

Sligo Bay CFERM Study

Emergency works



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1 Introduction

In June 2025, Tetra Tech Consulting Ltd (formerly RPS) completed a Coastal Flooding and Erosion Risk Management (CFERM) study for Strandhill and Easkey on behalf of Sligo County Council. The study established a framework for managing coastal erosion and flooding risks and to inform appropriate long-term management policies for vulnerable areas.

At Strandhill, the study found that.

- The long-term *average rate* of coastal retreat along the northern section of the Strandhill frontage, based on historical data, equated to c.0.94m per year. There was significant variability in erosion rates along the coast, with the highest rates during the period of records having been observed south of the Uisce Éireann WWTP revetment. The rate of erosion in this area has since reduced closer to the average rate.
- The existing coastal defence structures are estimated to have a residual design life of c. 12 years with erosion resuming at an average rate of c.0.94m/yr upon their failure. The rock revetment and seawall at Strandhill town are estimated to have a combined residual design life of 24 years.
- Based on historical rates, the coastline between Strandhill and the WWTP revetment could retreat by up to c.94m over the long term. Future climate change and rising sea levels could result in an *additional* 15 – 50m of coastal retreat over the long-term.
- Erosion of this magnitude could result in the partial but significant loss of the Cummeen Strand/ Drumcliff Bay SAC, Strandhill Camping and Caravan Park and potentially threaten the Strandhill WWTP if the existing rock revetment was not maintained.

To address these risks, an options and feasibility assessment was undertaken, including an initial screening of high-level management policies and a Multi-Criteria Analysis of potential solutions. Following an economic appraisal, the preferred option for Strandhill was refined to include the following measures:

- Upgrading the primary armour layer along the existing c. 200m rock revetment at Strandhill town and extending this revetment northwards by c.90m.
- Placing c.175m of 1-3T rock armour for toe loading around the perimeter of the Killaspugbrone Graveyard.
- Reinstating the storm water drainage infrastructure north of Strandhill town.

Based on discussions with experienced contractors with knowledge of the Irish market and a review of available cost data from previous coastal revetment schemes, it was estimated that this scheme would cost c. €2,730,726.27 ex. VAT to implement (subject to further detailed design and other market pressures including but not limited to inflation). This included initial construction & future maintenance costs as well as a 10% contingency, mobilisation & demobilisation costs and an optimism bias of 40%.

However, given the imminent coastal risks at Strandhill, coupled with the aging condition of the existing defences and the lead time required to implement the preferred long-term option, Sligo County Council (SCC) and the Office of Public Works (OPW) requested that Tetra Tech examine the feasibility of developing emergency works. These emergency works would provide temporary protection while the necessary marine planning and environmental consents for the preferred option are being secured.

This technical memo therefore provides further information on these emergency works in respect to purpose of the works, design information, cost estimates and a potential construction methodology. It is envisaged that this report will inform an Appropriate Assessment Screening report and subsequent consenting process.

2 The need for coastal defence measures

As comprehensively described in the CFERM report, there have been long-standing issues with coastal erosion at Strandhill. These issues were partially addressed in 2011 with a suite of improvements comprising rock armour with a concrete wall and a coastal path. During storm events in 2011 and 2014 many of the existing defences were damaged. Since 2012, much of the coastline has retreated by up to c. 20m which has resulted of the complete failure of a surface water drainage asset north of Strandhill town and the significant loss of an extensive and well established dune near the WWTP.

Whilst the current defences along this coastline provide much needed wave protection, the residual design life of some of these structures has been estimated at between c. 12 – 24 years. Once these defences reach “end of life”, it is expected that the once protected hinterland will begin to retreat in response to coastal erosion pressures. It should be noted that failure of these defences could also occur earlier (or later) subject to prevailing wave action and storm conditions.

Regarding the revetment structure at Strandhill, it is noted that pro-active maintenance/repair works have been undertaken in five of the last seven years which indicates that the primary armour material is no longer sufficiently sized for present day conditions. Recent drone survey footage of the structure (see Figure 2.1) shows slumping of the existing (c. 1 – 3 T) primary armour from the crest down the slope towards the toe which indicates the armour is potentially undersized.

