 (100mg/l) for Scenario B. In some isolated inter-tidal regions this level is increased due to re-suspension of deposited material, however as discussed earlier, this sedimentation is likely to be over-predicted due to the wave induced dispersion which would occur in these regions but is not included within the model.

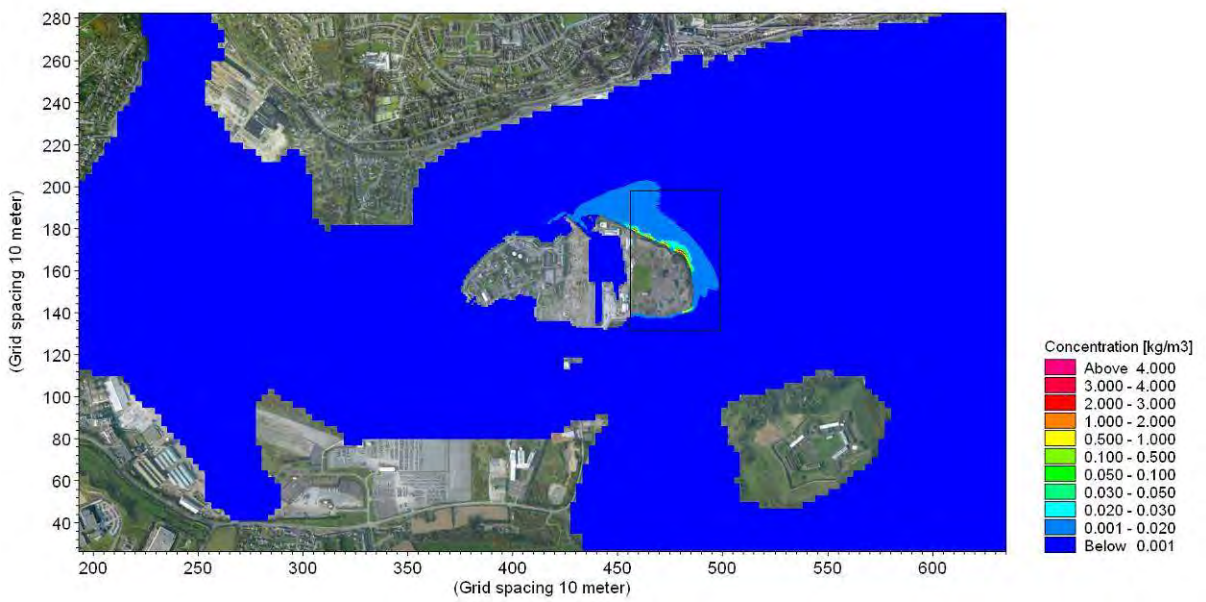


Figure 3.9: Scenario A: Average suspended solids concentration – water column

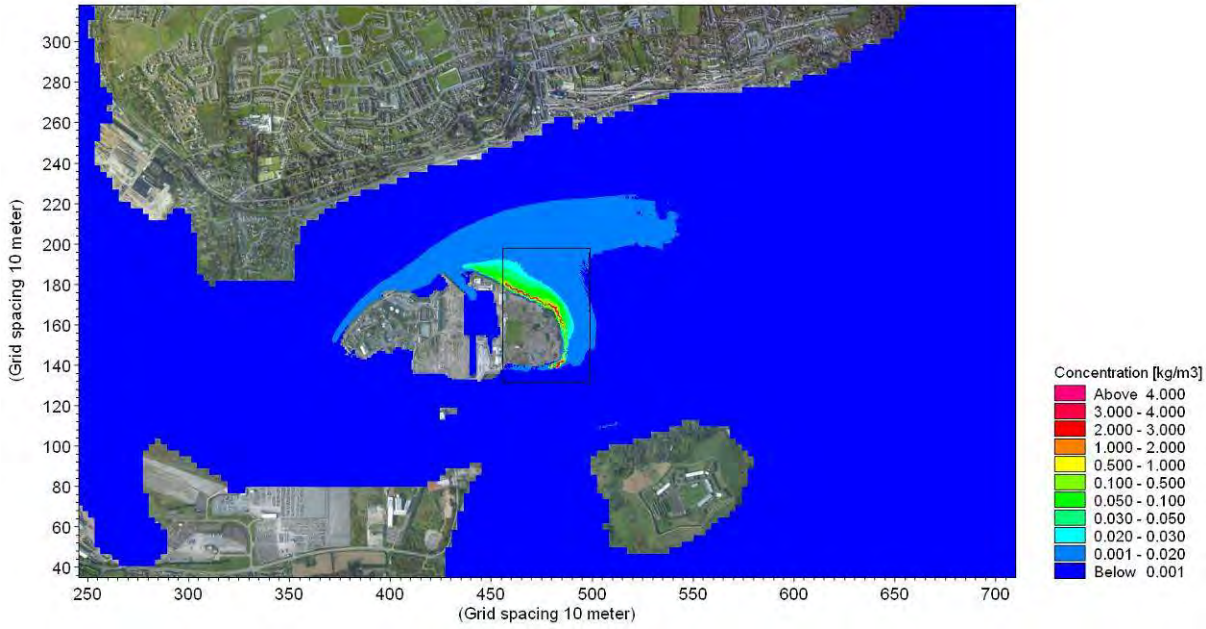


Figure 3.10: Scenario B: Average suspended solids concentration – water column

Average suspended solids concentration in the bottom 0.5m is presented in Figure 3.11 for the keystone trench scenario and in Figure 3.12 for the bulk excavation scenario. Values in close vicinity of the construction in both cases are similar to those reported in the water column but the plume envelope has greater extent. Although the extent of the plume in Scenario B seems to be more widespread the values far from the site do not exceed 0.03kg/m^3 (30mg/l).

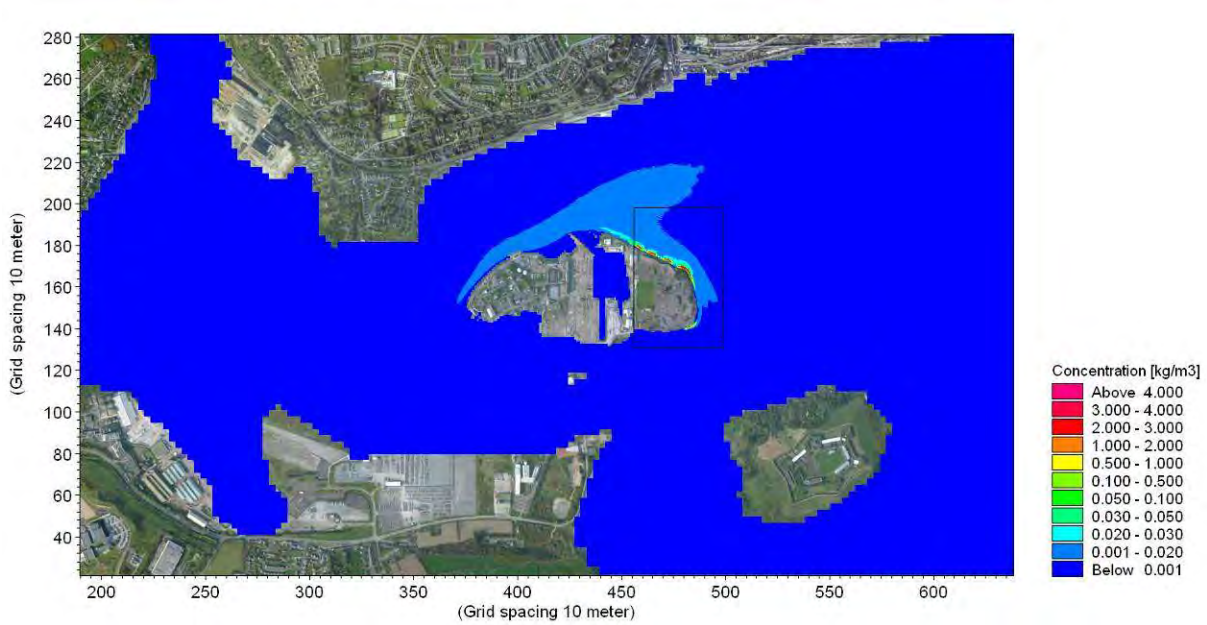


Figure 3.11: Scenario A: Average suspended solids concentration – bottom 0.5m

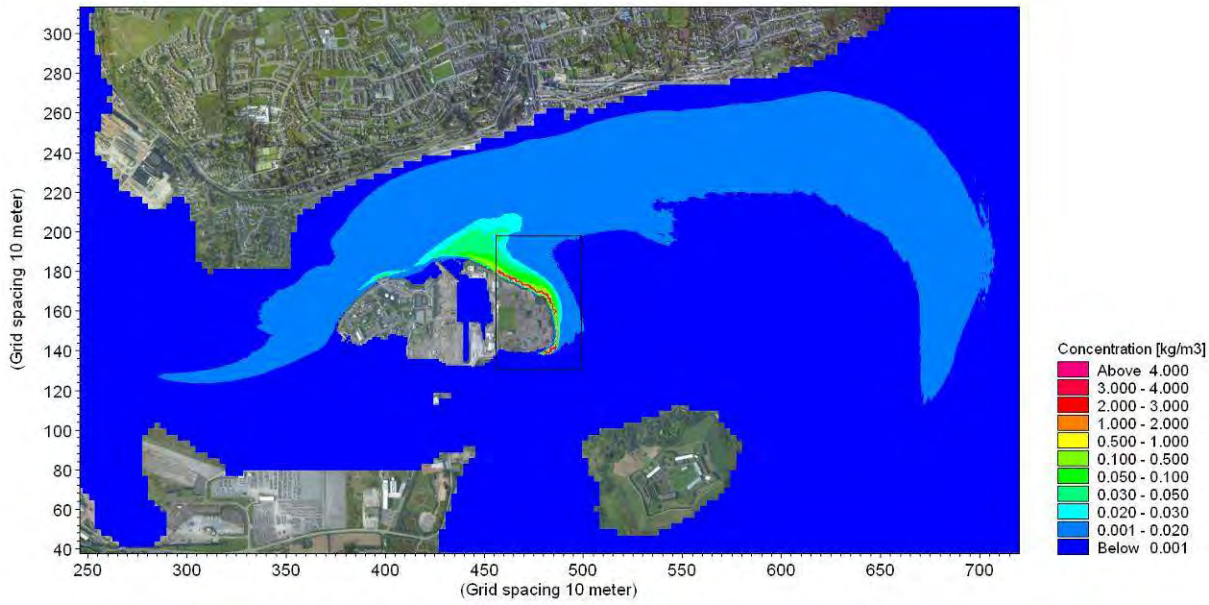


Figure 3.12: Scenario B: Average suspended solids concentration – bottom 0.5m

4 CONCLUSIONS

The potential effects of the proposed remediation project and associated rock armour revetment at Haulbowline on the coastal processes of Cork Harbour have been investigated using numerical models. Four scenarios have been examined using industry standard hydrodynamic modelling tools. Two scenarios (A and B) simulated potential sediment plumes over a conservatively short one month construction period on the foreshore.

The hydraulic flow model simulations showed that there were no changes in the flow regime away from the immediate area around the PES. Even the changes in current velocities in the immediate vicinity of the construction area were predicted to be very small, typically in the range -0.4 to +0.04m/s. Residual currents are predicted to be affected in a range of -0.03 m/s to +0.03m/s, with no increase in water level. The predicted changes to currents are considered to be not significant. The proposed development will have no significant impact of the wave climate in the area and will not affect the overall sediment transport regime in Cork Harbour. Thus it is concluded that the proposed developments at Haulbowline Island will not have a significant impact on the coastal processes of Cork Harbour.

Sediment deposition at the end of the dredging process is conservatively predicted to reach a depth of 50mm for scenario A and 120mm for scenario B at the entrance to the Haulbowline Island Harbour Basin. These depths would be localised and not very significant particularly when the conservative model assumptions are taken into account. Pre and post construction bathymetric surveys in the area would confirm the significance of any deposition in this area. If following these surveys localised sediment deposition is identified this could be removed as part of the 'tidy-up' at the end of the dredging period. No measurable amounts of material will be deposited further away from Haulbowline Island. Specifically, no measurable sedimentation is predicted in the main navigation channel or in the area of the turning circle for the Port of Cork's Cobh Cruise terminal.

During the course of the excavation work for both Scenarios A and B average suspended solid concentrations are predicted to remain largely below 100mg/l and is therefore considered not to be significant in the context of the water quality in this area of Cork Harbour.

In the long term it is expected that there will be some minor localised redistribution of sediments in the immediate area around the perimeter engineered structure but this is not expected to be significant.

APPENDIX O

ECOLOGY

APPENDIX O.1

DATA TABLE

Appendix O.1 – Data Table

Table O1-1: Protected Non-Marine Mammal Species (Other than Bats) Recorded by Hayden and Harrington (2000) from the 20km Square within which the Proposed Development Site is Located

Species	Indication of Population	Level of Protection/Conservation Status
Badger	Found throughout Ireland	Wildlife Acts, Appendix III of the Bern Convention. Irish Red Data Book 'Internationally important'.
Hedgehog	Found throughout Ireland	Wildlife Acts, Appendix III of the Bern Convention.
Irish stoat	Found throughout Ireland.	Wildlife Acts, Appendix III of the Bern Convention.
Pygmy shrew	Found throughout Ireland	Wildlife Acts, Appendix III of the Bern Convention.
Otter	Found throughout Ireland	Annex II and IV of Habitats Directive, Wildlife Acts, Appendix II of the Bern Convention. Irish Red Data Book 'Internationally important'.
Irish (mountain) hare	Found throughout Ireland	Annex V of the Habitats Directive, Wildlife Acts, Appendix III Bern Convention. Irish Red Data Book 'Internationally important'.
Red squirrel	Distributed widely through Ireland	Wildlife Acts; classified as 'Near Threatened' in a global context in the 2000 IUCN Red List of Threatened Species.

Table O1-2: Cetacean Observations in SW Ireland (Reid *et al*., 2003; DCENR, 2011; Ó Cadhla *et al*., 2004 and IDWG, 2011)

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Common Dolphin												
	The most frequently recorded dolphin species in Irish waters. Present in the Celtic and Irish Sea, predominantly in the summer and early autumn (Reid *et al*., 2003). Most abundant and breeding along the south and south west coasts of Ireland.											
Bottle-Nosed Dolphin												
	Found in all Irish coastal waters and are the second most frequently recorded dolphin species in Irish waters. They occur inshore around all Irish coasts with semi-resident groups historically reported outside Cork Harbour and at Kenmare (O'Brien et al 2009). They also occur offshore in the Celtic Sea and in the Irish Sea. They are present year round and breed in Irish waters. Inshore and offshore ecotypes may exist.											
Risso's Dolphin												
	Continental shelf species. Recorded throughout the year in Irish waters with a wide distribution (Aecom & Metoc, 2010). Some seasonal movements apparent (Baines & Evans 2009). Occasionally, observed inshore and in bays along the southwest and southeast coasts (NPWS, 2008). Regularly occurring in the southern and central Celtic Sea (Baines & Evans 2009). Breeds in Irish waters.											
Harbour Porpoise												
	Ireland's only porpoise species. Abundant in the inshore waters throughout the year along the south and southwest coasts. Breeds in Irish waters. Occurs throughout the Irish and Celtic Sea with some large aggregations noted off the south coast in the Autumn months. Some evidence for an offshore movement in spring between March and June (IWDG, 2010b) which may be linked to calving.											
Killer Whale												
	Observed off all coasts and in the Irish Sea. Inshore sightings tend to increase during late summer and autumn (Berrow *et al*., 2010).											
Fin Whale												
	The majority of inshore sightings come from counties Cork, Waterford and Wexford (Berrow *et al*., 2010). These species move inshore in early summer between May and June with a regular peak in sightings during November in west Cork. A single sighting (2007) within Cork Harbour of an individual later believed to have stranded. There has only been one recorded sighting in the area from 2000-2009 (IWDG,2011).											

Key		Absent		Present

Table O1-3: Bird Species Recorded During Field Survey, 14th August 2012; and Bird Species Likely to Breed at the Site

Common Name	Scientific Name	Number Recorded 14/08/12	Likely Breeding Status
Ringed Plover	*Charadrius hiaticula*	0	Possible but unlikely breeding species in spoil areas
Feral Pigeon	*Columbia livia* var. *domestica*	0	Likely breeding species in buildings
Rock Pipit	*Anthus petrosus*	0	Shoreline provides suitable breeding habitat, possible breeding species
Meadow Pipit	*Anthus pratensis*	0	Possible breeding species in better vegetated spoil areas and around sports field
Pied Wagtail	*Motacilla alba*	1	Likely breeding species in buildings and in spoil areas
Swallow	*Hirundo rustica*	1	Likely breeding species in buildings
Dunnock	*Prunella modularis*	0	Possible breeding species around the sports field
Robin	*Erithacus rubecula*	0	Possible breeding species around the sports field
Wren	*Troglodytes troglodytes*	0	Likely breeding species around the sports field, buildings and possibly in spoil areas
Wheatear	*Oenanthe oenanthe*	2	Possible but unlikely breeding species in spoil areas
Stonechat	Saxicola torquata	0	Possible breeding species in vegetated spoil areas and around the sports field
Song Thrush	*Turdus philomelos*	0	Possible breeding species around the sports field
Blackbird	*Turdus merula*	0	Possible breeding species around the sports field
Jackdaw	*Corvus monedula*	0	Likely breeding species in buildings and other structures
House Sparrow	*Passer domesticus*	0	Likely breeding species in buildings and other structures
Starling	*Sturnus vulgaris*	30	Likely breeding species in buildings and other structures
Linnet	*Carduelis cannabina*	12	Possible breeding species around sports field
Goldfinch	*Carduelis carduelis*	20	Unlikely to breed

Table O1-4: Key Fish Species Present in the Estuaries (Wheeler 1967, O'Calhda 2009, Lourcan, 2010, Marine Istitute 2007)

Common Name	Species		Common Name	Species
Finfish Species			**Finfish Species Continued**	
Pogge	*Agonus cataphractus*		Horse Mackerel *	*Scomber trachurus*
Sandeels*[1]	*Ammodytes spp.*		Lesser Spotted Dogfish*	*Scyliorhinus canicula*
Red Gurnard*	*Aspitrigla cuculus*		Sole*	*Solea solea*
Dragonets	*Callionymus spp.*		Sprat*	*Sprattus sprattus*
Five Bearded Rockling	*Ciliata mustela*		Greater Pipefish	*Syngnathus acus*
Herring*	*Clupea harengus*		Nilsson's Pipefish	*Syngnathus rostellatus*
Bass*	*Dicentrarchus labrax*		Bib	*Trisopterus luscus*
Cod*	*Gadus morhua*		Poor Cod	*Trispoterus minutus*
Dab	*Limanda limanda*		**Migratory Fish Species**	
Whiting*	*Merlangius merlangus*		Allis Shad	*Alosa alosa*
Lemon Sole*	*Microstomus kitt*		Twaite Shad	*Alosa fallax*
Ling	*Molva molva*		Eel*	*Anguilla anguilla*
Flounder	*Platichthys flesus*		River Lamprey	*Lampetra fluviatilis*
Plaice*	*Pleuronectes platessa*		Smelt	*Osmerus eperlarus*
Sand Gobies	*Pomatoschistus spp.*		Sea Lamprey	*Petromyzon marinus*
Thornback Ray*	*Raja clavata*		Salmon*	*Salmo salmar*
Atlantic Mackerel	*Scomber scombrus*		Sea Trout	*Salmo trutta*

[1] (*) Denotes species of commercial importance.

Table O1-5(a): Species Characterising Benthic Biotopes at Haulbowline, Cork Harbour, October 2012: A5.432, *Sabella pavonina* with Sponges and Anemones on Infralittoral Mixed Sediment.

(a) Group A5.432: MS01, MS03, MS04, MS05, MS07 Average similarity: 49.08%					
Species	**Av.Abund**	**Av.Sim**	**Sim/SD**	**Contrib%**	**Cum.%**
Chaetozone gibber	2.33	3.14	3.95	6.41	6.41
Scoloplos armiger	2.16	2.99	4.18	6.09	12.50
Melinna palmata	2.16	2.48	4.17	5.06	17.56
Nephtys hombergii	1.72	2.32	2.88	4.72	22.28
Actiniaria	1.88	2.18	5.67	4.45	26.74
Mytilus edulis	1.80	2.13	4.05	4.34	31.07
Abra alba	1.56	2.09	5.22	4.27	35.34
Sabella pavonina	1.49	1.98	4.99	4.04	39.38
Angulus fabula	1.33	1.72	3.37	3.50	42.88
Platynereis dumerilii	1.45	1.71	4.08	3.49	46.36
Musculus costulatus	1.24	1.56	5.76	3.18	49.55
Ampelisca tenuicornis	1.26	1.50	1.15	3.05	52.59
Mediomastus fragilis	1.45	1.36	1.12	2.77	55.36
Ampharete finmarchica	1.13	1.30	1.13	2.64	58.00
Tubificoides benedii	1.41	1.16	0.94	2.36	60.37
Abra nitida	0.93	1.04	1.14	2.12	62.49
Aora typica	1.23	1.04	1.08	2.11	64.60
Ericthonius punctatus	1.21	1.00	1.13	2.05	66.65
Nematoda	1.30	0.94	1.14	1.91	68.55
Capitella	0.96	0.93	1.09	1.90	70.45
Achelia echinata	1.14	0.93	1.11	1.89	72.35
Polydora ciliata	0.96	0.90	1.11	1.84	74.19
Sphaerosyllis taylori	0.98	0.89	1.15	1.82	76.00
Polynoidae	0.96	0.83	1.12	1.69	77.70
Caulleriella killariensis	0.94	0.81	1.13	1.65	79.34
Eumida sanguinea	0.87	0.70	0.62	1.42	80.76
Parvicardium exiguum	0.76	0.66	0.62	1.34	82.10
Oerstedia dorsalis	0.96	0.60	0.61	1.21	83.31
Galathowenia oculata	1.03	0.58	0.61	1.19	84.50
Owenia fusiformis	0.66	0.53	0.62	1.09	85.59
Atylus guttatus	0.76	0.52	0.60	1.05	86.64
Notomastus	0.76	0.49	0.62	1.00	87.64
Exogone longicirris	0.91	0.47	0.61	0.96	88.60
Pseudopolydora pulchra	0.74	0.46	0.62	0.94	89.54
Sthenelais boa	0.60	0.46	0.62	0.94	90.47

Table O1-5(b): Species Characterising Benthic Biotopes at Haulbowline, Cork Harbour, October 2012: A5.24, Infralittoral Muddy Sand

(b) Group A5.24: MS02, MS06, MS16 **Average similarity: 36.20%**					
Species	**Av.Abund**	**Av.Sim**	**Sim/SD**	**Contrib%**	**Cum.%**
Chaetozone gibber	2.00	5.58	7.85	15.42	15.42
Nephtys hombergii	1.79	4.81	3.93	13.29	28.71
Tapes	1.43	4.03	7.68	11.13	39.84
Galathowenia oculata	1.27	3.26	19.87	9.00	48.84
Scoloplos armiger	1.34	3.16	12.20	8.72	57.56
Mediomastus fragilis	1.11	3.00	6.04	8.29	65.85
Melinna palmata	1.35	1.86	0.58	5.14	70.99
Abra alba	1.15	1.23	0.58	3.38	74.37
Angulus fabula	1.13	1.04	0.58	2.86	77.24
Microprotopus maculatus	0.67	1.04	0.58	2.86	80.10
Mytilus edulis	0.73	1.04	0.58	2.86	82.96
Pygospio elegans	0.77	1.04	0.58	2.86	85.82
Tubificoides benedii	0.83	1.04	0.58	2.86	88.68
Ampelisca brevicornis	0.73	0.82	0.58	2.26	90.95

Table O1-5(c): Species Characterising Benthic Biotopes at Haulbowline, Cork Harbour, October 2012: A5.43, Infralittoral Mixed Sediments

(c) Group A5.43: MS09, MS10, MS14, MS19 Average similarity: 45.06%					
Species	**Av.Abund**	**Av.Sim**	**Sim/SD**	**Contrib%**	**Cum.%**
Tapes	3.09	2.07	7.28	4.60	4.60
Mytilus edulis	3.34	1.84	4.01	4.08	8.68
Phoronis	3.08	1.84	6.64	4.08	12.76
Tubificoides benedii	2.56	1.77	5.80	3.93	16.68
Mediomastus fragilis	2.15	1.67	4.10	3.71	20.39
Chaetozone gibber	1.93	1.38	2.25	3.06	23.45
Amphipholis squamata	2.87	1.33	3.19	2.94	26.39
Pholoe innornata	2.09	1.23	6.01	2.73	29.12
Kurtiella bidentata	2.06	1.19	5.16	2.63	31.75
Nematoda	3.16	1.16	2.29	2.58	34.33
Syllidia armata	2.26	1.12	2.79	2.48	36.81
Sphaerosyllis taylori	2.72	1.06	0.91	2.36	39.17
Sthenelais boa	1.46	1.03	3.65	2.28	41.45
Eteone longa	1.48	1.00	6.43	2.22	43.67
Hiatella arctica	2.12	0.99	2.47	2.20	45.87
Actiniaria	1.47	0.95	2.23	2.12	47.99
Platynereis dumerilii	1.44	0.94	7.11	2.10	50.08
Musculus costulatus	1.61	0.90	4.23	2.00	52.09
Nemertea	1.40	0.90	5.51	1.99	54.08
Exogone longicirris	1.59	0.88	4.77	1.96	56.04
Aora typica	1.32	0.88	5.10	1.95	57.99
Eumida sanguinea	1.64	0.84	0.89	1.87	59.86
Monocorophium sextonae	2.05	0.81	0.91	1.79	61.65
Galathowenia oculata	1.70	0.76	0.85	1.69	63.34
Parvicardium scabrum	1.23	0.70	0.87	1.55	64.89
Ampharete finmarchica	1.22	0.69	0.88	1.53	66.41
Scoloplos armiger	1.41	0.65	0.71	1.44	67.86
Spirobranchus lamarcki	2.13	0.60	0.72	1.32	69.18
Mya arenaria	1.00	0.56	0.90	1.25	70.43
Nephtys hombergii	1.08	0.56	0.76	1.24	71.67
Ampelisca tenuicornis	1.03	0.54	0.80	1.21	72.88
Aphelochaeta marioni	1.23	0.52	0.87	1.15	74.03
Protodorvillea kefersteini	1.59	0.51	0.91	1.14	75.17
Achelia echinata	1.38	0.50	0.91	1.11	76.29
Notomastus	1.09	0.50	0.90	1.11	77.40
Anomia ephippium	1.47	0.48	0.88	1.06	78.46
Tubificoides pseudogaster	0.99	0.48	0.84	1.06	79.51
Polynoidae	1.76	0.47	0.82	1.05	80.56
Aonides oxycephala	1.50	0.46	0.83	1.03	81.59
Gibbula umbilicalis	1.06	0.46	0.89	1.03	82.62
Melinna palmata	1.60	0.46	0.41	1.02	83.64
Polydora ciliata	1.36	0.46	0.91	1.01	84.65
Polycirrus	1.14	0.44	0.91	0.97	85.62
Tanaidacea	1.27	0.42	0.91	0.94	86.55
Eunereis longissima	1.08	0.40	0.90	0.88	87.43
Carcinus maenas	0.84	0.39	0.87	0.88	88.31
Ophiothrix fragilis	1.05	0.39	0.91	0.86	89.17
Rissoa parva	0.85	0.37	0.89	0.82	89.98
Lumbrineris gracilis	0.88	0.36	0.89	0.80	90.78

Table O1-6: Plant Species Recorded at Haulbowline Site, 14th August 2012

Common Name	Scientific Name	DAFOR Abundance and Notes
Harte's-tongue Fern	*Phyllitis scolopendrium*	Occasional in moist depressions
Polypody	*Polypodium* sp.	Occasional in moist depressions
False Oat-grass	*Arrhenatherum elatius*	Frequent on topsoil mound
Common Bent-grass	*Agrostis capillaris*	Frequent
Red Fescue	*Festuca rubra*	Frequent close to the shore
Cock's-foot	*Dactylis glomerata*	Occasional
Yorkshire-fog	*Holcus lanatus*	Occasional
Creeping Buttercup	*Ranunculus repens*	Occasional
Yellow-horned Poppy	*Glaucium flavum*	Occasional
Hedge Mustard	*Sisymbrium officinale*	Occasional
Common Scurveygrass	*Cochlearia officinalis*	Occasional close to the shore
Sea Beet	*Beta vulgaris*	Frequent close to the shore
Herb-robert	*Geranium robertianum*	Occasional
Bladder Campion	*Silene vulgaris*	Frequent close to the shore
Thyme-leaved Sandwort	*Arenaria serpyllifolia*	Abundant
Common Bird's-foot Trefoil	*Lotus corniculatus*	Occasional
Black Medick	*Medicago lupinula*	Occasional
Red Clover	*Trifolium pratense*	Frequent
Common Gorse	*Ulex europaeus*	Occasional
Bramble	*Rubus fruticosus* agg.	Occasional
Biting Stonecrop	*Sedum acre*	Abundant
Rosebay Willowherb	*Chamaenarion angustifoium*	Frequent
Common Nettle	*Urtica dioica*	Frequent on topsoil mound
Ivy	*Hedera helix*	Frequent close to buildings
Beech	*Fagus sylvatica*	Rare
Sycamore	*Acer pseudoplatanus*	Frequent along sports field fence line
Grey Willow	*Salix cinerea* agg.	Rare
Hogweed	*Heracleum sphondylium*	Occasional
Wild Carrot	*Daucus carota*	Occasional
Fennel	*Foeniculum vulgare*	Occasional
Rock Samphire	*Crithmum maritimum*	Frequent close to the shore
Elder	*Sambucus nigra*	Occasional close to buildings
Common Sorrel	*Rumex acetosa*	Occasional
Broad-leaved Dock	*Rumex obtusifolius*	Frequent on topsoil mound
Scarlet Pimpernel	*Anagallis arvensis*	Frequent
Thrift	*Armeria maritima*	Occasional close to the shore
Yellow-wort	*Blackstonia perfoliata*	Occasional
Buddleia	*Buddleia davidii*	Occasional
Common Figwort	*Scrophularia nodosa*	Frequent
Ivy-leaved Toadflax	*Cymbalaria muralis*	Occasional
Hedge Bindweed	*Calystegia sepium*	Frequent on topsoil mound
Hedge Woundwort	*Stachys sylvatica*	Frequent on topsoil mound
Ribwort Plantain	*Plantago lanceolata*	Frequent
Sea Plantain	*Plantago maritima*	Occasional close to the shore
Red Valerian	*Centranthus ruber*	Occasional
Common Ragwort	*Senecio jacobaea*	Frequent
Groundsel	*Senecio vulgaris*	Occasional
Hawksbeard	*Hieracleum sp.*	Frequent
Colt's-foot	*Tussilago farfara*	Occasional
Canadian Fleabane / Bilbao Fleabane	*Conyza canadensis* / *C. bilbaoana* / hybrids	Abundant
Pineappleweed	*Matricaria matricaroides*	Frequent
Scentless Mayweed	*Tripleurospermum maritimum*	Abundant
Oxeye Daisy	*Chrysanthemum leucanthemum*	Occasional
Creeping-thistle	*Cirsium arvense*	Frequent on topsoil mound
Spear Thistle	*Cirsium vulgare*	Occasional

APPENDIX O.2

BAT FAUNA SURVEY

HAULBOWLINE EAST TIP, RINGASKIDDY, COUNTY CORK

BAT FAUNA STUDY

Prepared on behalf of

RPS Group

by

Conor Kelleher AIEEM, ACQI

12th October 2012

Aardwolf Wildlife Surveys

Spring Lane, Carrigagulla, Ballinagree,
Macroom, Co. Cork
Ph: 021-7339247 Mobile: 087-2980297
Email: conorkelleher@eircom.net

CONTENTS

Page no.

BAT FAUNA

1. RECEIVING ENVIRONMENT

1.1 Introduction

Cork County Council is proposing to redevelop the eastern tip of Haulbowline Island, within Cork Harbour, at Ringaskiddy, County Cork. As the site planned for redevelopment is in a sensitive and protected area, *Aardwolf Wildlife Surveys* was requested by *RPS Group*, on behalf of their client, to provide an assessment of the bat fauna occurring on-site as part of a wider ecological assessment of the area.

Development or removal of buildings and changes to or removal of existing vegetation may adversely affect bats through loss of breeding/resting places or traditional commuting features, displacement and injury. It is essential therefore that a study of the activity of protected species such as bats be undertaken in such areas to identify any conflict zones and hence to avoid and/or reduce impacts through mitigation to these animals.

This report details the results of an on-site bat survey and assessment undertaken in the autumn of 2012.

1.2 Site location and description

The proposed development area is situated at the eastern tip of Haulbowline Island at Ringaskiddy, approximately 11km southeast of Cork city, within National Grid Reference square W7965 (Ordnance Survey Discovery Series Sheet No. 87).

The site is reclaimed land with a shoreline boundary of large boulders (CC1) which has been infilled with processing waste, approximately 650,000m^3 from a former steelworks site on Haulbowline Island. Although some areas are being recolonised (ED3) by vegetation (mainly non-native plant species such as Canadian *Conyza canadensis* and Bilbao fleabane *C. Bilbaoana*) (Plate 1) and one area is maintained as a grassed amenity (GA2) area for sports, most of the site consists of open, bare ground with large heaps of waste (ED2) (Plates 3 & 4) from the former *Irish Steel* industrial plant which operated on the island for many years. On-site buildings (BL3) include a derelict single-storey building (Plate 5), a modern, two-storey office block (Plate 6) and large steel and iron shed (Plate 7) used for security and storage (Plate 8), respectively, and a small, derelict metal structure (Plate 9). A disused and decaying gantry crane (Plate 10) is also present.

1.3 Designated sites of conservation interest in the locality

The study area is situated on Haulbowline Island, between Cobh to the North and Ringaskiddy to the south at a distance of 1.4km from Cork Harbour Special Protection Area (SPA) and 4.2km from Great Island Channel candidate cSAC.

1.4 Bat survey

This report presents the results of an on-site bat survey undertaken on the 12th September 2012 by Conor Kelleher. The bat fauna occurring on-site is described and the likely impacts of the planned works on protected species discussed.

1.4.1 Survey methodology

The study area was surveyed for favourable bat habitats during daylight hours. This included inspection of site structures for evidence of use by these animals. Sign of bats is more often observed than the animals themselves therefore each building was externally and internally inspected for evidence of bat presence which is often shown by grease staining, droppings,

corpses, feeding signs such as invertebrate prey remains and/or the presence of bat fly *Nycteribiidae* pupae, though direct observations are also occasionally made.

A detector survey using a heterodyne/frequency division bat detector – *Batbox Duet* – was undertaken at dusk and into the hours of darkness to determine any bat activity associated with the on-site structures and to identify species present within the study area.

The site surveys were supplemented by a review of *Bat Conservation Ireland's* (BCIreland) National Bat Records Database.

1.4.2 Survey constraints

There were no seasonal or climatic constraints to survey. The assessment was undertaken within the active bat season, in good weather conditions and with temperatures of 12°C after dark. Winds were light and there was no rainfall.

2. BAT FAUNA SURVEY RESULTS

2.1 Review of local bat records

The review of existing bat records within 10km of the study area (sourced from BCIreland's National Bat Records Database) reveals that seven of the ten known Irish species have been observed locally. These include common *Pipistrellus pipistrellus* and soprano *P. pygmaeus* pipistrelle, Leisler's *Nyctalus leisleri*, brown long-eared *Plecotus auritus*, Daubenton's *Myotis daubentonii,* Natterer's *M. nattereri* and whiskered *M. mystacinus* bats as shown in Table 1 below. Roosts of some of these species are also known within this radius but none are known on Haulbowline Island.

Table 1: Adjudged status of Irish bat species in the immediate area

Common name	Scientific name	Presence	Local roosts	Source
Common pipistrelle	*Pipistrellus pipistrellus*	Present	None known	BCIreland
Soprano pipistrelle	*Pipistrellus pygmaeus*	Present	2 known	BCIreland
Nathusius' pipistrelle	*Pipistrellus nathusii*	Potential	None known	BCIreland
Leisler's bat	*Nyctalus leisleri*	Present	2 known	BCIreland
Brown long-eared bat	*Plecotus auritus*	Present	1 known	BCIreland
Lesser horseshoe bat	*Rhinolophus hipposideros*	Absent	None known	BCIreland
Daubenton's bat	*Myotis daubentonii*	Present	None known	BCIreland
Natterer's bat	*Myotis nattereri*	Present	None known	BCIreland
Whiskered bat	*Myotis mystacinus*	Present	None known	BCIreland
Brandt's bat	*Myotis brandtii*	Potential	None known	BCIreland

The remaining Irish bat species; lesser horseshoe *Rhinolophus hipposideros,* Nathusius' pipistrelle *P. nathusii* and Brandt's *M. brandtii* bat have not been recorded in the local area to date. The lesser horseshoe bat is largely confined to the west of the county and the nearest known record is adjacent to the town of Ballincollig, approximately 20km to the west. The latter two species are both rare and may occur in the area occasionally. Further information on the Irish bat species is given in Appendix 1 and 2.

2.2 Structure survey

All on-site structures were, during daylight hours, visually surveyed for bats or their sign and, at dusk, each building was again surveyed by detector. No evidence or activity of bats were noted in association with any structure.

2.3 Detector survey

The detector survey of the study area recorded only one bat, a common pipistrelle, which flew across the site a single time at the southern end of the football pitch. This bat was on-site for approximately 30 seconds until, returning along the same flight path, it left the area, flying west.

3. LEGAL STATUS – BATS

All Irish bat species are protected under the Wildlife Act (1976) and Wildlife Amendment Acts (2000 & 2010). Also, the EC Directive on The Conservation of Natural habitats and of Wild Fauna and Flora (Habitats Directive 1992), seeks to protect rare species, including bats, and their habitats and requires that appropriate monitoring of populations be undertaken. Across Europe, they are further protected under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982), which, in relation to bats, exists to conserve all species and their habitats. The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983) was instigated to protect migrant species across all European boundaries. The Irish government has ratified both these conventions.

All Irish bats are listed in Annex IV of the Habitats Directive and the lesser horseshoe bat is further listed under Annex II.

The current status and legal protection of the known bat species occurring in Ireland is given in Table 2 below.

Table 2: Legal status and protection of the Irish bat fauna

Common and scientific name	Wildlife Act 1976 & Wildlife (Amendment) Act 2000	Irish Red List status	Habitats Directive	Bern & Bonn Conventions
Common pipistrelle *Pipistrellus pipistrellus*	Yes	Least Concern	Annex IV	Appendix II
Soprano pipistrelle *P. pygmaeus*	Yes	Least Concern	Annex IV	Appendix II
Nathusius' pipistrelle *P. nathusii*	Yes	Not referenced	Annex IV	Appendix II
Leisler's bat *Nyctalus leisleri*	Yes	Near Threatened	Annex IV	Appendix II
Brown long-eared bat *Plecotus auritus*	Yes	Least Concern	Annex IV	Appendix II
Lesser horseshoe bat *Rhinolophus hipposideros*	Yes	Least Concern	Annex II Annex IV	Appendix II
Daubenton's bat *Myotis daubentonii*	Yes	Least Concern	Annex IV	Appendix II
Natterer's bat *M. nattereri*	Yes	Least Concern	Annex IV	Appendix II
Whiskered bat *M. mystacinus*	Yes	Least Concern	Annex IV	Appendix II
Brandt's bat *M. brandtii*	Yes	Data Deficient	Annex IV	Appendix II

NB: Destruction, alteration or evacuation of a known bat roost is a notifiable action under current legislation and a derogation licence **has** *to be obtained from the* National Parks and Wildlife Service (NPWS) **before** *works can commence.*

Also, it should be noted that any works interfering with bats and especially their roosts, including for instance, the installation of lighting in the vicinity of the latter, may only be carried out under a licence to derogate from Regulation 23 of the Habitats Regulations 1997, (which transposed the EU Habitats Directive into Irish law) issued by NPWS. The details with regards to appropriate assessments, the strict parameters within which derogation licences may be issued and the procedures by which and the order in relation to the planning and development regulations such licences should be obtained, are set out in Circular Letter NPWS 2/07 "*Guidance on Compliance with Regulation 23 of the Habitats Regulations 1997 - strict protection of certain species/applications for derogation licences*" issued on behalf of the Minister of the Environment, Heritage and Local Government on the 16th of May 2007- reproduced in Appendix 3.

Furthermore, on 21st September 2011, the Irish Government published the European Communities (Birds and Natural Habitats) Regulations 2011 which include the protection of the Irish bat fauna and further outline derogation licensing requirements re: European Protected Species.

4. ASSESSMENT OF BAT INTEREST OF THE STUDY AREA

The eastern tip of Haulbowline Island offers little to favour bats. The site is exposed, treeless and waterless and the little vegetation on-site is low and of mainly non-native species which would attract few insects as prey for these animals. The on-site structures, apart from the office block which is still in use by security personnel, are also poor for bat use as they would not retain the temperatures needed by these animals. The office building has potential to be used by bats as the building is heated and access for these animals is present beneath roof tiles and via its decaying eaves but the unfavourable habitat in which the building is located would not encourage bats to take up residence.

5. POTENTIAL IMPACT OF DEVELOPMENT ON BATS

As no bat roost was identified on-site and the existing habitats are exceptionally poor for these animals, the impact of any development on the favourable conservation status of local bat populations is expected to be negligible.

6. MITIGATION MEASURES

As no bat roost was identified within the study area and bat-use of the site is minimal with only one specimen of a common species being recorded on-site, no direct impact on these animals is expected from development therefore no mitigation measures specific to bats are required.

7. RESIDUAL IMPACT OF DEVELOPMENT ON BATS

Any future development on-site will change the local environment as existing structures and vegetation will be removed and, potentially, new structures and vegetation will be erected and planted. Such development is not expected to negatively affect bats as the existing habitats and site use are quite unsuitable for these animals and the area is avoided as a result.

The favourability of the area for these animals and other wildlife may however be improved through its future development if the development proposals are sensitively designed and constructed in a sustainable manner with consideration of the needs of the local fauna.