Aside from natural coastal processes, another significant pressure on the coastline to the north of Strandhill is pedestrian traffic which can have detrimental effects on a healthy dune system by disturbing and damaging the vegetation that stabilises the sand. Whilst it is difficult to quantify the impact of this specific pressure, it is generally recognised that without proper management, continued pedestrian disturbance can significantly contribute to the loss of dune systems which act as a natural coastal defence.



Figure 2.1: Potential slumping of the primary rock armour along the Strandhill town revetment (May 2025)

Regarding future risk it was concluded that based on an *average rate* of erosion, the coastline between the Uisce Éireann WWTP to the north and Strandhill could retreat by up to 94m over the long-term. Whilst existing defences would offset this erosion in relevant areas, upon failure, erosion of hinterland regions including at the WWTP and Strandhill town would likely commence at a similar average rate. The coastal erosion risk associated with the short (+10 years), medium (+30 years) and long term (+100 years) epochs are described below:

Short term (+10 years)

- All existing coastal defence structures are expected to perform as intended during this period. However, undefended sections of the coastline are projected to retreat at an average rate of c. 0.94 m/year, resulting in the loss of around 700 m² of land along the 730 m of undefended coastline between Strandhill town and the WWTP. This could lead to the loss of the coastal path connecting Strandhill town to the dune system in front of the caravan park, as well as partial loss of the Cummeen Strand/Drumcliff Bay SAC and Natural Heritage Area (pNHA).

Short to Medium term (+10 to +30 years)

- Without maintenance or upgrade works, existing coastal defences are expected to fail during this period, exposing previously protected areas to erosion at similar rates as undefended sections. Failure of the rock revetment and seawall at Strandhill town could undermine the Shore Road, severely impacting traffic and tourism. Several local businesses operating from the “Beach Store” premises could be lost, along with land belonging to the adjacent caravan and camping site. Approximately 30,000 m² of land could be lost between Strandhill town and the WWTP, resulting in significant loss of the Cummeen Strand/Drumcliff Bay SAC and pNHA.

Medium to Long term (+30 to + 100 years)

- With coastal defences having failed in this epoch, many local businesses, including cafés, restaurants, and shops along the frontage, as well as the recently constructed National Surf Centre of Excellence, could be at risk of erosion. The section of Shore Road running parallel to the seawall could also be undermined and ultimately lost. In addition, the WWTP, located at the northern extent of the coast, could potentially be at risk by around year +60. This is a critical asset, recently upgraded at a cost of €16 million, serving approximately 8,300 people, and essential for economic development and water quality improvements in the region. Approximately 74,000 m² of the Cummeen Strand/Drumcliff Bay SAC and pNHA would be lost, along with 21,000 m² of the Strandhill Camping and Caravan Park.

In brief, with the potential for such significant losses to built infrastructure, roads and business etc in the long-term epoch, Strandhill would almost certainly lose its current status as a popular coastal resort if existing defences are not properly repaired, maintained, and upgraded in the future.

The coastline north of Strandhill at Killaspugbrone Church and Graveyard is currently fixed by an old wall acting as an informal coastal defence. However, this structure could be breached during future storm events. If it fails, erosion may encroach inland, exposing graves and potentially threatening the Sligo Airport runway, which serves the Irish Coast Guard rescue helicopter.

In contrast, the southern section of Strandhill is relatively stable and shows significant sediment accretion, driven by sediment transport from the north towards Carrowdough Spit and Ballysadare Bay. This process likely includes material lost through erosion along the northern coast. Nonetheless, localised erosion can occur during extreme storm events when beach levels are temporarily lowered.

3 Preferred long-term Coastal Management Plan

Having identified the coastal flooding and erosion risks as summarised in the previous section, a preferred Coastal Management Plan was identified for Strandhill which included the following measures:

- Upgrading the primary armour layer along the c. 250m rock revetment north of Strandhill with a view of continuing to provide effective protection to Strandhill WWTP.
- Upgrading the primary armour layer along the existing c. 200m rock revetment at Strandhill town and extending the revetment at Strandhill town northwards by c.90m.
 - These measures were proposed to provide continued effective protection to Strandhill town and consolidate protection along a section of coastline. Importantly, these measures would also maintain the important tourism industry associated Strandhill by protecting local businesses and the popular promenade.
- Removing the remnants of the WWTP manhole which has become completely detached from the shore due to continuous erosion. This structure currently represents a significant health and safety risk to beach users and should be removed as it serves no purpose.

A high-level schematic of this preferred plan is illustrated in Figure 3.1 below.

Recognising that the preferred long-term plan for Strandhill would require Maritime Area Consent (MAC) given that it encroaches seaward of the historic High Water Mark, a process that can take more than a year, and in the context of the imminent risk of coastal erosion to Strandhill, emergency works that did not require a MAC were developed. These works are described further in the following Section.



Figure 3.1: Location and extent of the proposed CFERM plan for Strandhill

4 Description of Emergency Works

Recognising the constraints associated developing and implementing a permanent scheme, emergency works have been developed to enhance the life of the existing coastal protection until such time that Planning and other consents can be procured for a longer term permanent scheme.

As shown in Figure 4.1, the emergency works will involve placing c. 2,000T of 1–3 T rock armour with a suitable underlayer and geotextile matting on the existing shingle foreshore. This material, similar to the primary armour used in the town revetment, will be installed at a 1:2 slope. These works are required to ensure that the current defences are not outflanked by wave action during extreme storm events whilst consent and planning is progressed for the permanent long-term works. Without the emergency works, there is a risk that coastal erosion would result in the loss of hinterland and built assets which are critical in supporting the economic business case for the longer-term works.

Due to spatial constraints associated with the historical high-water mark, the toe of the revetment will not extend beyond the historical High Water Mark and is therefore classified as short-term emergency works. To reduce the risk of undermining and slippage, the toe of the revetment will be buried at least 1 m below the shingle beach, comprising 3–4 primary armour units, subject to available space.

The rock armour will tie into the existing revetment to the south and taper down to meet beach levels at the northern extent. It is important to note that this will be a dynamic structure, which may experience movement during extreme storm events due to its semi-informal nature and lack of extensive toe structure.

Typical cross-sections of the proposed works are presented in Figure 4.2, illustrating that the crest will tie into the existing promenade pathway linking the town to the popular dune walk. The material placed during emergency works will be reused as part of the repair and upgrade of the main town revetment and the proposed 90 m extension under the permanent coastal management plan.

4.1 Construction Methodology

The rock armour material required for the revetment will be transported to a temporary site compound by the contractor/quarry. A potential the temporary site compound area has been identified immediately adjacent to the proposed works within the carpark associated with the Beach Stores premises. It is currently envisaged that the rock armour material will be sourced and transported from Harrington's Quarry located at Ballysadare Bay.

The access/egress route to beach will be via a dedicated 20x20m section at the southwestern corner of Strandhill Caravan Park and Camping site.

Access along the beach by plant transporting the revetment material will be along the supratidal zone immediately adjacent to the coastline and above the historical high water mark. Refuelling shall only occur off site as the beach is not accessible to emergency services and refuelling areas are required to be in a location accessible to emergency services.

It may be necessary to excavate a small volume of the shingle material on the upper foreshore in order to achieve the proposed 1 in 2 slope along the face of the rock material. Any material displaced during these works will be used to bury the toe and wave action zone of the revetment.

Contractors will begin re-grading the existing shingle foreshore where necessary and then excavate beach material to facilitate the placing of rock material at the toe in a trench for the revetment toe. The 1 – 3 T primary rock armour material will then be imported to the site (or transported from the temporary site compound) and placed on a suitable underlayer and geotextile matting.

Works will commence at the southern extent of the footprint and tie in with the existing revetment at Strandhill town. All work will be undertaken above the historical high water mark.

Key working areas associated with the emergency works are illustrated in Figure 4.3.

Strandhill Emergency Works

In respect to construction time, it is estimated that the proposed emergency works can be comfortably installed within three weeks following appointment of a contractor and the sourcing of a sufficient quantity of suitable rock armour material.

The works are planned to commence in April 2026 with works taking c. 3 weeks to complete.