8. REFERENCES AND BIBLIOGRAPHY

Barratt, E.M., Deauville, R., Burland, T.M., Bruford, M.W., Jones, G., Racey, P.A. and Wayne, R.K. 1997 DNA answers the call of pipistrelle bat species *Nature* **387**: 138-139

Bat Conservation Ireland 2004 on-going *National Bat Record Database* Virginia, Co. Cavan

Boyd, I. and Stebbings, R.E. 1989 Population changes in brown long-eared bats (*Plecotus auritus*) in Bat Boxes at Thetford Forest. *Journal of Applied Ecology* **26**: 101-112

Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) 1982

Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) 1979

EC Directive on the Conservation of Natural habitats and of Wild Fauna and Flora (Habitats Directive) 1992

European Communities (Birds and Natural Habitats) Regulations 2011 Government of Ireland

Jefferies, D.J. 1972 Organochlorine insecticide residues in British bats and their significance *Journal of Zoology*, London **166**: 245-263

Kelleher, C. 2004, Thirty years, six counties, one species – an update on the lesser horseshoe bat *Rhinolophus hipposideros* (Bechstein) in Ireland *Irish Naturalists' Journal* **27**, No. 10, 387-392

Kelleher, C. 2005 *International Bat Fieldcraft Workshop, Killarney, Co. Kerry* National Parks and Wildlife Service, Department of the Environment, Heritage, and Local Government, Dublin

Kelleher, C. 2006a Nathusius' pipistrelle *Pipistrellus nathusii* and Brandt's b*at Myotis brandtii* - new bat species to Co. Kerry *Irish Naturalists' Journal* **28**: 258

Kelleher, C. 2006b Brandt's bat *Myotis brandtii*, new bat species to Co. Tipperary *Irish Naturalists' Journal* **28**:345

Marnell, F., Kingston, N. and Looney, D. 2009 *Ireland Red List No. 3: Terrestrial Mammals* National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin

Mullen, E. 2007 Brandt's bat *Myotis brandtii* in Co. Wicklow *Irish Naturalists' Journal* **28**: 343

Racey, P.A. and Swift, S.M. 1986 The residual effects of remedial timber treatments on bats. *Biological Conservation* **35**: 205-214

Swift, S.M. 1998 *Long-eared bats* T. & A.D. Poyser Ltd., London

Whilde, A. 1993 *Threatened mammals, birds, amphibians and fish in Ireland: Irish Red Data Book 2: Vertebrates* HMSO, Belfast

Wildlife Act 1976 and Wildlife [Amendment] Acts 2000 and 2010 Government of Ireland

9. APPENDICES

9.1 APPENDIX 1: Bat ecology

Introduction
The bat is the only mammal that is capable of true flight using modified hands and arms which are covered by a supple membrane of skin. This ability has allowed bats to exploit aerial insect prey and avoid predation. As the largest mammalian group after the rodents (to which they are not related), bats are very successful and have diversified into over 1,200 species worldwide, representing almost a quarter of all mammal species. Within such diversification, they have evolved a range of hunting strategies, means of reproduction, roosting behaviours and social interactions. They are found throughout the world and in every continent apart from Antarctica.
Bats are classified within the Order Chiroptera (meaning 'Hand-wing') and this is further divided into two Superfamilies: the Megachiroptera and Microchiroptera. The former are mainly fruit-eaters while the latter are predominantly insectivorous. Of these, 49 bat species are currently known in Europe.

Irish bat species
In Ireland, nine species of bat are currently known to be resident with the residency of the tenth recorded species yet to be proven. These are classified into two Families: the Rhinolophidae (Horseshoe bats) and the Vespertilionidae (Common bats). The lesser horseshoe bat *Rhinolophus hipposideros* is the only representative of the former Family in Ireland. All the other Irish bat species are of the latter Family and these include three pipistrelle species: common *Pipistrellus pipistrellus*, soprano *P. pygmaeus* and Nathusius' *P. nathusii*, four *Myotids*: Natterer's *Myotis nattereri*, Daubenton's *M. daubentonii*, whiskered *M. mystacinus*, Brandt's *M. brandtii*, the brown long-eared *Plecotus auritus* and Leisler's *Nyctalus leisleri* bats. Individual species accounts with distribution maps are given in Appendix 2.

Hunting with sound
The microbats are unique as they use a type of sonar, called echolocation, by which they hunt their prey. This is a stream of sound produced at high frequencies which allows the animal to build-up a complete 'sound picture' of their surroundings. These sounds are produced well beyond the range of human hearing. Using these sounds, the bats are able to detect the clutter of nearby leaves, hear an insect, know how fast it is travelling, how fast its wings are beating, whether it is hard or soft bodied etc. before closing in for the catch. Although bats use this method to find their way around, they also use their eyes to see in low light levels.
All the European bat species feed exclusively on insects and/or spiders and a pipistrelle, weighing only 4 to 8 grams, will eat up to 3,500 insects every night. This allows the bat to increase its body weight by 50% each night but this is immediately burned off through calorie consumption while flying. Such feeding ensures a build up of fat in the form of brown adipose tissue between the shoulder blades of the bat which acts as a winter fuel store to keep the animal alive while in hibernation.

Roosting behaviour
Bats naturally roost in caves and trees but some species have recently adapted to using man-made structures for roosting. Being social animals, these roosts can reach substantial numbers in the peak period of bat activity in mid-summer and especially if the roost has been selected as a maternity site. These nursery roosts are mainly composed of breeding females but often they include some non-breeding females and males that may be the previous season's young still with their mother. Males are more solitary and form smaller roosts apart from the females. For summer roosting, bats seek warm temperatures but, for hibernation in winter, they require constant temperatures of only 5° or 6°C and humid surroundings to keep from dehydrating. In mild winters, bats will emerge from such sites to hunt should insects be on the wing.

Breeding and longevity
In autumn, male bats attract females by song flights and form harems with up to 20 females being defended by a male. After mating, the males take no further part in the rearing of the young. Irish bats can produce one young per year but, more usually, only one young is born in spring every two years (Boyd and Stebbings 1989). There is no fixed pregnancy period and gestation is governed by ambient temperature. The slow rate of reproduction by bats inhibits repopulation in areas of rapid decline. Although bats have been known to live for twenty or more years, this is rare as most die in their first and the average lifespan, in the wild, is four years. The survival of the young is closely linked to climate and poor weather in spring and summer can result in high infant mortality.

Threats
All bat species are in decline as they face many threats to their highly developed and specialised lifestyles. Many bats succumb to poisons used as woodworm treatments within their roosting sites (Racey and Swift 1986). Agricultural intensification, with the loss of hedgerows, treelines, woodlands and species-rich grasslands have impacted bat species also. Habitual roosting or hibernation sites in caves, mines, trees and disused buildings are also often lost to development. Summer roosts are prone to disturbance from vandals. Agricultural pesticides accumulate in their prey, reaching lethal doses (Jefferies 1972). Chemical treatments in cattle production sterilise dung thus ensuring that no insects can breed within it to be fed upon by bats. Likewise, river pollution, from agricultural runoff, reduces the abundance of aquatic insects. Road building, with the resultant loss of foraging and roosting sites is a significant cause in the reduction of bat populations across Europe.

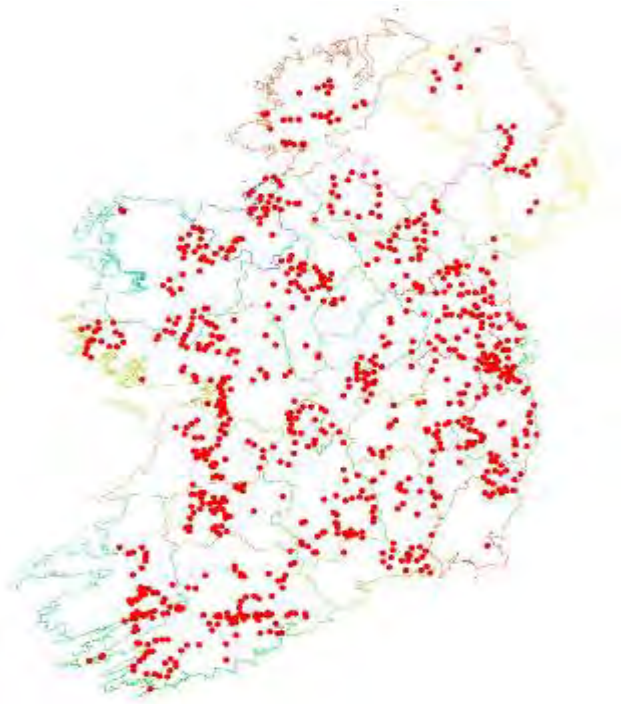
Extinction
As recently as 1992, the greater mouse-eared bat *Myotis myotis* became the first mammal to become extinct in Britain since the wolf in the 18th century.

9.2 APPENDIX 2: Distribution and status of Irish bat species

Brief species accounts and current known distribution (maps from *Bat Conservation Ireland*)

Common pipistrelle *Pipistrellus pipistrellus*

This species was only recently separated from its sibling, the soprano or brown pipistrelle *Pipistrellus pygmaeus*, which is detailed below (Barratt *et al.* 1997). The common pipistrelle's echolocation calls peak at 45 kHz. The species forages along linear landscape features such as hedgerows and treelines as well as within woodland.

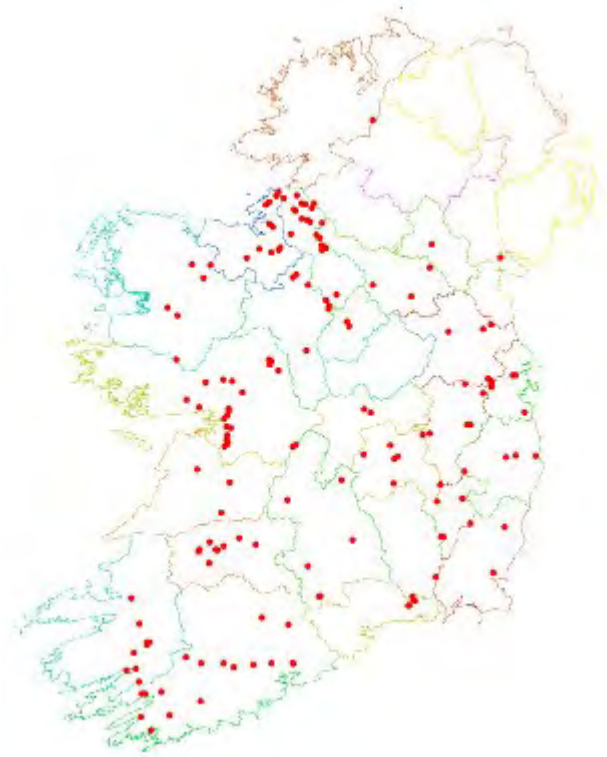


Soprano pipistrelle *Pipistrellus pygmaeus*

The soprano pipistrelle's echolocation calls peak at 55 kHz, which distinguishes it readily from the common pipistrelle. The pipistrelles are the smallest and most often seen of our bats, flying at head height and taking small prey such as midges and small moths. Summer roost sites are usually in buildings but tree holes and heavy ivy are also used. Roost numbers can exceed 1500 animals in mid-summer.

Leisler's bat *Nyctalus leisleri*

This species is Ireland's largest bat, with a wingspan of up to 320mm; it is also the third most common bat, preferring to roost in buildings, although it is sometimes found in trees and bat boxes. It is the earliest bat to emerge in the evening, flying fast and high with occasional steep dives to ground level, feeding on moths, caddis-flies, and beetles. The echolocation calls are sometimes audible to the human ear being around 15 kHz at their lowest. The audible chatter from their roost on hot summer days is sometimes an aid to location. This species is uncommon in Europe and Ireland holds the largest national population. The species is considered as *Near Threatened.*

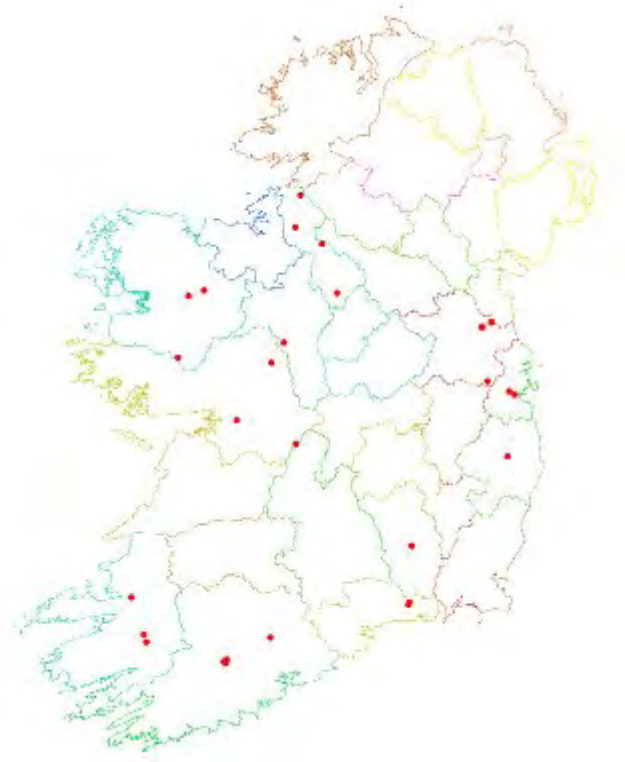


Natterer's bat *Myotis nattereri*

This species has a slow to medium flight, usually over trees but sometimes over water. They follow hedges and treelines to their feeding sites, consuming flies, moths and caddis-flies. Natterer's bats are frequently recorded in hibernation sites in winter but there are few records of summer roosts. Those that are known are usually in old stone buildings but they have been found in trees and bat boxes.

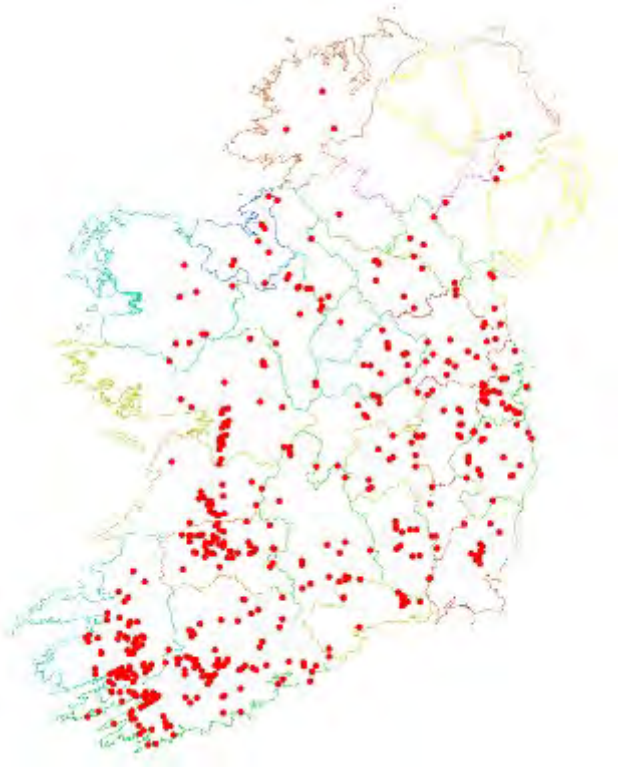
Daubenton's bat *Myotis daubentonii*

This bat species feeds close to the surface of water, either over rivers, canals, ponds, lakes or reservoirs, but can also be found foraging in woodlands. Flying at 15 kilometres per hour, it gaffs insects with its over-sized feet as they emerge from the surface of the water - feeding on caddis flies, moths, mosquitoes, midges etc. It is often found roosting beneath bridges or in tunnels and also makes use of hollows in trees.



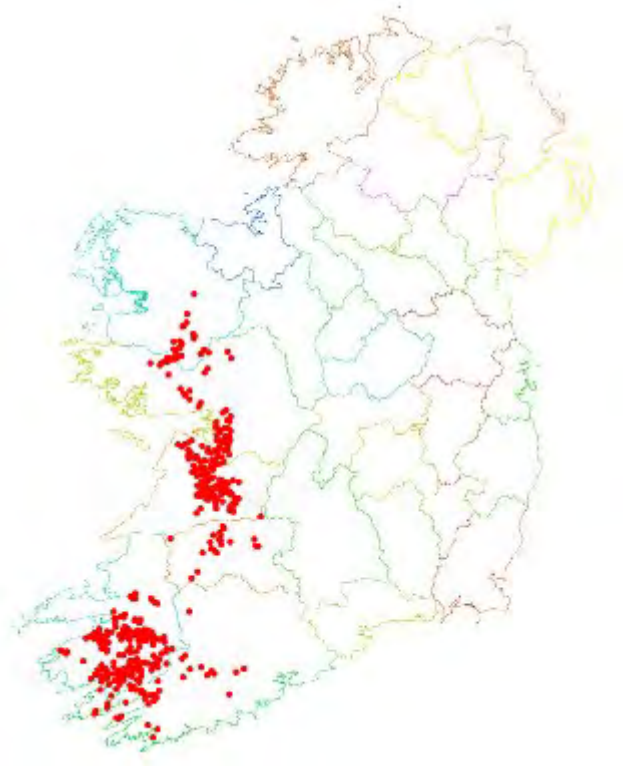
Whiskered bat *Myotis mystacinus*

This species, although widely distributed, has been rarely recorded in Ireland. It is often found in woodland, frequently near water. Flying high, near the canopy, it maintains a steady beat and sometimes glides as it hunts. It also gleans spiders from the foliage of trees. Whiskered bats prefer to roost in buildings, under slates, lead flashing or exposed beneath the ridge beam within attics. However, they also use cracks and holes in trees and sometimes bat boxes.



Brown long-eared bat *Plecotus auritus*

This species of bat is a 'gleaner', hunting amongst the foliage of trees and shrubs, and hovering briefly to pick a moth or spider off a leaf, which it then takes to a sheltered perch to consume. They often land on the ground to capture their prey. Using its nose to emit its echolocation, the long-eared bat 'whispers' its calls so that the insects, upon which it preys, cannot hear its approach (and hence, it needs oversize ears to hear the returning echoes). As this is a whispering species, it is extremely difficult to monitor in the field as it is seldom heard on a bat detector. Furthermore, keeping within the foliage, as it does, it is easily overlooked.

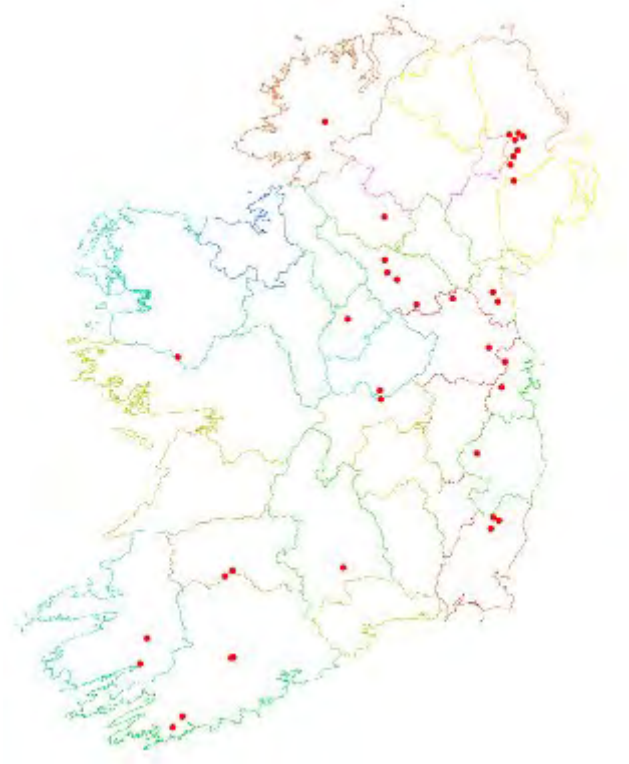


Lesser horseshoe bat *Rhinolophus hipposideros*

This species is the only representative of the Rhinolophidae family in Ireland. It differs from our other species in both habits and looks, having a unique nose leaf with which it projects its echolocation calls. It is also quite small and, at rest, wraps its wings around its body. Lesser horseshoe bats feed close to the ground, gleaning their prey from branches and stones. They often carry their prey to a perch to consume, leaving the remains beneath as an indication of their presence. The echolocation call of this species is of constant frequency and, on a bat detector, sounds like a melodious warble. Its distribution is restricted to the western Atlantic seaboard counties of Mayo, Galway, Clare, Limerick, Kerry and Cork (Kelleher 2004). However, single specimens have recently been discovered in Lough Key, near Boyle, Co. Roscommon in 2004 (B. Keeley pers. comm.) and in Tobercurry, Co. Sligo in 2008 (pers. obs.), two counties where their low numbers may have caused their presence to be overlooked in the past. This species is an Annex II species under the *EC Habitats Directive 1992*.

Nathusius' pipistrelle *Pipistrellus nathusii*

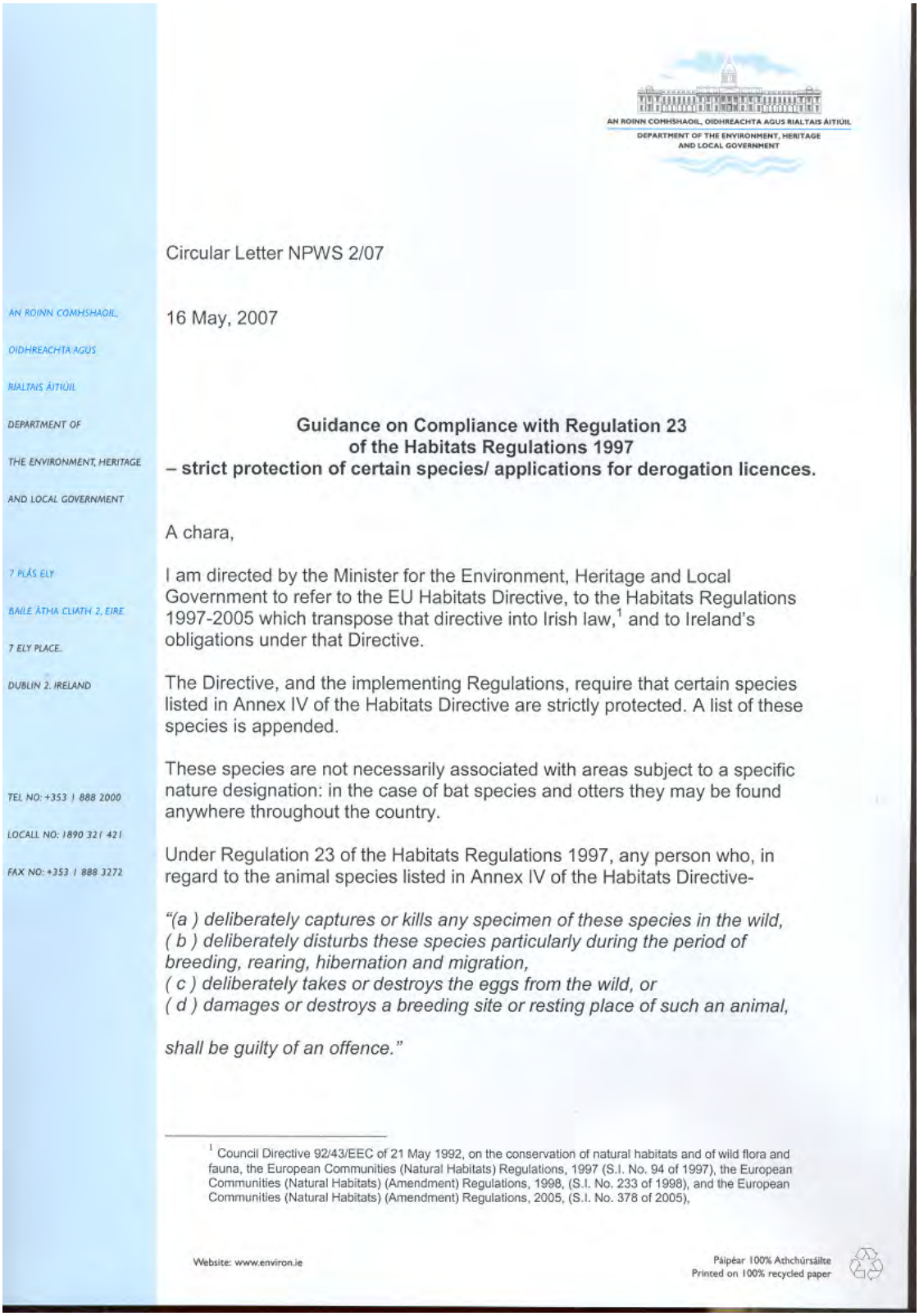
Nathusius' pipistrelle is a recent addition to the Irish fauna and, so far, has only been recorded from the north of the island in Cos. Antrim, Down and Longford but is assumed to be spreading as the known resident population is enhanced in the autumn months by an influx of animals from Scandinavian countries. There is a likelihood, therefore, that this species may occur in the area as a vagrant especially in the autumn months. However, it was not observed during the present survey. The status of the species has not been determined.