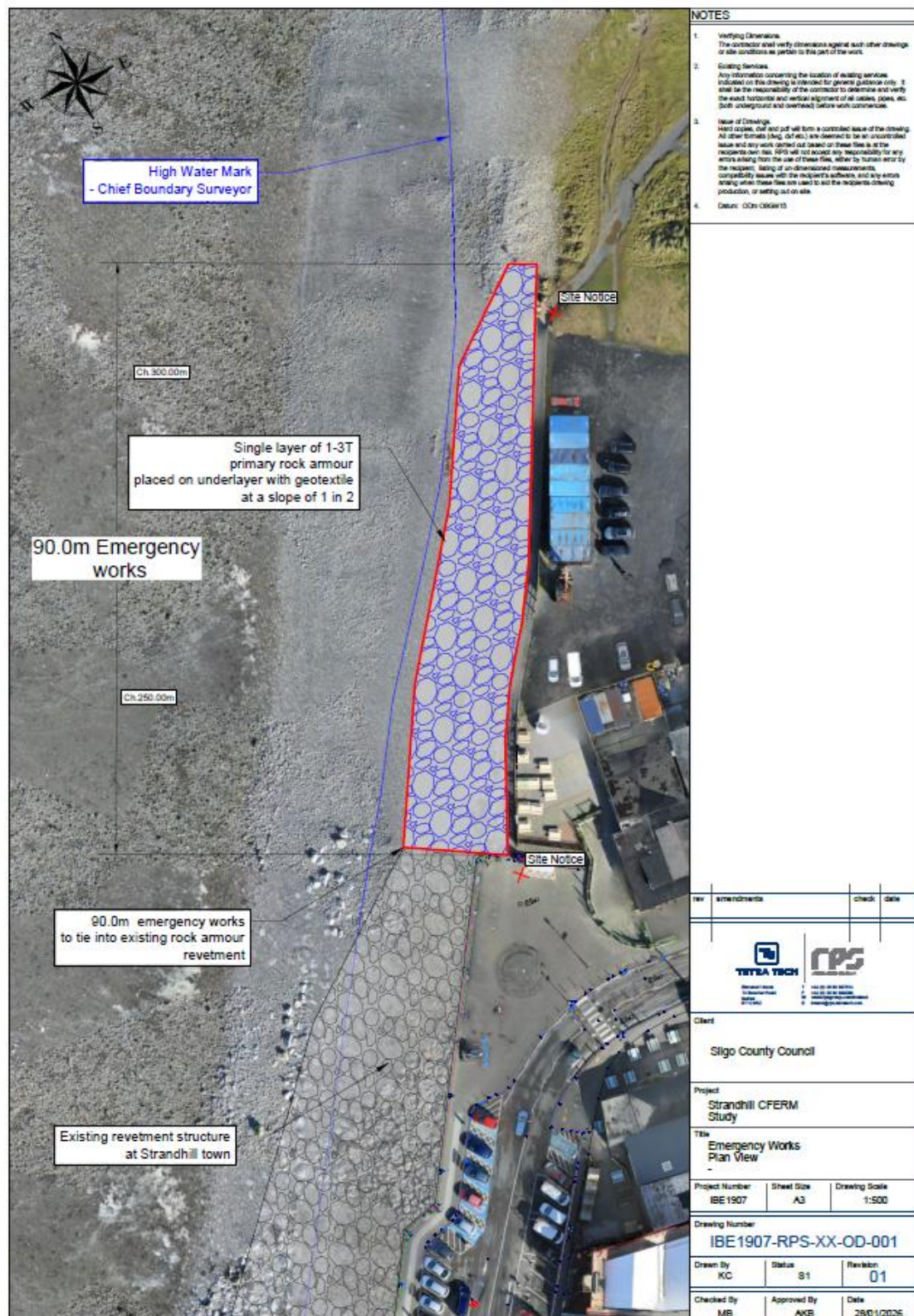


Figure 4.1: Extent of the proposed emergency works in context of the existing revetment at Strandhill town and surrounding area