Brandt's bat *Myotis brandtii*

This sibling species to the whiskered bat is known from four specimens found to date in Cos. Wicklow (Mullen 2007), Cavan, Clare (B. Keeley pers. comm.) and Tipperary (Kelleher 2006b). A fifth specimen was identified in Killarney National Park, Co. Kerry in August 2005 (Kelleher 2005 & 2006a). Its status is unknown – no map shown.

9.3 APPENDIX 3: NPWS Circular Letter 2/07



AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

Circular Letter NPWS 2/07

16 May, 2007

Guidance on Compliance with Regulation 23 of the Habitats Regulations 1997 – strict protection of certain species/ applications for derogation licences.

A chara,

I am directed by the Minister for the Environment, Heritage and Local Government to refer to the EU Habitats Directive, to the Habitats Regulations 1997-2005 which transpose that directive into Irish law,[1] and to Ireland's obligations under that Directive.

The Directive, and the implementing Regulations, require that certain species listed in Annex IV of the Habitats Directive are strictly protected. A list of these species is appended.

These species are not necessarily associated with areas subject to a specific nature designation: in the case of bat species and otters they may be found anywhere throughout the country.

Under Regulation 23 of the Habitats Regulations 1997, any person who, in regard to the animal species listed in Annex IV of the Habitats Directive-

"(a) deliberately captures or kills any specimen of these species in the wild,
(b) deliberately disturbs these species particularly during the period of breeding, rearing, hibernation and migration,
(c) deliberately takes or destroys the eggs from the wild, or
(d) damages or destroys a breeding site or resting place of such an animal,

shall be guilty of an offence."

[1] Council Directive 92/43/EEC of 21 May 1992, on the conservation of natural habitats and of wild flora and fauna, the European Communities (Natural Habitats) Regulations, 1997 (S.I. No. 94 of 1997), the European Communities (Natural Habitats) (Amendment) Regulations, 1998, (S.I. No. 233 of 1998), and the European Communities (Natural Habitats) (Amendment) Regulations, 2005, (S.I. No. 378 of 2005),

AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT
7 PLÁS ELY
BAILE ÁTHA CLIATH 2, EIRE
7 ELY PLACE,
DUBLIN 2, IRELAND
TEL NO: +353 1 888 2000
LOCALL NO: 1890 321 421
FAX NO: +353 1 888 3272

Website: www.environ.ie

Páipéar 100% Athchúrsáilte
Printed on 100% recycled paper

Regulation 21 provides corresponding protection for Annex IV plant species.

The carrying out of any work that has the potential to disturb these species, and for which a derogation licence has not been granted, may constitute an offence under Regulation 21 or 23 of the Habitats Regulations.

It should be noted that in the case of Regulation 23 (d), it is not necessary that the action should be deliberate for an offence to occur. This places an onus of due diligence on anyone proposing to carry out an action or project that might result in such damage or destruction.

A particular concern arises regarding works carried out by or on behalf of local authorities themselves, including works of maintenance or repair.

Examples of cases that are likely to require assessment are the removal of trees and other habitat during the construction of roads or other infrastructure, the modification of the courses of rivers, drainage and discharge of water, and even the re-pointing or replacement of masonry in bridges, walls and other structures where bats are likely to roost, etc.

Procedure to be followed

Local authorities must ensure that they, their staff and their agents comply fully with the requirements of the Directive and the Regulations as follows:

1. In advance of any works, an appropriate initial assessment should be carried out by a person competent to identify where a risk of damage or disturbance to an Annex IV species may exist (e.g. by an appropriately qualified ecologist). The fact that such an assessment has been carried out should be recorded and kept with the papers associated with the project.

2. Projects where a risk is identified should be subject to an appropriate scientific assessment. It will be necessary to identify alternatives or modifications that will avoid that risk.

3. Where it is not possible to identify a means of avoiding the risk completely, the question of seeking a derogation licence from the Minister under Regulation 23 of the Habitats Regulations should be considered if it is desired, notwithstanding, to proceed with the action or project.

4. The Minister is empowered, within strict parameters, to grant a license for derogation from complying with the requirements of the provisions of section 21 of the Wildlife Act 1976 and Regulations 23 and 24 of the Habitats Regulations. The scope of the Minister's powers to grant derogation licences is set out in Regulation 23, as follows:

Where there is no satisfactory alternative and the derogation is not detrimental to the maintenance of the populations of the species to which the Habitats Directive relates at a favourable conservation status in their natural range, the Minister may, in respect of those species, grant a licence to one or more persons permitting a

derogation from complying with the requirements of the provisions of section 21 of the Principal Act and Regulations 23 and 24 where it is—

(a) in the interests of protecting wild fauna and flora and conserving natural habitats, or

(b) to prevent serious damage, in particular to crops, livestock, forests, fisheries and water and other types of property, or

(c) in the interests of public health and public safety, or for other imperative reasons of overriding public interest, including those of a social or economic nature and beneficial consequences of primary importance for the environment, or

(d) for the purpose of research and education, of repopulating and re-introducing these species and for the breeding operations necessary for these purposes, including the artificial propagation of plants,

(e) to allow, under strictly supervised conditions, on a selective basis and to a limited extent, the taking or keeping of certain specimens of the species to the extent (if any) specified therein, which are set out in the First Schedule.

6. Any application for a derogation licence (to be submitted to Mr Jamie Mulleady of this Department at: Species and Regulations Unit, National Parks and Wildlife Service, 7 Ely Place, Dublin 2 email: Jamie.mulleady@environ.ie) should address the criteria referred to in the above paragraph as well as proposed scientifically-based mitigation measures to address any potential impact on the identified Annex IV species. A decision on an application will be made on the basis of the information and proposals submitted and best scientific knowledge.

7. An application for such a derogation licence should be made in advance of seeking approval under Part 8 or 10 of the Planning and Development Regulations, 2001, as amended, or seeking planning permission for works. This will ensure that full consideration can be given to the impacts of the proposed project on the species and to avoid the possibility of delay to the proposed project or of a refusal of a derogation licence which would prevent the works being carried out as planned.

8. The obligation to obtain a derogation licence is additional to the requirement to notify the Minister of a proposed development which may have an impact on nature conservation to the Minister under article 82(3)(n) and others of the Planning and Development Regulations, 2001 (as amended). Local authorities should notify the Minister (Development Applications Unit) in any case where it appears that a proposed development may pose a risk to Annex IV species.

9. Should a problem be identified regarding Annex IV species in the course of works, this should be reported immediately to the National Parks and Wildlife Service. No further work that might impact on such species should take place unless a derogation licence has been obtained.

Applications for planning permission
Issues concerning damage or disturbance to Annex IV species also arise in the context of applications for planning permission for proposed development, e.g. proposals to renovate older houses. The responsibility of avoiding disturbance or damage to Annex IV species, or of obtaining an appropriate derogation licence, rests with the developer.

However, planning authorities should note that in any case where it appears that a proposal may pose a risk to Annex IV species, the planning application should be referred to the Minister under article 27(1)(n) of the Planning and Development Regulations 2001 (as amended). This referral should be done in the appropriate manner for applications having impacts on nature conservation sites. Planning authorities could also take the opportunity afforded by any pre-application discussions to alert prospective applicants to the requirements in relation to Annex IV species.

Further information
Species Action Plans, which set out specific measures for the monitoring and protection of these species, have been or are being prepared. They are published on www.npsw.ie or can be obtained from Species Unit (Tel: 01 888 3212). Guidelines in regard to bats are available at www.npsw.ie.

General questions in relation to the protection of Annex IV species or require any further information on an application for a derogation licence should be referred to Species Unit (01 8883214). Specific queries regarding a proposed project, location or species should be referred to the appropriate National Parks and Wildlife Service Divisional Ecologist or to the Regional Manager (contact details http://www.npws.ie/media/Media,4976,en.pdf).

If you have any questions in relation to the referral of a planning application, please contact Development Applications Unit (Tel: 01 8883181)

Is mise le meas,

Peter Carvill,
Assistant Principal Officer.

To: all County and City Managers, Directors of Services for Planning, Town Clerks

9.4 APPENDIX 4: Photographic record

Plate 1: Non-native vegetation recolonising bare ground

Plate 2: Football field with amenity grassland

Plate 3: Bare ground and waste material from the Irish Steel plant which was once on-site

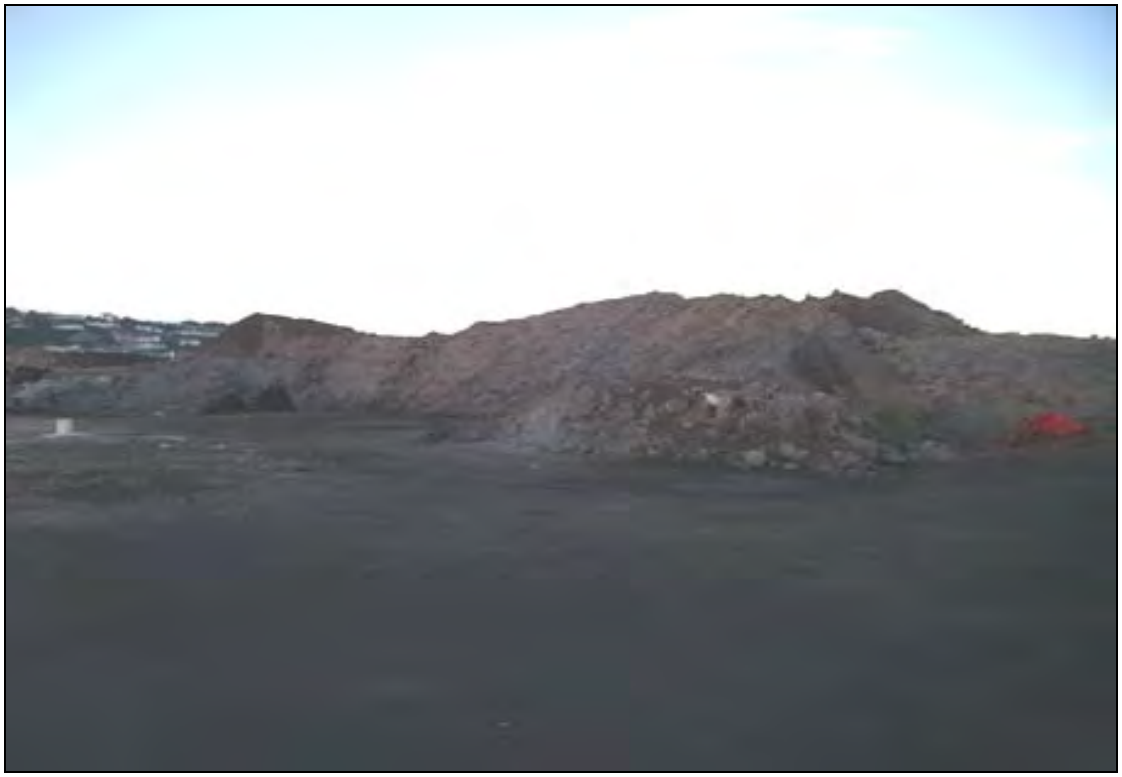


Plate 4: Large heaps of furnace waste dominate the site

Plate 5: Derelict single-storey building

Plate 6: Office building still in use as an on-site security base

Plate 7: Large steel and iron maintenance shed which is still used for storage

Plate 8: Internal view of the shed with stored machinery and soil samples

Plate 9: Small, derelict office constructed of steel and iron

Plate 10: Disused gantry crane

APPENDIX O.3

BIRD RESULTS

Appendix O.3 - Bird Results

Survey Date	Survey Type	Time	Species	No.	Behaviour	Flight Direction
23/10/2012	High Tide	10:25	Starlings	25		Throughout the site
23/10/2012	High Tide	10:54	Sanderling	2	Along south facing shore.	Flew in a southern direction from the south facing shore.
23/10/2012	High Tide	Throughout Survey	Goldfinch	15	Feeding. Goldfinch were noted during all site surveys towards the west of the site in association with the playing fields. Other songbirds, including song thrush, chaffinch, pied wagtail, blackbird and green finch were also noted during	Mainly recorded in association within western side of the site surrounding the playing field
09/11/2012	High Tide	11:25	Curlew	1	Did not rest on the island	Flew from north to south in the direction of Spike Island
09/11/2012	High Tide	11:40	Grey Heron	1	Feeding along the shore on the northwest beach.	Disturbed during survey transect and flew east circling south back to the eastern side of Hawlbowline
09/11/2012	High Tide	12:05	Grey Heron	1	In flight	Recording flying south to Spike Island from the southern shoreline. Came to rest on top of a building at the northern shore of Spike Island.
09/11/2012	High Tide	12:25	Little Egret	1	Feeding along northshore, approximately 50m to the east of the beach in the northwest corner of the site. The bird was disturbed during the survey transect.	Disturbed from north shore during transect and flew north before circling east and back to the island to land on the east-facing shore
09/11/2012	High Tide	13:07	Little Egret	2	Roosting on the south-facing side of the island. Recorded for 2 minutes.	Fly in southern direction towards Spike Island
09/11/2012	High Tide	13:20	Red Shank	2	Roosting in the tip head towards the east of the site. Not on the shoreline.	
09/11/2012	High Tide	12:25	Red Shank	1	Resting breifly on the south shore.	Recorded approaching from the south, resting briefly before flying north over the site.
09/11/2012	High Tide	13:35	Grey Heron	1	In flight	Flying over southeast section of the site. Landed in the southeastern corner of the site.
23/11/2012	High Tide	12:43	Grey Heron	1	Stalking along the southeastern shoreline	Not in flight

Survey Date	Survey Type	Time	Species	No.	Behaviour	Flight Direction
23/11/2012	High Tide	13:30	Grey Heron	1	Stalking over rock pool along the southern shoreline.	Not in flight
23/11/2012	High Tide	14:00	Snipe	1	In flight	Flew at height (c. 40m) south over the site towards the mainland.
23/11/2012	High Tide	15:00	Snipe	5	Roosting on the tip head to the east of the site.	Disturbed during transect and flew west, southwest
23/11/2012	High Tide	15:05	Grey Heron	1	Stalking on beach near northwestern corner of the site.	Flew north then circled east and came to rest on top of a slag heap within the site. Remained in-situ for approximately 20 minutes
30/11/2012	Low Tide	12:45	Grey Heron	2	Along the southern shoreline stalking by the waters edge.	Not in flight
30/11/2012	Low Tide	13:18	Oystercatcher	1	In flight	Flyiong south along the eastern side of the island.
30/11/2012	Low Tide	13:38	Grey Heron	1	Stalking in the northwest corner of the island by the beach.	Flew north then east on approach and came to rest on top of the peak of a spoil heap - same pattern as the previous survey.
04/01/2013	High Tide				No waders, waterbirds or herons recorded during the final high tide survey. Bird activity was very low with only passerines recorded. Resident flock of gold finch was noted to the west of the site in association with the playing fields.	

APPENDIX P

ARCHAEOLOGY AND CULTURAL HERITAGE

15 ARCHAEOLOGY AND CULTURAL HERITAGE

METHODOLOGY

Legislation, Standards and Guidelines

The following legislation and guidelines were considered and consulted for the purposes of the report:

National Monuments Acts, 1930-2004
The Planning and Development (Strategic Infrastructure) Act, 2000-2010
Heritage Act, 1995
CAAS Environmental Ltd on behalf of the Environmental Protection Agency (EPA) (2002), Guidelines on the information to be contained in Environmental Impact Statements
CAAS Environmental Ltd on behalf of the Environmental Protection Agency (EPA) (2003), Advice Notes on Current Practice (in preparation of Environmental Impact Statements)
Department of Arts, Heritage, Gaeltacht and Islands (DAHGI), (1999a), Framework and Principles for the Protection of the Archaeological Heritage
NRA, (2006), Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes
NRA, (2006), Guidelines for the Assessment of Architectural Heritage Impacts of National Road Schemes
Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act, 1999 and the Planning and Development Act 2000 to 2006
Department of Environment, Heritage and Local Government (2004a) Architectural Heritage Protection, Guidelines for Planning Authorities, Guidance on Part IV of the Planning and Development Act 2000

EXISTING ENVIRONMENT

Archaeological and Historical Background

Prehistoric Period

Cork Harbour is a drowned inlet or ria which claims it origins from Pleistocene ice movement and Holocene changes in sea-level (risknat.org). The coastline of the natural harbour with distinctive promontories has attracted human settlement and has been readily exploited since the Neolithic (7000–4000 BC). Its promontories are separated by shallow creeks which are attractive waters for fishing and the anchorage of small boats.

The region has a long tradition of archaeological, historical and palaeo-environmental research. Palaeo-environmental studies carried out (mainly by the Dept. of Geography, UCC) within the harbour indicate significant sea-level change since the prehistoric period and submerged peats. There is good evidence to show that human activity in this area began before the sea had advanced to its present temporal level within the natural harbour. The half submerged megalithic tomb at Rostellan (CO088-010, c. 10km to the east of the study area) on the eastern side of the harbour has been virtually covered by the sea. The tomb is described as a dolmen and at high tide little more than its capstone can be seen above of the waves. The land surface occupied by the tomb has been long destroyed by wave action which has stripped the 'footprint' and the environs of the tomb down to hard sandstone bedrock.

There are several shell middens located on the mainland to the south of Haulbowline (all c. 1.7km–3km away), two in Ringaskiddy townland (CO087-054, CO087-161) on the eastern shore of the Ringaskiddy peninsula, to the south of this three are recorded in Curraghbinny townland strung out along the shore line at Lough Beg (CO087-055) and on the northern shore of Curraghbinny Hill (CO087-056, CO087-057). A fifth midden has been identified inland in Barnahely townland (CO087-120). Shell middens are the remains of shellfish that were collected as a food source along the foreshore that have been discarded by humans, they are composed of marine faunal shell remains, predominantly edible molluscs. They can be dated from the Later Mesolithic period to up to the 16th and 17th century. These sites further attest to the early coastal activity of the harbour.

No prehistoric sites have been recorded within the areas proposed for development and on Haulbowline Island

Early Medieval (Early Christian) Period (AD 400–1200)

Archdall's Monasticon Hibernicum is among many early documents that mentions a monastery on '*Inispic'* Island which was later identified as Spike Island. It was reputedly an ecclesiastical site associated with St Mochuda who is associated with the monasteries of Rahan and Lismore. The saint received a grant from Cathal, King of the '*Ciarraige Cuirche'*, the local petty kingdom who was deaf and dumb and was cured by the saint. Cathal made a gift to St Mochuda of '*Oilean Cathail and Ros-Beg and Ros-More and Inis-Píc'* (Spike Island). Mochuda commenced to build a church on *Inis Píc* where he stayed for a year (Colman 1892). He then placed it in charge of Goban who had with him forty other monks. It is recorded that in the 5th century there were twelve monks under St. Domangen in *Spuict* Island.

In 1427 the island was owned by a family named Pyk or Pyke from which the island got his name. However it may be a derived from '*Insaspig'* meaning Island of the Bishop's. The Church of St. Ruisen on Innispic was granted in 1178 to St. Thomas' Abbey in Dublin indicating a church and monastery on Spike Island.

No features dating to the early medieval period has been identified on within the areas proposed for development and Haulbowline Island.

Cork harbour was an easy access route into the heart of Munster and was used in the 9th and 10th century by the Vikings who later settled in Cork. The first recorded attack on the monastery at Cork occurred in 820 AD and the most valuable treasures were plundered. It was raided again four to five times in the ensuing one hundred years While there is no evidence of Viking activity on the Haulbowline Island the placename has possible Viking origins; it is thought to be a Norse (or Viking) name meaning 'haunt of the eels'. Brunacardi (1969) suggests that the word Haulbowline was originally a Norse compound noun of four syllables, which in modern Norwegian is *alebolig*, meaning the abode or haunt of the eels. Furthermore, he notes that Haulbowline is on estuarial rocks, which are well-known to fishermen as the haunts of the Conger, or King, eel.

The etymology or origin of the placename however has been subject to much debate, Lyons claims that it is derived from the Irish *Ail Bó Linne* meaning cliff of the cow pool. Professor O' Donoghue proposes that it derives from *Ail Bolglinne* meaning Dwelling Water Rock. The Hardiman Atlas (early seventeenth century map) refers to 'the forte of *Hale-Boulinge*, on the island of *Ennis Shenagh* near Corke' interpreted as *Inis Sionnach*, or Fox Island, however according to the Placenames of Ireland there is no evidence that Haulbowline was ever called this by Irish Speakers (Loganim.ie).

The Medieval period

The harbour continued to provide access into the interior of Munster and in the twelfth century a new threat of invasion arose, the Anglo Normans. By the early 1170s the Anglo-Normans had taken control of large tracts of land from Waterford to Dublin. In 1172 they turned their attention to Cork. Two Anglo-Norman lords, Milo de Cogan and Robert Fitzstephen, were dispatched to Cork with a small land force to confront and dispossess the chief of the McCarthys, Diarmuid, of his lands in counties Cork and Kerry. There is no evidence for Anglo Norman activity on Haulbowline, however there is ample evidence that people continued to defend, exploit and inhabit the harbour, as one of the leading ports in Ireland since medieval times. There is documentary evidence of British naval activity in Cork from the 15th Century. Under a charter of Edward IV, the Lord Mayor of Cork was created Admiral of the Port, though this was largely a ceremonial office. The many castle sites found around the harbour are shown on Candell's map of the Harbour (1587, Fig. 15.3).

Post Medieval Defence of Cork Harbour

The tower houses and castles found at various locations around the harbour indicate the strategic importance of Cork Harbour since medieval times. Haulbowline Island has a strategic position within the harbour as it commands the main entrance channel into the inner harbour and the city of Cork.

Seventeenth century defence, the bastioned fort (1602)

In 1602, Haulbowline was considered for fortification in a coastal defence scheme for the south coast after the Battle of Kinsale (1601) exposed a potential weakness in the defence of the harbour to raiders and marauders. For the defence of Cork Harbour and the City, it was so seated that *'no shipping of any burden can pass… but under the command thereof'*. In that year under the direction of Paul Ivye 'her majesties engineer' the construction of the bastioned fort (CO087-059003) commenced on the northern side of Haulbowline, at its highest point. In 1602 Carew President of Munster wrote to the Privy Council that the nature of the ground was 'so rocky as the works rise slowly, with great expense and loss of tools', because of the ground conditions it was not completed until 1604, though it had been garrisoned in October (Hayes-McCoy 1604, Brunicardi 1982, 9).

Contemporary plans (Fig. 15.4) shows 'an irregular work based on a quadrangle with demi-bastions on the north, or cliff edge, and two bastions on the southern corners' (Gowen 1978, 246) with a rampart, ditch and a bank. Repairs were carried out in 1609 but, despite this, it was described in 1611 by Bodley as '*altogether defective being little more than half made up*' and further improvements were made. Sometime between 1608–11, a tower (castle), accommodation for the wardens, a gatehouse, a guard house and a 'well of fresh water' were added, these are shown in a contemporary maps in 1608 and 1610 (Fig. 15.5 and 15.6). Again in 1625 the fort was needing repair as the rampart had been '*cleane down to the ground*…(because) ..*cowes and Sheepe*' had been grazing on the walls and had '*made passages in the bulwarks'* and the lodging house was in ruins, the necessary repairs may however not have been made as it is in 1665 recorded in a list of forts that required repairs and provisions (ibid, 249).

By 1624 the fort was abandoned and by 1665 it was probably in complete ruin, it is not mentioned on subsequent military reports and did not play any part in the 1690 attack of Cork Harbour and City. The fort remained in disrepair throughout rest of 17th and 18th centuries (Gowen 1978, 249, Brunicardi 1982, 11-15). Brunicardi (1982-6, 21) describes the remains of some of these features, including the keep *'now only about 15 feet in height*', but Gowen (1979, 251) found *'the whole area has been subject to much disturbance'* and concludes that *'it is unlikely that any diagnostic features remain*' (RMP files). Some of the guns associated with the fort remain on the island.

The fort remained without a garrison or ordnance until the Rebellion of 1641, the island was alternately in the possession of the royalists and parliamentarians, but ultimately submitted to Cromwell in 1649. After the Restoration, the fort was much neglected, but in 1688 it was seized by the adherents of James I., and remained in their possession till the arrival of an English fleet, in 1690, when it was deserted by the Irish troops and garrisoned by the Earl of Marlborough, on his route to Cork. A battery to the east of Cobh was constructed in 1743 and Haulbowline ceased to have any significance as the main defence of the Harbour.

The Water Club (c. 1720)

Haulbowline, now no longer having a military function was leased by Lord Inchiquin of Rastellen in 1707. There he established the 'Water Club', the predecessor of the Royal Yacht Club in 1720 which was the first sailing club in the world. The small 'keep' (castle) associated with the earliest fortification was the club house (Dublin Penny Journal 1883) from there they regulated their sailing, membership and dining affairs according to a set of rules known to us today as 'The Old Rules'. The island became the scene of sports banqueting regattas and amusements.

In 1795 a survey of Haulbowline was carried out to establish its suitability for the storage of supplies for ships and smaller vessels, and provisions for up to 3,000 men for four months and accommodation to the administrators and watchmen. The situation, extent and convenience of Haulbowline was deemed to be sufficient by Navy officials to set up a victualling yard (supply depot) there.

Early Nineteenth century defence, the Martello tower and barracks (c. 1813)

In 1804, Lord Gardiner for the Admiralty and Lieutenant Colonel Sir C. Holloway for the Board of Ordnance advised that the eastern part of the Island should be reserved for the Navy and the western part be retained for the Board of Ordnance. In 1805, it was recorded that no building existed then on the island except those within the enclosure of a small fort erected a long time ago by the Ordnance Department and occupied by only a sergeant and five men (Brunicardi 1982, 16). In 1806 when the British Army moved to Spike Island, directions were given by the Order in Council to erect a naval establishment at Haulbowline.

The Martello tower on Haulbowline (CO087-05902, protected structure RPS 00578 (See Figure 15.12), was constructed in 1813-1815 on the high ground at northern edge of Haulbowline island, overlooking entrance to the upper harbour; formerly part of 'Ordnance Ground', which is now occupied by Naval Service. It cost of £3,000 (Kerrigan 1978, 148). It is oval in plan (14.6m x 9.1m; H c. 13.4m) and was built of coursed limestone blocks with entrance at first floor level (Enoch 1975, 28). A barracks to accommodate three officers and sixty men, two storehouses, a gun carriage yard, smithy and carpenters' workshop and other installations were constructed on this part of the island. There were seven Martello towers in the vicinity of Cork Harbour of which five are upstanding. They were built to a roughly uniform design being generally oval or circular in plan and two storeys high. Their function was defensive and they contained a magazine and could accommodate a small garrison. The roof of a Martello tower contained one or a pair of 32-pounder muzzle-loading guns mounted on traversing carriages.

In 1810 a magazine was constructed on Rocky Island, a small rocky outcrop located to the south of Haulbowline. It was designed to contain 25,000 barrels of powder. The island was originally conical and the east and west shoulders of the rock were excavated out and large vaults were excavated beneath the levelled surface. Into these vaults two magazine buildings were built, of which only one survives. It is thought that the eastern magazine was filled-in during the construction of the road which ran from the mainland through the island to Haulbowline in 1965. On the remaining central ridge a

watch tower was constructed upon which there was a revolving light which was operated by a sentry. The tower no longer survives, only some lower rubble stone courses of it survive today. The western magazine building has been conserved and is in use as a crematorium.

The victualling yard/ Royal Alexandra Yard (c. 1820)

On the Naval side of the island (i.e. the eastern side) a large victualling yard containing six large storehouses, living quarters for the supply staff and medical officers, houses for the Chief Surgeon and the cooper's and other workshops were erected. It also included mast houses, a floating pound, stables, water storage tanks, slipways and hospital facilities which included fine new wharves on the north and east shores of the island built using limestone quarried on site. The area around the store-houses, cranes and quay walls was known as the Royal Alexandra Yard. The cranes were used to transfer stores onto barges to be transported to the ships at anchor in the channel (Brunicardi 1982)

The island was extended by 4.5 acres of reclaimed land in order to construct the flat wharfage area. The building contractor was Mrs. Deane of Cork who visited the site daily. The works were completed in 1822.

The Royal Alexandra Yard was opened as a relief depot during the Great Famine in 1847. The Crimean War brought the yard back into use in 1853 and plans began to have it supplemented with a full dockyard.

Expansion eastward of Haulbowline, the development of the Naval Dockyard (1865)

In 1865 the British Government established a major industrial dockyard for the repair and maintenance of naval ships on the shoal extending eastward from Haulbowline to the spit. The construction was planned to be completed in 5 years but was was not finished until 1887 nor was it in full operation until 1894.

The dockyard was formed by reclaiming sand bar to the east of the island resulting in a twofold increase of the island i.e. to 30 acres bringing the total area of the island to approximately 60 acres. The reclamation work subsumed a small island off the west coast called Rat or Coney Island. The material used was quarried from the island itself and from the mainland including gravel brought by barge from pits in Ballinacurra. A nine acre dock was constructed with a graving dock on the south side. In 1907 this was extended from 417 to 608 feet to make room for larger battle ships and a modernised fleet, this extension was constructed of granite rather than the limestone used in the structures throughout the site.

The labour was again carried out by prisoners of Spike Island and later this was supplemented by paid workers from the mainland. In 1867 a causeway from Spike Island to Haulbowline was built for the prisoners to cross, this causeway is shown on R.L Stopfords 1870 view of the island from Cove (Fig. 15.8). In 1883 Spike Island prison closed and the bridge remained standing for a further ten years

(Brunicardi 1982). Remnants of this causeway still survive in the foreshore as demonstrated by the underwater archaeological assessment carried out for the EIS (See Section 15.6 of Main EIS Report).

During the Great War Cork harbour was a major operations base for British and American Navies and warships anchored there. Up to 3,000 men worked in the dockyard. After the war only a skeleton staff worked there.

During The Emergency a little fleet of torpedo and patrol boats were placed at Haulbowline. They carried out patrolling operations during the war years.

It was handed over to the Irish Free State in 1923, and remains the main naval base and headquarters for the Irish Naval Service. The Irish Navy, established in 1946, is based at the historic dockyard of Haulbowline. The majority of the Naval Service campus is on the west, or natural side of the Island with the exception of the football pitch which was reclaimed from the East Tip area in the 1980s.

Irish Steel and the development of the East Tip (after 1938)

Haulbowline's early industries included ship-breaking, oil refining and steelworks. Irish Steel was set up on Haulbowline in 1938 by the Haulbowline Steel Syndicate and later Irish Steel Ltd. They leased c. 10 acres and cleared the central area of the island in the space between the storehouses and the dock to erect a factory. One month before the Second World War in August 1939, the Haulbowline Steel Syndicate began production of steel.

It was taken over by the government after World War II in 1947 and was the only steel processing plant in Ireland. The plant was expanded in 1959 and in 1966 a bridge which linked Haulbowline to the mainland via rocky island was constructed. In 1970/73 an up-to-date plant was erected with a new furnace, casting machine, a rolling mill, a cutting and bundling facility and a new dispatch wharf (Brunicardi 1982). However, the fortunes of the steel plant took a turn for the worse and, in 1995/96, it was purchased by Ispat International from the Irish government for the sum of IR£1. Despite Ispat International's worldwide success, the Irish Ispat Steelworks failed to thrive and closed in 2002.

The natural island of Haulbowline is approximately 27 acres, the nineteenth century reclamation on the eastern side extended the area of the island by c. 30 acres and a further c. 22 acres was added in the twentieth century by the consistent dumping of process slag from the steel works at Haulbowline on the sand bank on the the eastern side of the island. Over a period of 137 years the the total area of the Haulbowline Island increased from 27 acres to over 80 acres/32 hectares.

References

Bennet, I. 1997-2003 *Excavations Bulletin*. Summary accounts of archaeological excavations in Ireland. Wordwell Limited.

Brunicardi, N 1968, Haulbowline, Spike and Rocky Islands Cork Historical Guides Committe,

Brunicardi. N. 1982 *Haulbowline, Spike, and Rocky Islands in Cork Harbour* Fermoy, Co. Cork, Ireland. Éigse Books

Cadogan, T. 1998 Lewis' *Cork: A topographical dictionary of the Parishes, towns and villages of Cork City and County* (First published in 1837.) The Collins Press, Cork.

Gowen, M. 1979 '*Irish artillery fortifications 1500-1700'* (unpublished M.A. thesis, University College Cork

Power, D., Byrne, E., Egan, U., Lane, S. and Sleeman, M. 1994 *Archaeological Inventory of County Cork* Volume 2: East and South Cork. Dublin

Power, D. et al. 1994 *Archaeological Inventory of County Cork Vol I*, East and South Cork. Office of Public Works.

Rev. Power, P. 1923 *Placenames and Antiquities.* Proceedings of the Royal Irish Academy Vol. 34C. p 164-205

James Coleman 1892 Spike Island in *The Journal of the Royal Society of Antiquaries of Ireland* , Fifth Series, Vol. 2, No. 2 (Jul.,), pp. 180-181

Hurley 1982 *The early church in SW* Ireland Settlement and organisation. Bar. Oxford

Q.J.C. 1936 *The early monastic associations of spike island and cork harbour* JCHAS XLI

Hurley V. 1980 *Additions to the map of monastic Ireland the southwest* JCHAS LXXXV

National Monuments Legislation (1930-2004)

All archaeological sites have the full protection of the national monuments legislation (Principal Act 1930; Amendments 1954, 1987 and 1994). In the 1987 Amendment of Section 2 of the Principal Act (1930), the definition of a national monument is specified as:

- any artificial or partly artificial building, structure or erection or group of such buildings, structures or erections;
- any artificial cave, stone or natural product, whether forming part of the ground, that has been artificially carved, sculptured or worked upon or which (where it does not form part of the place where it is) appears to have been purposely put or arranged in position;
- any, or any part of any, prehistoric or ancient tomb, grave or burial deposit, or
- ritual, industrial or habitation site and any place comprising the remains or traces of any such building, structure or erection, any cave, stone or natural product or any such tomb, grave, burial deposit or ritual, industrial or habitation site...

Under Section 14 of the Principal Act (1930):
It shall be unlawful...to demolish or remove wholly or in part or to disfigure, deface, alter, or in any manner injure or interfere with any such national monument without or otherwise than in accordance with the consent hereinafter mentioned (a licence issued by the Office of Public Works National Monuments Branch),or to excavate, dig, plough or otherwise disturb the ground within, around, or in the proximity to any such national monument without or otherwise than in accordance...

Under Amendment to Section 23 of the Principal Act (1930),
A person who finds an archaeological object shall, within four days after the finding, make a report of it to a member of the Garda Síochána...or the Director of the National Museum...

The latter is of relevance to any finds made during a watching brief.

In the 1994 Amendment of Section 12 of the Principal Act (1930), all the sites and 'places' recorded by the Sites and Monuments Record of the Office of Public Works are provided with a new status in law. This new status provides a level of protection to the listed sites that is equivalent to that accorded to 'registered' sites [Section 8(1), National Monuments Amendment Act 1954] as follows:

The Commissioners shall establish and maintain a record of monuments and places where they believe there are monuments and the record shall be comprised of a list of monuments and such places and a map or maps showing each monument and such place in respect of each county in the State.

The Commissioners shall cause to be exhibited in a prescribed manner in each county the list and map or maps of the county drawn up and publish in a prescribed manner information about when and where the lists and maps may be consulted.

In addition, when the owner or occupier (not being the Commissioners) of a monument or place which has been recorded, or any person proposes to carry out, or to cause or permit the carrying out of, any work at or in relation to such monument or place, he shall give notice in writing of his proposal to carry out the work to the Commissioners and shall not, except in the case of urgent necessity and with the consent of the Commissioners, commence the work for a period of two months after having given the notice.

The National Monuments Amendment Act enacted in 2004 provides clarification in relation to the division of responsibilities between the Minister of Environment, Heritage and Local Government, Finance and Arts, Sports and Tourism together with the Commissioners of Public Works. The Minister

of Environment, Heritage and Local Government will issue directions relating to archaeological works and will be advised by the National Monuments Section and the National Museum of Ireland. The Act gives discretion to the Minister of Environment, Heritage and Local Government to grant consent or issue directions in relation to road developments (Section 49 and 51) approved by An Bord Pleanála and/or in relation to the discovery of National Monuments

14A. (1) The consent of the Minister under section 14 of this Act and any further consent or licence under any other provision of the National Monuments Acts 1930 to 2004 shall not be required where the works involved are connected with an approved road development.

(2) Any works of an archaeological nature that are carried out in respect of an approved road development shall be carried out in accordance with the directions of the Minister, which directions shall be issued following consultation by the minister with the Director of the National Museum of Ireland.

Subsection 14A (4) Where a national monument has been discovered to which subsection (3) of this section relates, then

(a) the road authority carrying out the road development shall report the discovery to the Minister
(b) subject to subsection (7) of this section, and pending any directions by the minister under paragraph (d) of this subsection, no works which would interfere with the monument shall be carried out, except works urgently required to secure its preservation carried out in accordance with such measures as may be specified by the Minister.

The Minister will consult with the Director of the National Museum of Ireland for a period not longer than 14 days before issuing further directions in relation to the national monument.
The Minister will not be restricted to archaeological considerations alone, but will also consider the wider public interest.

Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act, 1999

This Act provides for the establishment of a national inventory of architectural heritage and historic monuments.
Section 1 of the act defines “architectural heritage” as:

(a) all structures and buildings together with their settings and attendant grounds, fixtures and fittings,
(b) groups of such structures and buildings, and,
(c) (c) sites which are of architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest

Section 2 of the Act states that the Minister (for Arts, Heritage, Gaeltacht and the Islands) shall establish the NIAH, determining its form and content, defining the categories of architectural heritage, and specifying to which category each entry belongs. The information contained within the inventory will be made available to planning authorities, having regard to the security and privacy of both property and persons involved.

Section 3 of the Act states that the minister may appoint officers, who may in turn request access to premises listed in the inventory from the occupiers of these buildings. The officer is required to inform the occupier of the building why entry is necessary, and in the event of a refusal, can apply for a warrant to enter the premises.

Section 4 of the Act states that obstruction of an officer or a refusal to comply with requirements of entry will result in the owner or occupier being guilty of an offence.

Section 5 of the Act states that sanitary authorities who carry out works on a monument covered by this Act will as far as possible preserve the monument with the proviso that its condition is not a danger to any person or property, and that the sanitation authority will inform the Minister that the works have been carried out.

The provisions in the Act are in addition to and not a substitution for provisions of the National Monument Act (1930–94), and the protection of monuments in the National Monuments Act is extended to the monuments covered by the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act (1999).

Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act, 2000 and the Local Government (Planning and Development) Act 2000

The Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act provides for the establishment of a national inventory of architectural heritage and historic monuments.

Section 1 of the act defines "architectural heritage" as:

(a) all structures and buildings together with their settings and attendant grounds, fixtures and fittings,
(b) groups of such structures and buildings, and,
(c) sites, which are of architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest.

The Local Government (Planning and Development) Act, 1999, which came into force on 1st January 2000, provides for the inclusion of protected structures into the planning authorities' development plans and sets out statutory regulations regarding works affecting such structures, thereby giving greater statutory protection to buildings. All structures listed in the development plan are now referred to as Protected Structures and enjoy equal statutory protection. Under the 1999 Act the entire structure is protected, including a structures interior, exterior, the land lying within the curtilage of the protected structure and other structures within that curtilage. This Act was subsequently repealed and replaced by the Planning and Development Act, 2000, where the conditions relating to the protection of architectural heritage are set out in Part IV of the Act.

Protected Structures, Curtilage & Attendant Grounds

A *protected structure* is defined in the Local Government (Planning and Development) Act 2000 as any structure or specified part of a structure, which is included in the planning authorities' Record of Protected Structures (RPS). Section 57 (1) of the 2000 Act states that *"…the carrying out of works to a protected structure, or a proposed protected structure, shall be exempted development only if those works would not materially affect the character of*

(a) the structure, or
(a) any element of the structure, which contributes to its special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest."

By definition, a protected structure includes the land lying within the curtilage of the protected structure and other structures within that curtilage and their interiors. The notion of curtilage is not defined by legislation, but according to *Architectural Heritage Protection Guidelines for Planning Authorities (2004)* and for the purposes of this report it can be taken to be the parcel of land immediately associated with that structure and which is (or was) in use for the purposed of the structure.

The attendant grounds of a structure are lands outside the curtilage of the structure but which are associated with the structure and are intrinsic to its function, setting and/or appreciation. The attendant

grounds of a country house could include the entire demesne, or pleasure grounds, and any structures or features within it such as follies, plantations, lakes etc.