Strandhill Emergency Works

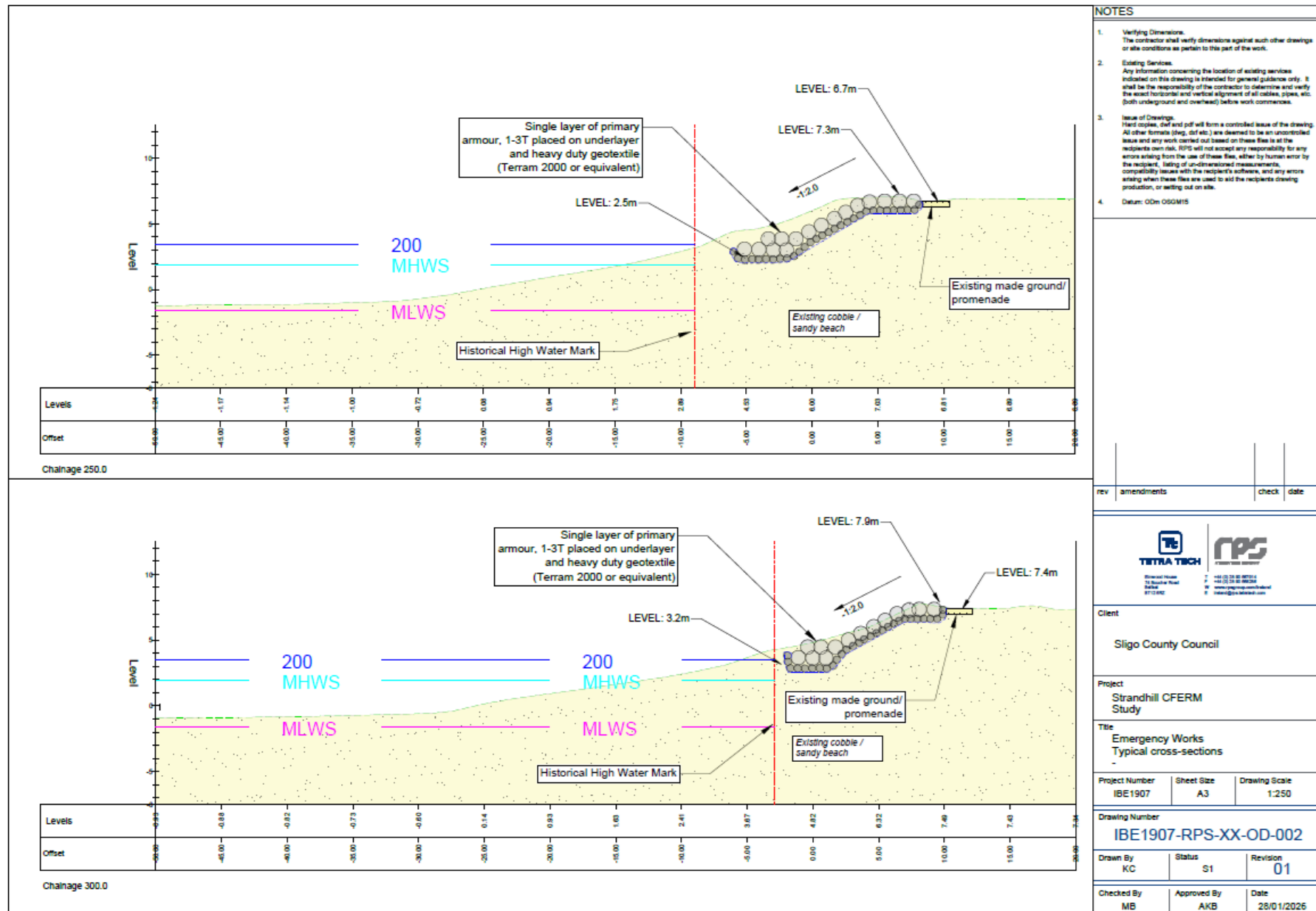


Figure 4.2: Typical cross-sections for the proposed emergency works at Strandhill

Strandhill Emergency Works

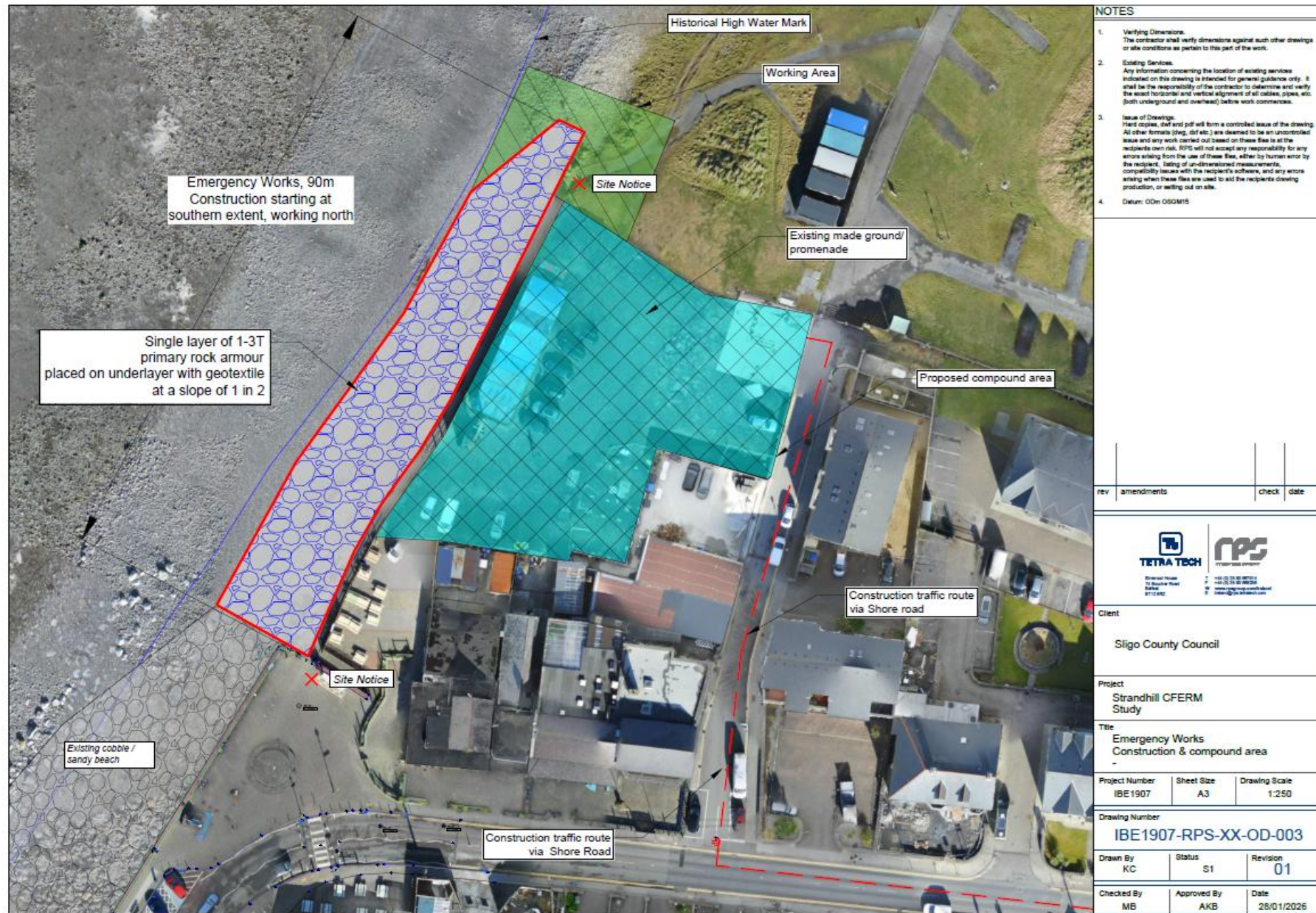


Figure 4.3: Construction and temporary site compound areas associated with the Emergency works at Strandhill

5 Impact of Emergency Works on Coastal Processes

As part of the consenting process for the emergency works, it is important to consider and assess the potential impact of the proposed works on existing coastal processes. To that end, Tetra Tech Consulting Ltd utilised existing hydrodynamic models of the area to undertake a bespoke hydraulic assessment of the proposed works on tidal flows within the surrounding area.

5.1 Modelling Software

The computational modelling was undertaken using the suite of MIKE coastal processes modelling software, developed by the Danish Hydraulic Institute. The basis is the Hydrodynamic Module which simulates water level variations and flows in response to a variety of forcing functions in lakes, estuaries and coastal regions. It has the ability to include flooding and drying, momentum dispersion, bottom shear stress, Coriolis force, wind shear stress, barometric pressure gradients, ice coverage, tidal potential, precipitation and evaporation, wave radiation stresses and sources and sinks.