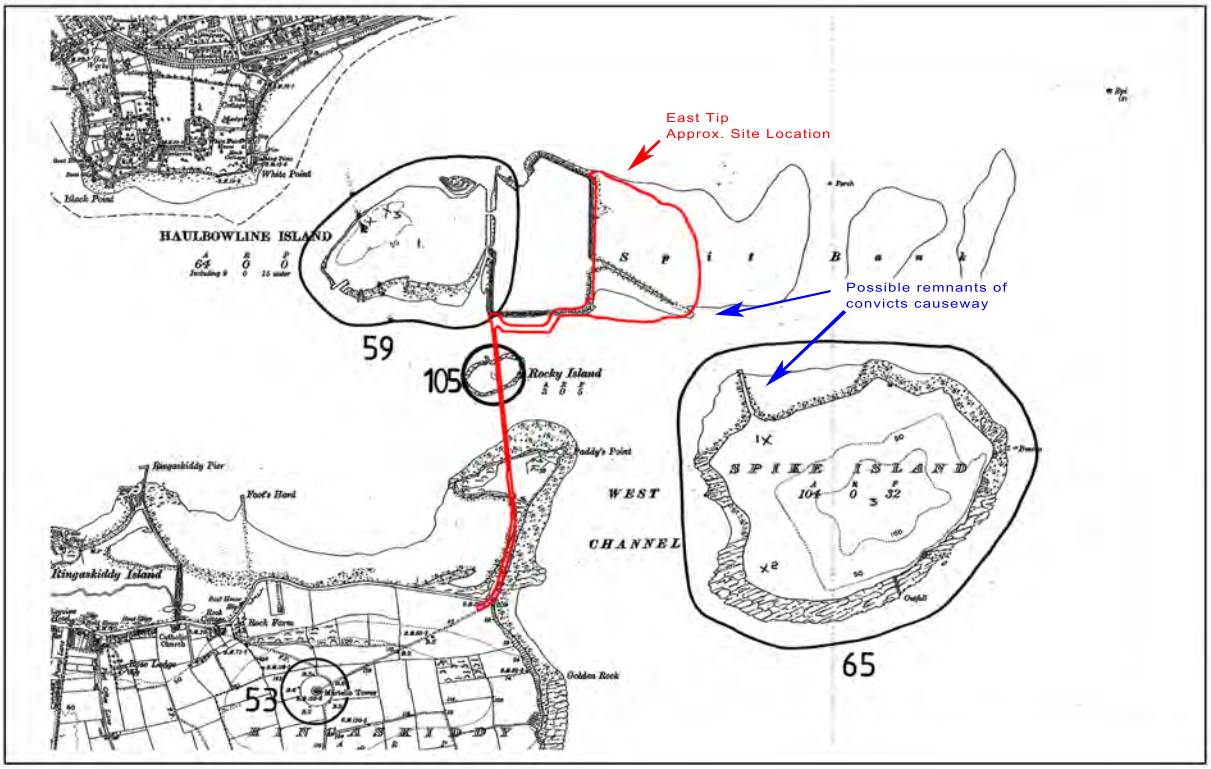


Fig. 15.1 RMP site location map and East Tip site location

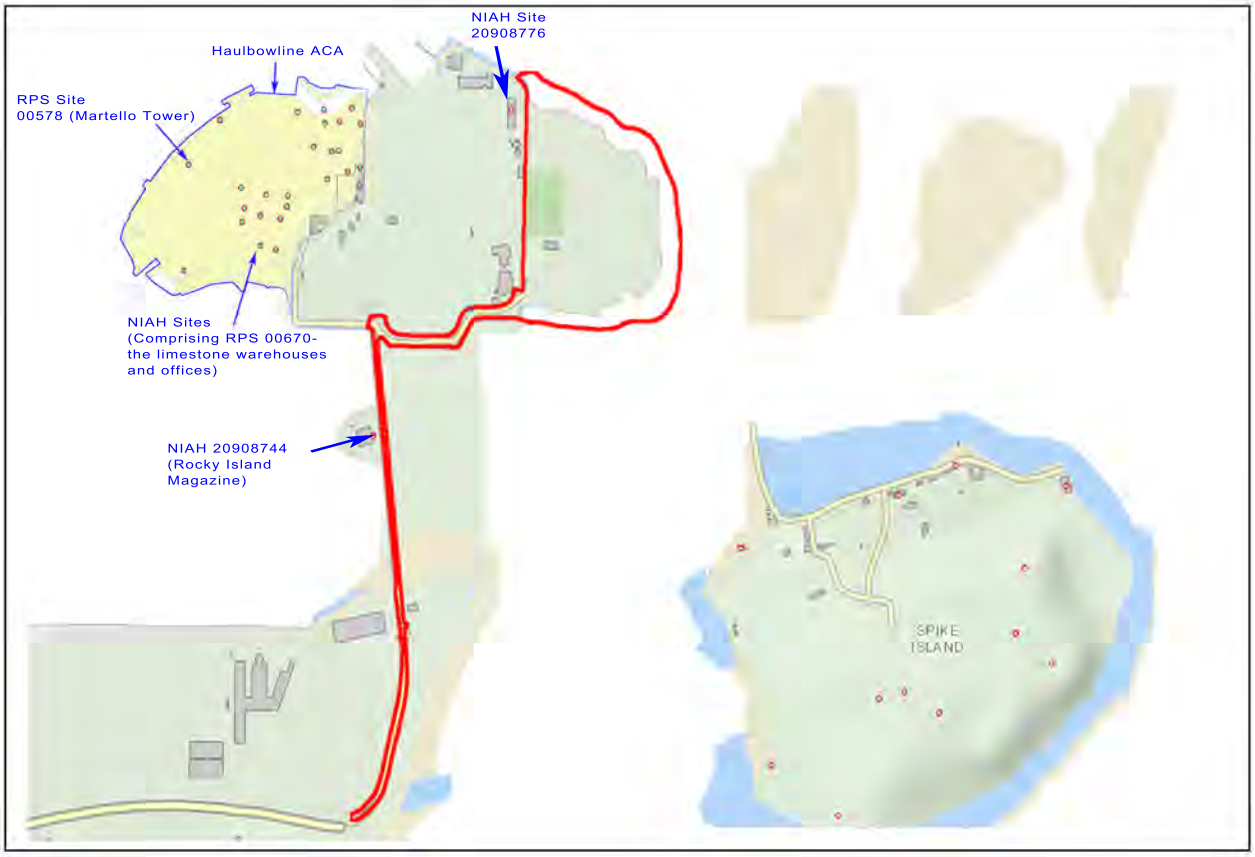


Fig. 15.2 ACA, RPS and NIAH sites and the East Tip site location

COURTNEYDEERY
Heritage Consultancy

Project:	The East Tip, Haulbowline Island, Cork, Archaeology and Cultural Heritage EIS
Date:	12-12-2012
Figures:	15.1 and 15.2

Fig. 15.3 Candell's map of Cork Harbour, 1587

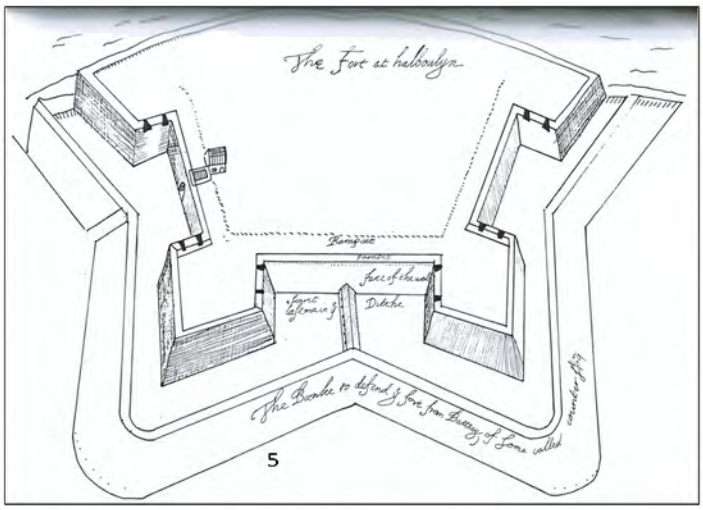


Fig. 15.4 Paul Ivye 'Fort at Halboulyn', 1402

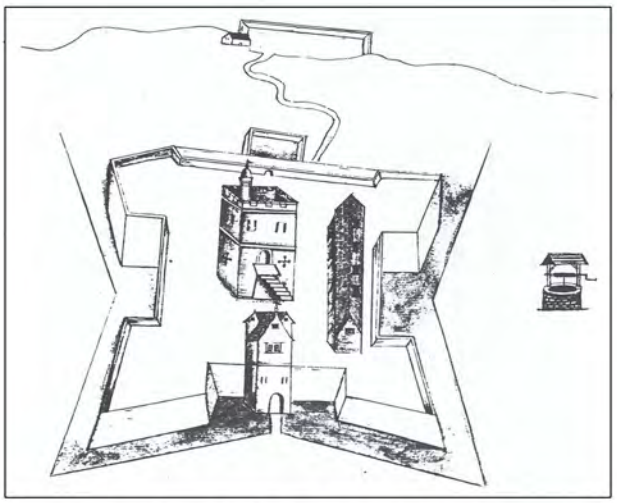


Fig 15.5 *'The Forte of Haulboline upon the Haven of Corke' c.1608*

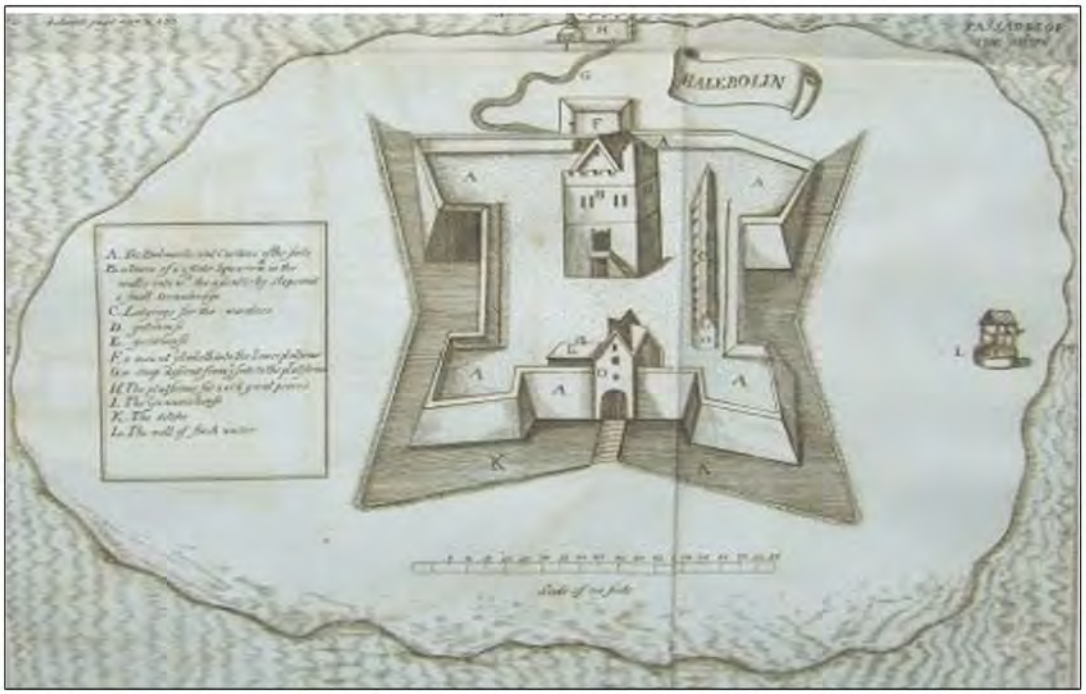


Fig. 15.6 Pacata Hibernia, 1610

COURTNEYDEERY
Heritage Consultancy

Project:	The East Tip, Haulbowline Island, Cork, Archaeology and Cultural Heritage EIS
Date:	12-12-2012
Figures	15.3 to 15.6

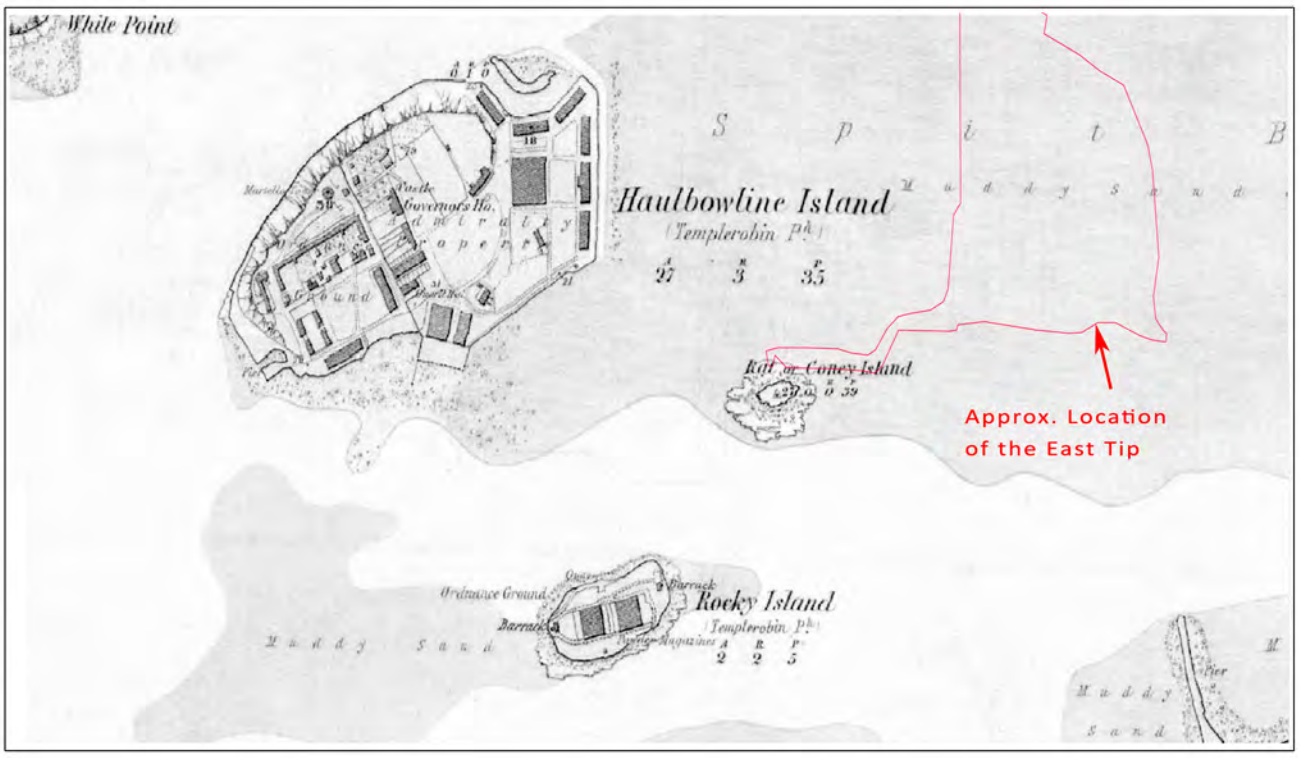


Fig. 15.7 First edition Ordnance Survey Map, 1842

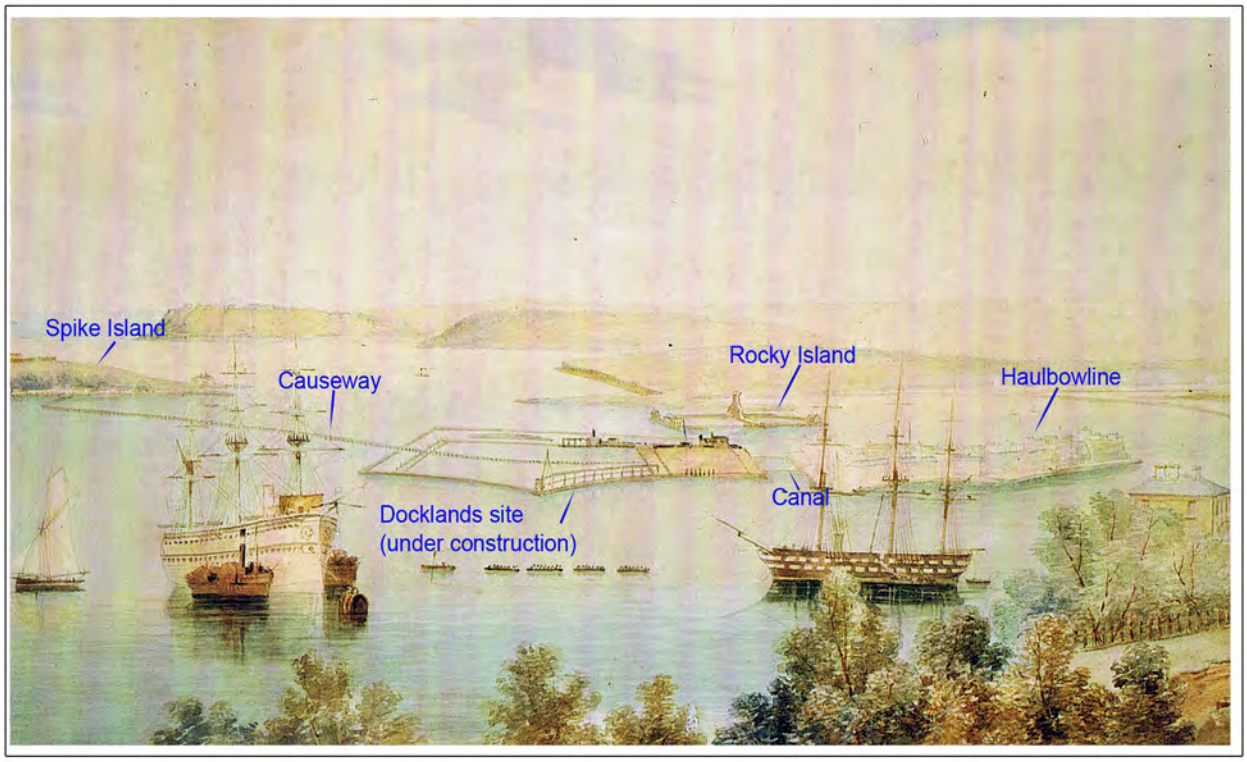


Fig. 15.8 R. L. Stopford from *A Panoramic View of Cork Harbour*, c. 1870

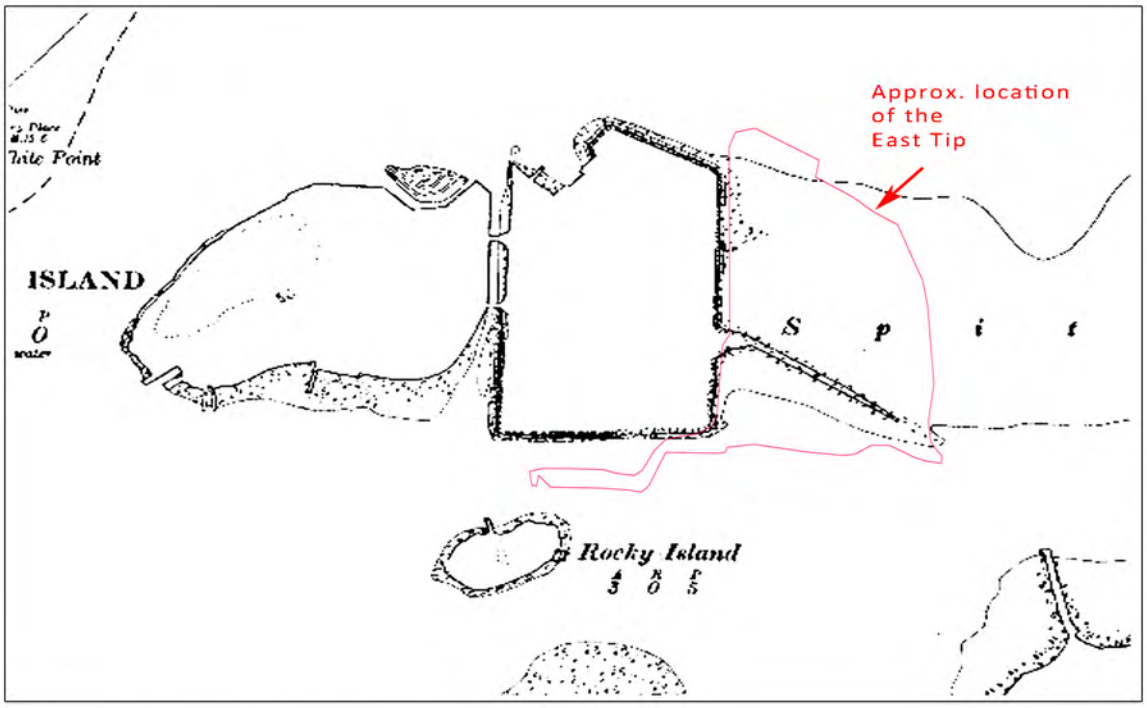


Fig. 15.9 Revised 1934 Ordnance Survey Map

Fig. 15.10 Aerial photograph taken sometime in the late 1960's/ early 1970's before the demolition of the Steel Processing Plant

COURTNEYDEERY
Heritage Consultancy

Project:	The East Tip, Haulbowline Island, Cork, Archaeology and Cultural Heritage EIS
Date:	12-12-2012
Figures	15.9 and 15.10

Plate 15.1 View of the East Tip from Cobh

Plate 15.2 Spoil heaps in the East Tip

Plate 15.3 Features associated with the former twentieth century steelworks

Plate 15.4 Southeastern sea wall of the docklands area, dated after 1865

Plate 15.5 Northeastern sea wall of the docklands area, dated after 1865

Plate 15.6 Rudimentary steps in the southeastern sea wall known as the ‘Priest’s Stairs’

Plate 15.7 View of the Naval buildings and former steel site from the East Tip

Figure 15.8 Naval workshop (NIAH 20908776) view from the East Tip

Figure 15.9 Naval dock

Plate 15.10 Naval dock basin

Plate 15.11 Three storehouses (c.1825 associated with the Royal Alexandra dockyard) and used by Ispat steelworks until recently, area in the foreground the dismantled steelworks

Plate 15.12 Pump house associated with the Naval Dock

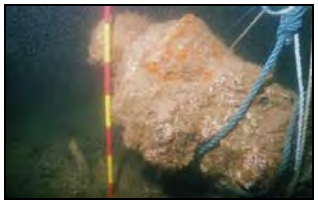
Plate 15.13 Dismantled steelworks area, view taken towards the East Tip area

Plate 15.14 View from the interior of the East Tip towards Cobh

Plate 15.15 View towards Spike Island from Haulbowline

Plate 15.16 View of Haulbowline from Cobh





Archaeological Intertidal & Underwater Assessment
The East Tip Remediation
Haulbowline Island, Cork Harbour

12D034, 12R133

THE ARCHAEOLOGICAL DIVING COMPANY LTD.

Archaeological Intertidal & Underwater Assessment
The East Tip Remediation
Haulbowline Island, Cork Harbour

12D034, 12R133

18th February 2013

Project Director **Dr. Niall Brady**

Brehon House, Kilkenny Road, Castlecomer, Co. Kilkenny info@adco-ie.com

THE ARCHAEOLOGICAL DIVING COMPANY LTD.

CONTENTS

EXECUTIVE SUMMARY

The Archaeological Diving Company Ltd. (ADCO) was appointed by RPS on behalf of Cork County Council, to undertake an archaeological intertidal and underwater assessment for the East Tip Remediation Project, Haulbowline, Cork Harbour.

The East Tip is located on Haulbowline Island, within Cork Harbour, between Cobh to the north and Ringaskiddy to the south. It is connected to the mainland at Ringaskiddy via a bridge which crosses Rocky Island. Spike Island lies to the southeast, and this small archipelago of islands retains a complex of known archaeological features. The west side of Haulbowline is a natural island and the site of a significant archaeological complex, associated with a series of fortifications from at least the early seventeenth century. The east side of the island is reclaimed from the Spit Bank. It contained a causeway bridge connecting Haulbowline with Spike Island.

Marine geophysical survey data indicates a deep deposit of silty-sand and sandy-clay over bedrock.

Systematic visual inspection of the foreshore/ intertidal and sub-tidal seabed areas took place along the east and southeast shoreline of Haulbowline, in November 2012. The archaeological work confirmed the presence of a causeway feature extending from Haulbowline towards Spike Island. Site work also recorded the presence of stone-built sea walls on Haulbowline. No other features of archaeological interest were identified exposed on the seabed within the area of proposed development activity.

The conclusion of the present survey is that the known archaeological potential is highlighted by the presence of the causeway and the stone-built sea walls. The possibility remains that subsurface deposits retain archaeological material, and the deep deposits of silty-sand and sandy-clay of the intertidal and sub-tidal areas would be ideal holding areas for such material. This is especially the case for wooden constructions, such as log boats and other pre-modern sailing craft and related features.

This report recommends that further in-water work in advance of construction is not required.

The remediation works adjacent to and on the foreshore will anticipate some impact with the merging of new structures and the stone-built sea walls.

The remediation works represent a potentially significant impact on the existing environment and it is recommended that a programme of archaeological monitoring be conducted during construction, with the proviso to resolve fully any archaeological material that is observed at that point.

The recommendations in this report are subject to the requirements of the Department of Arts Heritage and the Gaeltacht.

LIST OF FIGURES

LIST OF PLATES

Plate 29: Example shot of seabed within dive survey area (NGR: 179537E, 65160N).

1.0 INTRODUCTION

The Archaeological Diving Company Ltd (ADCO) was appointed by RPS on behalf of Cork County Council, to carry out archaeological intertidal and underwater assessment on Haulbowline Island, Cork Harbour, as part of the Environmental Impact Statement (EIS) being prepared for the remediation of the East Tip, Haulbowline Island, Cork Harbour. The following report considers the foreshore and in-water areas associated with the development area.

Haulbowline Island is located within Cork Harbour, between Cobh to the north and Ringaskiddy to the south (Figure 1). It is connected to the mainland at Ringaskiddy, via a bridge which crosses Rocky Island. The Headquarters of the Irish Naval Service is situated on the western portion of the Island with the Naval Dockyard to the east. East of the Naval Dockyard is the East Tip, an area of land reclaimed from the Spit Bank by infilling with processing waste from steelworks that were associated with the dockyard. The primary objective of this project is to remediate the East Tip, thereby ensuring that potential risks to humans and the wider environment are minimized. It is proposed that waste at the site will be contained by constructing an engineered capping system, placed on-top of the waste, with an outer barrier around the waste body; the extent of these works are shown in Figure 2. Once the remediation solution has been constructed, it is proposed that the site will be used for amenity and recreational purposes.

ADCO sought to:

- Identify and record the location, nature, and dimensions of any archaeological features, fabric or artefacts that may be impacted by the proposed works within the foreshore and sub-tidal areas.
- Make detailed recommendations for the mitigation of any archaeology present within foreshore and sub-tidal locations of the development area.
- Make recommendations as to the options available to the client in the event of archaeology being present.

Particular attention was paid to recording seabed and foreshore topography, bottom composition, and highlighting any material concentrations. The intertidal and underwater assessment was completed on 16th November 2012. The assessment was carried out by a team of two maritime archaeologists and a certified Dive Supervisor. The assessment was carried out under licence from the Department of Arts, Heritage and the Gaeltacht (DAHG), licence numbers 12D034, 12R133.

2.0 PROPOSED DEVELOPMENT

The primary objective of the project is to remediate the East Tip to ensure that potential risks to humans and the wider environment are minimised.

It is proposed that the waste at the site will be contained by constructing:

- An engineered capping system on top of the waste (to meet requirements of EPA Landfill Site Design Manual and EU Landfill Directive).
- A perimeter engineered structure around the north, south and east of the waste body (approximately 900m in length) which will include rock armour protection.

The existing access road to the East Tip will be widened to allow for two additional lanes and footpaths on either side.

Once the remediation solution has been constructed, it is proposed that the East Tip will be landscaped for amenity and recreational purposes.

3.0 SURVEY METHODOLOGY

Desktop archaeological assessment was completed by Courtney-Deery, who are engaged by RPS to consider the wider archaeological context of the entire Haulbowline Island area. ADCO refers to that work, which is presented in Chapter 15 of the EIS. ADCO has also reviewed Ordnance Survey and related mapping for the area, and the company's own archive, derived from marine archaeological projects conducted in Cork Harbour. Hydrographic survey information was provided by RPS, based on bathymetric and sub-bottom profile data acquired for the project in 2012.[1]

The following legislation, standards and guidelines were considered and consulted for the purposes of this evaluation:

- National Monuments Acts, 1930-2004;
- The Planning and Development (Strategic Infrastructure) Bill, 2006;
- The Heritage Act, 1995;
- Guidelines on the information to be contained in Environmental Impact Statements, 2002, EPA;

[1] Hydrographic Surveys,'Haulbowline Bathymetric and Geophysical Survey Report', 2012.

- Advice Notes on Current Practice (in preparation of Environmental Impact Statements), 2003, EPA;
- Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes, NRA
- Frameworks and Principles for the Protection of the Archaeological Heritage, 1999, (formerly) Department of Arts, Heritage, Gaeltacht and Islands;
- Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act, 2000 and the Local Government (Planning and Development) Act 2000; and
- Code of Practice between Bord Gáis Éireann and the Minister for Arts, Heritage, Gaeltacht and the Islands (now the Department of Environment Heritage and Local Government), 2002.

The on-site archaeological fieldwork was carried out following the data review and under licence from the Department of Arts, Heritage and the Gaeltacht (DAHG), licence numbers: 12D034, 12R133. The full extent of the east and southeast inter-tidal foreshore of Haulbowline Island was field-walked when the tides were at Low Water, to maximise the area of foreshore that was exposed above the waterline. The survey extended east of the sea walls on the north shore, and west to the edge of the development footprint on the south shore. Underwater survey was undertaken across the southwest section of the development area, east of the bridge to Rocky Island, where water-depth necessitated diver-based survey (Figure 2). Intertidal survey was conducted along the south, east and north shores. The intertidal survey extended below the Low Water Mark as a waded/ snorkel survey of the sub-tidal zone, where water depth was below 0.50m at Low Water (see Figure 7 for survey extent). A detailed written record, supplemented by photographic record, of the foreshore and the sub-tidal environment was made. A hand-held GPS unit was used to position-fix the survey route and any observations made.

A team of two maritime archaeologists (certified to a minimum of HSE Part III diving certification) and a certified dive supervisor conducted the work, using a mobile surface-supplied diving set-up. Maximum coverage of the underwater inspection area was achieved using a diver-towed survey method. The dive survey was carried out to HSE/HSA standards using Surface Supplied Diving Equipment and all relevant safety equipment.

Magnetometry survey by hand-held metal-detection (Fisher Aquanaut 1280X) was undertaken, but the high level of ambient metal waste from the East Tip constrained practical use of the metal-detector. Underwater visibility was very good, however,

providing clear visibility of the seabed in both the intertidal and diver-based survey areas.

Limitations

No limitations were encountered during the surveys and the full extent of the intertidal foreshore of the East Tip has been field-walked at Low Water, and the sub-tidal zone has been dive inspected.

Classification of Impacts

The impact categories listed below have regard to those set out in the 'Guidelines on the information to be contained in Environmental Impact Statements', 2002, EPA, 'Advice notes on Current Practice (in preparation of Environmental Impact Statements), 2003, EPA, and Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes, National Roads Authority.

Impacts are generally categorised as either being a direct impact, an indirect impact or as having no predicted impact:

> **Direct impact** occurs when an item of archaeological heritage is located within the centreline of the proposed route alignment and entails the removal of part, or all, of the monument.
>
> **Indirect impact** may be caused where a feature or site of archaeological interest is located in close proximity of the proposed development.
>
> **No predicted** impact occurs when the proposed route option does not adversely or positively affect an archaeological heritage site.

These impact categories are further assessed in terms of their quality i.e. positive, negative, neutral (or direct and indirect).

> **Negative Impact:** a change that will detract from or permanently remove an archaeological monument from the landscape.
>
> **Neutral Impact:** a change that does not affect the archaeological heritage.
>
> **Positive Impact:** a change that improves or enhances the setting of an archaeological monument.

A significance rating for these impacts is then given i.e. slight, moderate, significant or profound.

Profound: applies where mitigation would be unlikely to remove adverse effects. This is reserved for adverse, negative effects only. These effects arise where an archaeological site is completely and irreversibly destroyed by a proposed development.

Significant: an impact which, by its magnitude, duration or intensity alters an important aspect of the environment. An impact like this would be where the part of a site would be permanently impacted upon leading to a loss of character, integrity and data about the archaeological feature/site.

Moderate: a moderate direct impact arises where a change to the site is proposed which though noticeable, is not such that the archaeological integrity of the site is compromised and which is reversible. This arises where an archaeological feature can be incorporated into a modern day development without damage and that all procedures used to facilitate this are reversible.

Slight: an impact which causes changes in the character of the environment which are not significant or profound and do not directly impact or affect an archaeological feature or monument.

Imperceptible: an impact capable of measurement but without noticeable consequences.

In addition, the Duration of Impacts is assessed and has been sub-divided into the following categories.

Temporary Impact:	Impact lasting for one year or less
Short-term Impacts:	Impact lasting one to seven years
Medium-term Impact:	Impact lasting seven to fifteen years
Long-term Impact:	Impact lasting fifteen to sixty years.
Permanent Impact:	Impact lasting over sixty years

4.0 THE RECEIVING ENVIRONMENT

Readers are directed to the desktop assessment set out in the terrestrial archaeology section, Chapter 15 of the East Tip Remediation EIS, for an overview to the archaeological information available for Haulbowline Island within the context of Cork

Harbour. What follows in this section is a particular consideration from a maritime cultural landscape perspective focused on Haulbowline Island.

4.1 Cartographic Information

Tudor interest in the planting of Munster in the late 16th century led to various attempts to map the province, and one such map survives as part of the National Maritime Museum's collections in Greenwich (Figure 3). The cartographer's name is not recorded but the 'Map of the Province of Mounster' dated 1595 reveals a lot of detail around the principal towns, and plots many of the inlets and coves that would have provided natural havens and landing places. Cork Harbour is given particular attention. The principal Elizabethan landholders are named with the extents of their lands or entitlements defined. As Figure 3 shows, many of the principal details of the upper harbour area are recorded. Great Island to the north is revealed in some detail, as is Fort Westmoreland (present-day Spike Island) to the south. Haulbowline is indicated as a small islet off the southwest corner of Great Island.

One must wait until the nineteenth-century however for the first appearance of metrically accurate mapping, and the Ordnance Survey's First Edition six-inch map of 1841 provides a useful overview of the island's natural features (Figure 4). The core of the island lies to the west, where a rocky outcrop provided the basis on which to develop a series of fortifications. It is possible that occupation of the island extends back into the early medieval period, if not before, when it is associated with Viking Age activity, but the present structures appear to date from at least the early 17th century, when a bastioned fort was built in 1602 under the direction of the military designer Paul Ive, who was also responsible for the fortification work at Castle Ny Park, to protect Kinsale. In the early 19th century, the fort was restructured to accommodate the then innovative form of coastal defence, the Martello tower, and a barracks was attached. The complex of remains (Sites and Monuments Record number [SMR] CO087-059001/002/003) stands on the west side of the island, extending over the rocky outcrop that forms the original extent of Haulbowline Island. It is one of a series of outcrops that forms a little archipelago to the south of Great Island and the narrowing of the sea approaches to Lough Mahon and Cork city to the north. It is little wonder that such islets become the locations for other fortifications, built to protect the important city and wider province. Rocky Island to the southwest of Haulbowline is the site of a powder magazine (CO087-105), built in 1813 to service Haulbowline. Spike Island, to the southeast was the site of another bastioned fort, built in 1779 as Westmoreland Fort (CO087-065003) and which replaced an earlier

battery on the island. A small burial ground and the site of an early ecclesiastical complex (CO087-065001/002) are also known on Spike Island.

A smaller islet, Coney Island, whose name suggests the former presence of a rabbit warren, has been absorbed within Haulbowline, and is located immediately west of the present survey area. The 1841 map also shows the extent of shallow waters to the east of Haulbowline, incorporating Coney Island, where extensive sands formed as part of Spit Bank. Navigation was possible only to the south and north, where the ebbing rivers maintain an active scouring across the bank, forming a narrow channel between Haulbowiine and Spike Island, and a wider channel north of Haulbowline, between the island and Cobh.

The naturally formed topography that defined Haubowline Island and the Spit Bank in the early nineteenth century was transformed dramatically after the island was upgraded to a Naval Dockyard in 1869. A painting dated c. 1870 and attributed to the estate of Admiral Robert Loe Stopford, Governor of Greenwich Hospital, captures an image of the striking alterations achieved or at least envisaged (Figure 5). The developed nature of the western side of the island is clear, as is the progressive reclamation to the east. A canal is indicated between the two sections, lying north of Rocky Island. Large-scale reclamation of the Spit Bank is indicated by the very flat nature of the docklands site, where a small stand of dry land gave access to a larger expanse of open water, constrained within a series of enclosures. A causeway is also indicated crossing this space and extending all the way to Spike Island.

Some of these details are recorded in the later Ordnance Survey maps. The 1912 map shows the narrow canal between the natural island and the reclaimed portion (Figure 6). It also shows as a large rectangular space as the enclosed polder area to the east. The causeway to Spike Island is also indicated, but it is not continuous, and does not cross the interior of the polder.

More recent mapping reveals the present-day layout (Figure 7). The narrow canal linking the natural island with the reclaimed portion no longer survives above ground; it has been covered over as part of the works area for the naval basin and former steelworks. The large polder area to the east has been partially in-filled and absorbs the reduced open-water space defined by the Royal Alexandra Yard. Further reclamation of the Spit Bank has taken place to the east, with the dumping here of waste from the steel works. There is some indication of the former causeway structure linking Haulbowline with Spike Island, surviving as a short finger-like appendix off the southeast shoreline, and visible only at Low Water.

4.2 Desktop Data

Terrestrial Sites

The register of archaeological monuments only refers to the sites of the bastioned fort, Martello tower and the barracks on Haulbowline Island (CO087-059001/002/003). The various standing buildings associated with the 19th-century naval base, which also occupy the eastern half of the island are more fully recorded in the Inventory of Architectural Heritage (NIAH 20908745-20908776). The twenty-seven records focus on naval building and residential houses. There is a single entry for the former dockyard quaysides, recorded as the Royal Alexandra Yard (NIAH 20908775). The brief entry refers to it as being a, 'dressed limestone harbour, built 1822, with dressed limestone retaining walls having dressed limestone paving with metal railings to top. Cast-iron cranes to water's edge with cast-iron cogs and arms on square-profile supports with circular bases. Maker's marks in relief'.

The area of reclaimed land to the east, and the site of the causeway between Haulbowline and Spike Island are not registered in either the archaeological or the architectural history archives.

Shipwreck Sites

The Shipwreck Inventory in the Department of Arts, Heritage and the Gaeltacht archive is a list of recorded instances of wrecking since 1750. The details provided describe the type of vessel, the journey it foundered on, and information on the ultimate plight of the vessel and its crew, where possible. In describing the wrecking event, the records will locate the incident in relation to the nearest headland or other topographic marker where known. This is not a record of where the wreckage lies, however, since the historic records generally only deal with the vessel before it sank. Such finer details emerge from other sources, such as fishermens' records of snag points and diver records of sites located underwater. These are included in the Inventory wherever possible, but it is true to say that most entries lack this final level of data.

A comprehensive list of wrecks within Cork Harbour is presented in the terrestrial archaeology section. It is sufficient here to focus on the ten wrecking events listed for Haulbowline, and Spike Island, and reproduced as Table 3. Perhaps the only instance where the location would most reasonably be understood to be close the present development area is the incident associated with the *Crampton*, which went aground c. 1900 off Spike Island. The four-masted bargue no doubt struck the

shallow waters of Spit Bank, which extends from the east shore of Haulbowline Island. The *Crampton* was however towed away, and as such should not remain as a wrecksite.

Vessel Name:	Date of loss:	Location:	Description:
Allison	22/11/1928	North of Haulbowline	Iron steamer, collided, sank.
Bacchus	03/09/1814	Back of Spike Island	Wooden rowing boat, went ashore.
Bredah/ Breda	12th November 184712/10/1690	Broadhaven Bay off Spike Island	Sailing Vessel 72-gun gunship, took fire and blew up.
Crampton	c. 1900	Off Spike	Four-masted barque went aground near Spike, towed away.
La Suffisante	25-27/12/1803	Between the Spit and Spike Island, possibly on the Curlane Bank south of Spike Island	14/16 gun naval sloop, dragged anchors and struck Spike. Dredging in 1980 recovered debris, possibly related to the wreck.
Luvius	1-5/11/1845	Near Haulbowline	In contact with a steamer and sank.
Miss Evans	31/07/1915	Rocky Bay	Wooden schooner, wrecked.
Shannon Lass	01/02/1935	Haulbowline wharf	Motor fishing vessel collided and sank at the wharf.
Unknown	20/10/1898	Between Haulbowline and Ringaskiddy	Wooden rowing boat in collision and registered as a total loss.
Unknown	c. 1900	Near Spike	Coasting steamer sank in the fairway near Spike.

Table 3: Instances of shipwrecking recorded in the general area, based on the DAHG Historic Shipwreck Inventory.

It is important to observe that the Shipwreck Inventory is at best a record of shipwrecking events for the period since 1750 AD. The Inventory does not claim to be a record for wrecking events prior to the mid-18th century, and therefore the medieval and prehistoric periods are not represented in this archive to any significant degree. Such insight would only come from the archaeological records, and this usually requires discoveries made in the course of active dredging and related maritime development projects.

Previous Archaeological work

Various licensed archaeological work has taken place in the upper reaches of Cork Harbour, and some of that work has occurred close to Haulbowline Island, but there has not been any work conducted in the East Tip area. Consequently, there is no

record of previous investigations to draw on for insight to the development area for the present project.

4.3 Marine Geophysical Data Review

The marine geophysical data available for review constitutes a report on the bathymetric and sub-bottom profile survey commissioned for the wider project in 2012.[2] The information was gathered to inform the civil engineering aspects of the project, rather than for archaeological reasons. It presents a comprehensive survey of the sub-tidal contours, and some indication of the nature of the sediments by trying to establish the depth of bedrock.

The survey lines were set approximately 10m apart, and provide a suitable density of cover across the survey area. Survey lines were run at right angles to the shore, and parallel with the shore, providing good coverage inshore from different directions.

The water depths within the project area are very shallow, extending to 2m over much of the east shore area, and only getting somewhat deeper in the south shore area. Water depths achieve up to -5.8m below Mean High Water in this location, along a narrow corridor that runs between Haulbowline Island and Rocky and Spike Islands.

The sediments revealed in the sub-bottom profile data indicate the presence of three strata of sand and gravel above a discontinuous layer of bedrock. The sediments comprise loose sandy silt on the surface that lies over two levels of sandy gravel or gravelly sandy clay. The sediments range from 0.2m to 12.2m in depth, representing a deep deposit of soft layers over bedrock.

Such sands and clays derive from the formation of Spit Bank, and represent a good holding area for cultural heritage material that could become trapped and buried over time, such as boat or shipwreck debris. Two of the sub-bottom profile lines sections (section 3 and 4) extended over the remnant of the causeway feature, which the report interprets as a ‘spit’. The data shows a shallow cover of sands and a low ridge of sandy silt in this location, some 20m wide, indicative of the presence of the linear feature.

4.4 Conclusion

Haulbowline Island forms part of an important archipelago of islands at the upper end of Cork Harbour, whose strategic importance in offering protection to shipping and the navigation channels that service Cork city have long been recognized. These are

[2] Hydrographic Surveys,’Haulbowline Bathymetric and Geophysical Survey Report’, 2012.

represented by the sequence of naval fortifications that are built on the islands. Haulbowline itself has a busy history of development from a fortification into a naval dockyard, and much of the present development area lies against land that has been reclaimed from the natural sandbar of Spit Bank. The vestigial remains of the former causeway to Spike Island are clearly mapped, while the sub-bottom profile data recovered for the present project indicates a deep and extensive sequence of sedimentary deposits that could readily retain buried remnants of archaeological interest.

5.0 ARCHAEOLOGICAL ASSESSMENT

The archaeological field assessment was carried out on 16 November 2012. Full access to all work areas was possible. The intertidal work commenced during Low Water at 13:00 hrs. Sea conditions were good, with a calm sea state. The dive work took place during a filling tide, and underwater visibility was up to 3m.

5.1 Intertidal Zone

Foreshore topography

The intertidal zone at Low Water extends to include much of the proposed works area along the north and east shores of the island. The natural foreshore consists of silty sand and/or mixed pebble cover that slopes imperceptibly seaward, where it is quickly replaced with a light fluid sand/silt surface that remains shallow for an extended distance seaward. A series of geo-referenced shots of the intertidal zone along the northern side of the survey area and serve to illustrate the foreshore topography present (Plates 1-17). This topography is the natural sandbar of Spit Bank. Overlying it on the landward side there is considerable addition of spoil that is dumped from the steelworks along the eastern side of the island (Plates 18-19). The waste is very dark/black in colour and is constituted largely of metal slag. It can form low cliffs against the shore, and retains striking layering that reveals the process of dumping. Debris and discarded objects are included in this material, and some of this material has fallen onto the foreshore (Plate 20).

A small indentation on the northeast edge suggests a small cove is developing on the shoreline, perhaps anticipating an indentation on the natural layering below, but also resulting from water run-off from the reclaimed portion of the island.

The shorelines on the north and south sides are more abrupt, where the ‘made-ground’ from the waste meets the Low Water line directly, and runs into the sub-tidal

zone. The deeper shore results from the limits of the Spit Bank, imposed by the river channels that drain into the harbour.

Features

The remains of stone-built sea walls survive at both the north and the south ends of the survey area, where existing structures on Haulbowline merge with the recently reclaimed portion of the island (Plates 21-23). The sea walls are steeply-pitched and are faced with granite rectangular blocks set with their long axis facing the ground. The stone is set in concrete. Along the south shore, newer additions of sea wall are built against the stone walls and are rendered in concrete.

The remains of the causeway feature that extended southeast from Haulbowline Island survives as a linear stone mound that runs from the foreshore to a point that is recorded at 179862E 65170N, where it ends as a rounded feature that may dip below the surrounding sands (Plates 24-25). The feature is made up of small stones forming a compact cairn, with a low rounded profile some c. 20m wide and up to 1m in height. A metal pipe is inserted into the stone mass at its outward end (Plate 26) There was no indication of timber piles or related features that might have supported a timber walkway, but such elements could easily have been eroded, and foundation stumps would be buried by the stone cairn.

The only object observed in the intertidal survey was a large steel cylinder with a domed surface and a steel bolt on its crown (Plate 27). It lay alone on the silty-sand, and may represent part of an abandoned buoy.

5.2 Sub-tidal Zone

To facilitate dive work, marker buoys were placed at two points, 179776E 65527N and 179516E 65082N respectively. The two points defined the seaward extent of the dive work, which was completed by a series of towed dive surveys completed inside the buoyed area. The diver was towed East and West in a grid pattern that was repeated at right angles, moving in and away from shore, to provide maximum coverage. Underwater visibility was good at 3m, ensuring 6m-wide sweeps at a time.

Seabed Topography

The underwater inspection confirmed the bathymetric survey, identifying a sloping seabed that rises gradually to the south, in keeping with the shallowing nature of the seabed as it approaches the east end of Rocky Island. Water velocity increased

where the water depths were greatest, and reflect the active flow of the tide as it races along this channel.

The seabed is for the most part covered in a silty-sand that is featureless (Plates 28-29). Some cobbling was evident in the deeper sections, as may be expected from constantly high water velocities, but within the sheltered areas inshore, soft sand was only punctuated by a line of modern rock armour associated with the sea walls, and also some modern metal debris.

No material was recovered and no material of archaeological significance was identified.

6.0 POTENTIAL IMPACTS[3]

Potential Impacts during Construction Phase

The development works adjacent to and on the foreshore will anticipate some impact with the merging of new structures and the stone-built sea walls.

The development works represent a potentially significant impact on the existing environment.

Impacts during Operation & Aftercare

There will be no impact on archaeological or cultural heritage during the operational stage of the project as it is anticipated that all archaeological features and sites will be resolved in the construction stage of the proposed development.

7.0 CONCLUSION

The conclusion of this assessment is that the known archaeological potential within the East Tip section of Haulbowline Island is low to medium. The presence of the stone-built causeway confirms the existence of works associated with the reclamation of the Island in the late 1800s as part of the construction of the dockyard. The presence of stone-built sea walls help to further define the edges of the visible

[3] This section does not purport to relate precise engineering details but is rather an attempt to understand the nature of the impact on the potential archaeological environment, based on the data supplied by RPS.

historical remains. The depth of sedimentary deposit over bedrock close inshore as revealed in the marine geophysical survey report highlights the potential holding capacity for previously unrecorded features associated with the presence of the Spit Bank as a navigation hazard. It is therefore recommended that all ground disturbances within the upper foreshore, inter-tidal, and sub-tidal areas be archaeologically monitored, with the proviso to resolve fully any archaeological material observed.

8.0 RECOMMENDATIONS

Pre-construction Measures

No further archaeological measures are deemed necessary in advance of construction works commencing.

Construction Phase Measures

ARCHAEOLGICAL SURVEY of sea-wall locations to be disturbed should be carried out prior to disturbance works. Such survey would usefully be a detailed photographic record supported by measured description.

ARCHAEOLOGICAL MONITORING. It is recommended that archaeological monitoring licensed by the Department of Arts, Heritage and the Gaeltacht is conducted during all seabed and inter-tidal/foreshore disturbances associated with the development. Licence applications take a minimum of three weeks to process through the Department, and advance planning is required to ensure that the necessary permits are in place before site works commence.

RETAINING AN ARCHAEOLOGIST/S. An archaeologist experienced in maritime archaeology will be retained for the duration of the relevant works.

THE TIME SCALE for the construction phase will be made available to the archaeologist, with information on where and when ground disturbances will take place.

DISCOVERY OF ARCHAEOLOGICAL MATERIAL. In the event of archaeologically significant features or material being uncovered during the construction phase, machine work should cease in the immediate area to allow the archaeologist/s to inspect any such material.

ARCHAEOLOGICAL MATERIAL. Once the presence of archaeologically significant material is established, full archaeological recording of such material is recommended. If it is not possible for the construction works to avoid the material, full excavation would be recommended. The extent and duration of excavation would be a matter for discussion between the client and the licensing authorities.

ARCHAEOLOGICAL TEAM. It is recommended that the core of a suitable archaeological team be on standby to deal with any such rescue excavation. This would be complimented in the event of a full excavation. The archaeological team should be experienced in maritime archaeology.

ARCHAEOLOGICAL DIVE TEAM. It is recommended that an archaeological dive team is retained for the duration of any inwater disturbance works on the basis of a twenty-four or forty-eight hour call-out response schedule, to deal with any archaeologically significant/potential material that is identified in the course of the ground disturbance activities. The permits necessary for this aspect of the site work are additional to the excavation licence required by the archaeological monitor, and are generally held by the dive-team leader. The archaeological dive licence takes a minimum of 3-5 weeks to process. It is necessary to ensure that all permits are in place before site works commence.

A SITE Office and facilities should be provided on site for use by archaeologists.

A secure WET TANK should be provided on site for the storage of materials that may be recovered in the course of archaeological work.

BOUYING/FENCING of any such areas would be necessary if discovered and during excavation.

MACHINERY TRAFFIC during construction will be restricted to avoid any identified archaeological site/s and their environs.

SPOIL will not be dumped on any of the selected sites discovered during archaeological monitoring or their environs.

PLEASE NOTE: The above recommendations are subject to the approval of the National Monuments Section at the Department of Arts, Heritage and the Gaeltacht.

<u>Operational Phase Measures</u>

It is not anticipated that any archaeological measures should be necessary during the operational phase.

Residual Impacts

There will be no residual impacts on archaeological features or sites encountered as it is understood that any archaeology encountered will be resolved in the construction stage of the proposed development.

9.0 ACKNOWLEDGEMENTS

Thanks are extended to Cathriona Cahill and Aileen Fitzgerald, RPS Group; Siobhan Deery; Dessie McGroarty, site foreman; Stephen Greaney, Irish Naval Service. The on-site work was carried out by Rex Bangerter and Dr. Niall Brady, with Simon Bennett, Dive Supervisor. The report was written by Brady, and the figures prepared by Bangerter.

Plate 1: North-facing view along intertidal foreshore, taken from NGR: 179835E, 65210N.

Plate 2: North-facing view along intertidal foreshore, taken from NGR: 179846E, 65276N.

Plate 3: North-facing view along intertidal foreshore, taken from NGR: 179854E, 65334N.

Plate 4: North-facing view along intertidal foreshore, taken from NGR: 179829E, 65373N.

Plate 5: Detail shot of foreshore composition at NGR: 179829E, 65373N.

Plate 6: East-facing view of intertidal foreshore at NGR: 179829E, 65373N.

Plate 7: South-facing view along intertidal foreshore, taken from NGR: 17983E, 65426N

Plate 8: North-facing view along intertidal foreshore, taken from NGR: 179826E, 65456N

Plate 9: West-facing view along intertidal foreshore, taken from NGR: 179780E, 65510N

Plate 10: South-facing view of intertidal foreshore, taken from NGR: 179769E, 65556N

Plate 11: East-facing view of intertidal foreshore, taken from NGR: 179759E, 65566N

Plate 12: Example shot of modern iron debris spread across foreshore at NGR: 179699E, 65549N.

Plate 13: East-facing view of intertidal foreshore, taken from NGR: 179678E, 65553N.

Plate 14: East-facing view of intertidal foreshore, taken from NGR: 179618E, 65608N.

Plate 15: East-facing view of masonry embankment forming north side of Haulbowline Island, taken from NGR: 179562E, 65636N.

Plate 16: Detail shot of foreshore composition at NGR: 179590E, 65573N, note dislodged stonework from adjacent embankment present at this location.

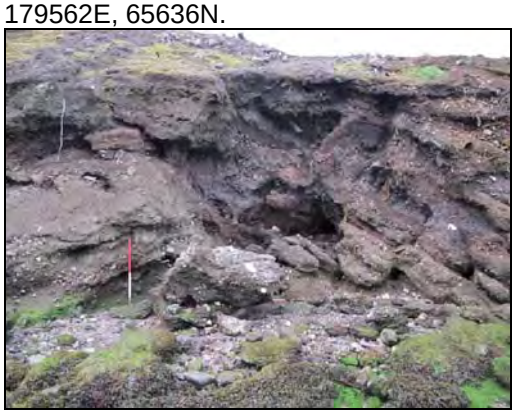


Plate 17: Example shot of cliff-face composed of slag material that delineates the upper foreshore (1m scale).

Plate 18: South-facing view of intertidal zone with large deposit of slag/ iron material delineating the upper foreshore.

Plate 19: West-facing view of upper foreshore and large mound of slag material forming upper foreshore (1m scale).

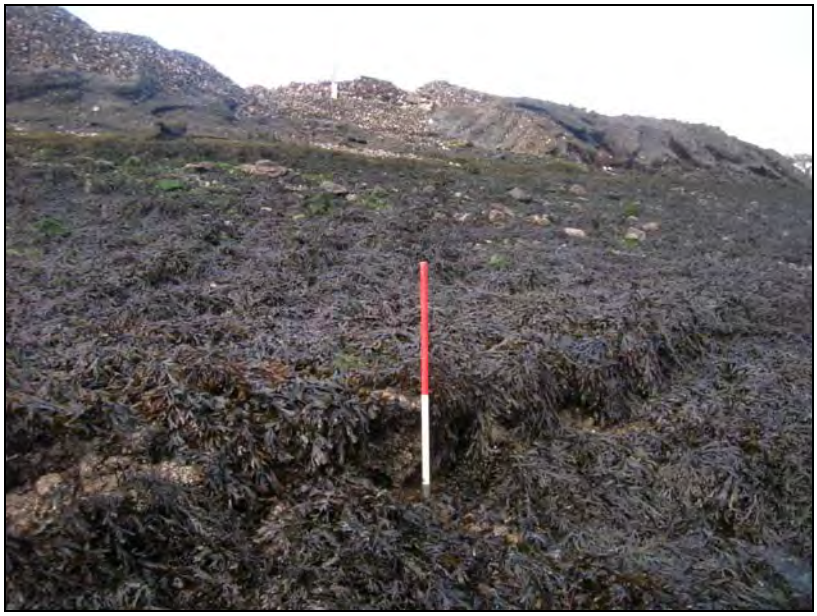


Plate 20: North-facing view of 20m long concrete slab forming edged a short distance below the HWM, located at 179840E, 65252N (1m scale).

Plate 21: West-facing view of masonry embankment forming north side of Haulbowline Island, taken from NGR: 179525E, 65631N.

Plate 22: West-facing view of masonry embankment running along south side of Haulbowline Island, adjacent to the dive survey area at NGR: 179482E, 65191N.

Plate 23: North-facing view of masonry embankment delineating the upper foreshore adjacent to the dive survey area (NGR: 179449E, 65168N).

Plate 24: Southeast-facing view of foreshore leading to a causeway feature located on the south east side of the present-day extent of the island, shot taken from NGR: 179744E, 65204N.

Plate 25: South-facing view across upper surface of the causeway feature, shot taken from NGR: 179801E, 65216N).

Plate 26: North-facing view of steel-pipe arrangement inserted at the toe of causeway feature (NGR: 179862E, 65180N) and interpreted as a modern service pipe (1m scale).

Plate 27: Steel object observed below the intertidal zone on the eastern side of the island (NGR: 179849E, 65392N), located *c.*3m from the LWM (1m scale).

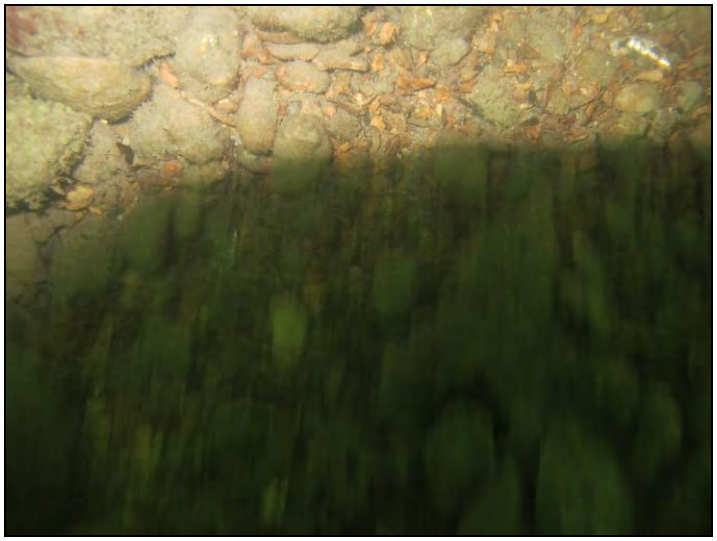


Plate 28: Example shot of seabed within dive survey area (NGR: 179468E, 65135N).

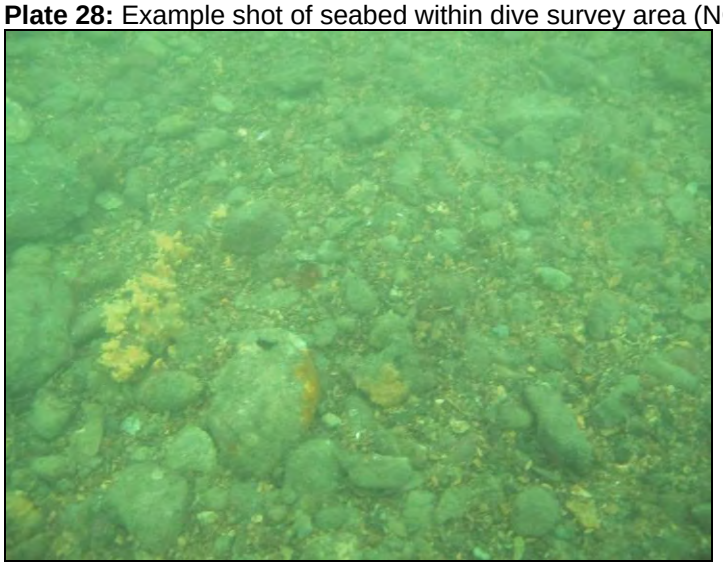
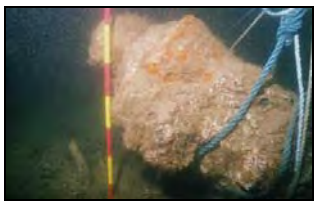


Plate 29: Example shot of seabed within dive survey area (NGR: 179537E, 65160N).

Recording prehistoric logboat at Gormanston, Co. Meath
GAS 2025 Irish Sea Interconnector

Underwater elevation of bridge pier collapsed in 1763. River Nore Flood Alleviation Scheme

Iron cannon on site of 17th-century timber wreck discovered during dredging programme
Waterford Harbour



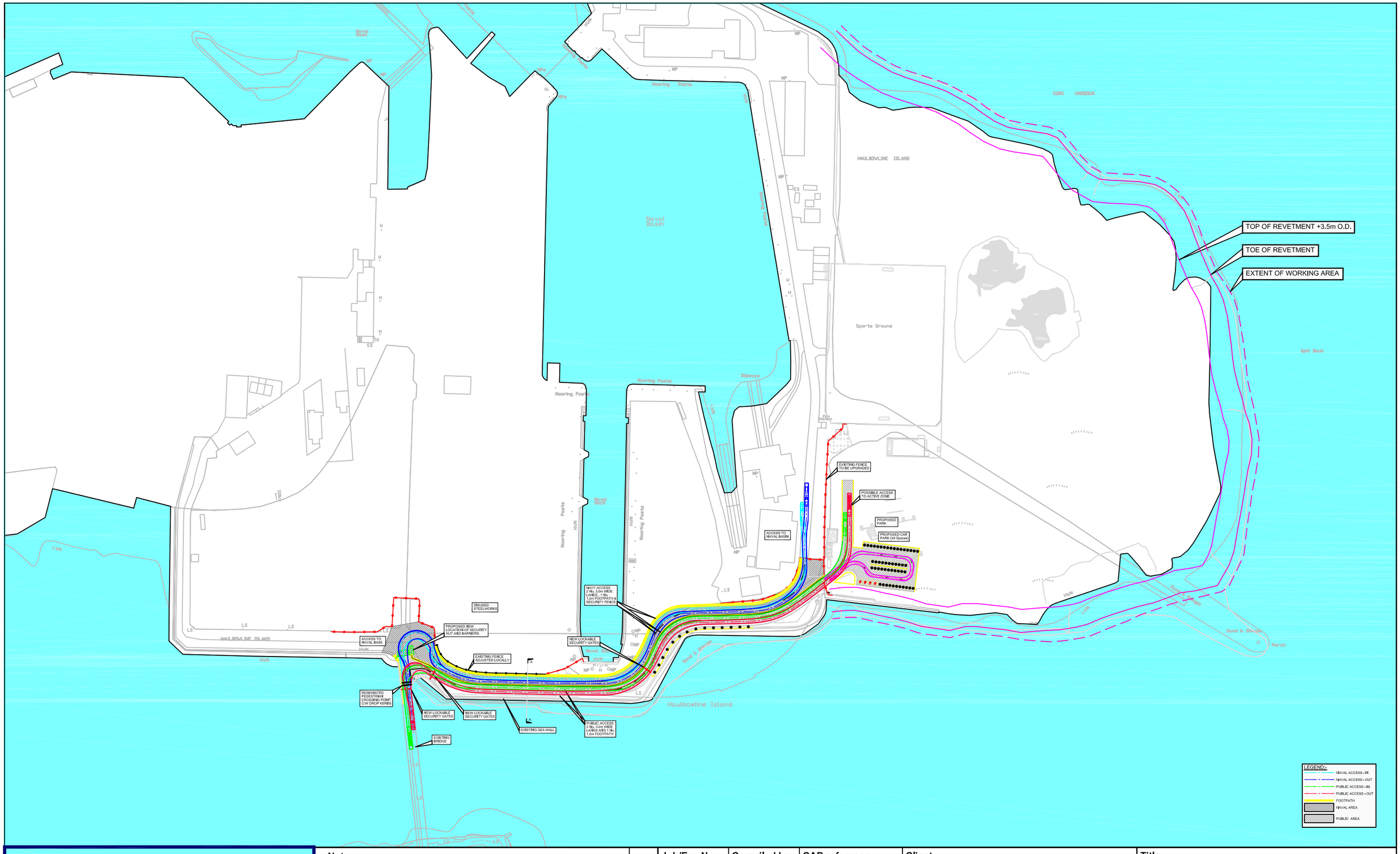
THE ARCHAEOLOGICAL DIVING COMPANY LTD.
Tel. 056 4440236 email: info@adco-ie.com

Notes
Source: OSI
Approximate location of ADCO underwater/ inter-tidal survey along the southern & eastern sides of Haulbowline Island.

A4

Job/Exc No.	Compiled by	CAD reference	Client
12D034	R.Bangerter	Haulbowline Island	RPS Ltd./ Cork County Council
Date	**Scale**	**Drawing No.**	**Project**
27.11.12	1:25,000	Figure 1	East Tip Remediation- Archaeological Assessment

Title
Figure 1- Extract from OS Discovery Series mapping showing location of Haulbowline Island, Cork Harbour, with ADCO Survey Area superimposed.



THE ARCHAEOLOGICAL DIVING COMPANY LTD.
Tel. 056 4440236 email: info@adco-ie.com

Notes
Figure Adapted from Project Drawing MCE0736DG001 and Overlay Working Area Lines 101212.dwg provided by RPS Ltd.

A3

Job/Exc No.	Compiled by	CAD reference	Client
12D034	R.Banegrter	Haulbowline Island	RPS Ltd./ Cork County Council
Date	**Scale**	**Drawing No.**	**Project**
27.11.12	1:2500	Figure 2	East Tip Remediation- Archaeological Assessment

Title
Figure 2- OS Background mapping of Haulbowline Island, Cork Harbour, with proposed development works superimposed.

THE ARCHAEOLOGICAL DIVING COMPANY LTD.
Tel. 056 4440236 email: info@adco-le.com

Notes
Source: National Marttime Museum, P/49 (27), online download [copyright permission to reproduce not acquired].

A4

Job/Exc No. 12D034	**Compiled by** R.Bangerter	**CAD reference** Haulbowline Island	**Client** RPS Ltd./ Cork County Council
Date 11.12.12	**Scale** N.T.S.	**Drawing No.** Figure 3	**Project** East Tip Remediation- Archaeological Assessment

Title
Figure 3- Extract from 1595 Map of Mounster with thumbnail detail showing the upper reaches of Cork Harbour.

ITM CENTRE PT COORDS

579446,565127

DESCRIPTION

MAP SHEETS

6 inchBE1
CK087

N

Authorised Internet Map

THE ARCHAEOLOGICAL DIVING COMPANY LTD.
Tel. 056 4440236 email: info@adco-le.com

Notes
Source: OSI HIstorIc Map ArchIve
Approximate location of ADCO underwater/ inter-tidal survey along the southern & eastern sides of Haulbowline Island.

A4

Job/Exc No. 12D034	**Compiled by** R.Bangerter	**CAD reference** Haulbowline Island	**Client** RPS Ltd./ Cork County Council	**Title** Figure 4- Extract from OS First Edition Mapping (1841) showing location of Haulbowline Island, Cork Harbour, with ADCO Survey Area superimposed.
Date 27.11.12	**Scale** 1:20,000	**Drawing No.** Figure 4	**Project** East Tip Remediation- Archaeological Assessment	