The Hydrodynamic Module in two-dimensions is based on the shallow water equations, the depth-integrated incompressible Reynolds averaged Navier-Stokes equations.

5.2 Model Domain

A previously calibrated model of Sligo Bay and the wider area was utilised with the full domain and bathymetry shown in Figure 5.1. This model was updated to include fine mesh resolution with a cell length of 5m within the vicinity of the emergency works, as shown in Figure 5.2.

It should be noted that that this model domain also accounted for the presence and influence of other relevant coastal structures, including the rock armour revetment at the WWTP to the north of Strandhill town by including these structures in the bathymetry domain of the numerical model.

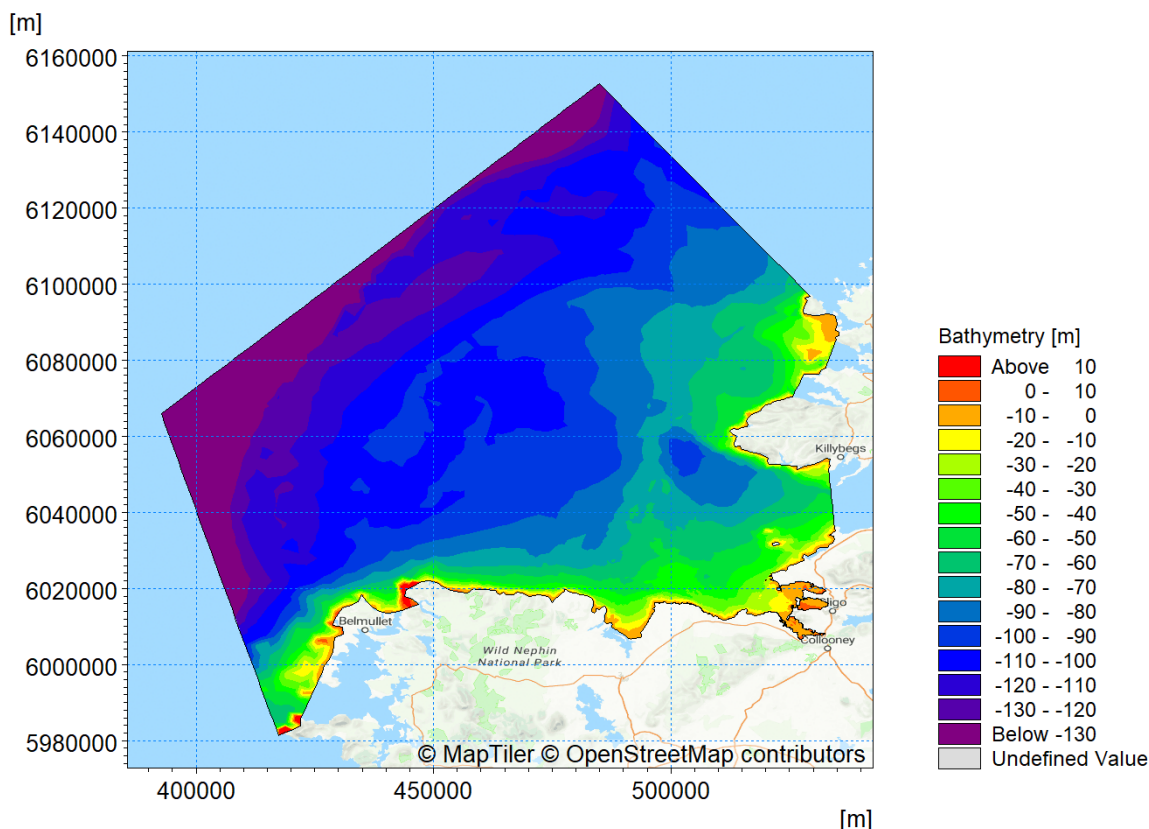


Figure 5.1: Extent of model domain and bathymetry

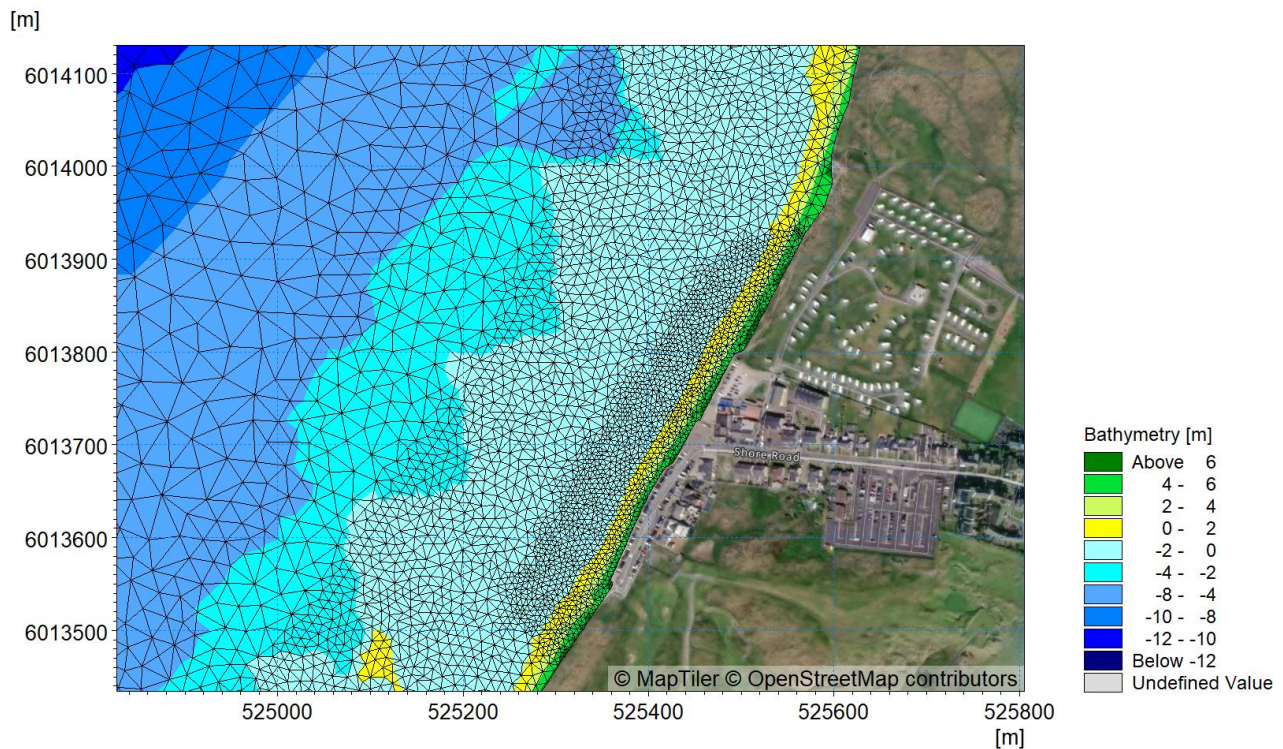


Figure 5.2: Refined mesh and bathymetry at Strandhill beach

5.3 Boundary Conditions

Tidal boundary data for the Strandhill model was generated using the information from an in-house Tidal and Storm Surge Forecast (TSSF) model of the Irish Sea. This model extends longitudinally from the northwestern end of France, including the English Channel as far as Dover, out into the Atlantic to 16° west, including the Porcupine Bank. In the latitudinal direction it extends from the northern part of the Bay of Biscay, taking in Rockall to just south of the Faroe Bank. Overall, the model covers the Northern Atlantic Ocean and UK continental shelf up to 600km from the Irish Coast as illustrated in Figure 5.3

This model was also constructed using flexible mesh technology; along the Atlantic boundary the model features a mesh size of 13.125' (24km). The Irish Atlantic coast has been described using cells of on average 3km size while in the Irish Sea the maximum cell size is limited to 3.5 km decreasing to 200m along the Irish coastline. The bathymetry of this model was generated from several different sources including digital chart data and surveys of several banks and coastal areas. This model is driven by astronomic tides generated from a global tidal model designed by a team at the Danish National Survey and Cadastre Department (KMS) and includes wind and pressure fields based on forecast data from the ECMWF.

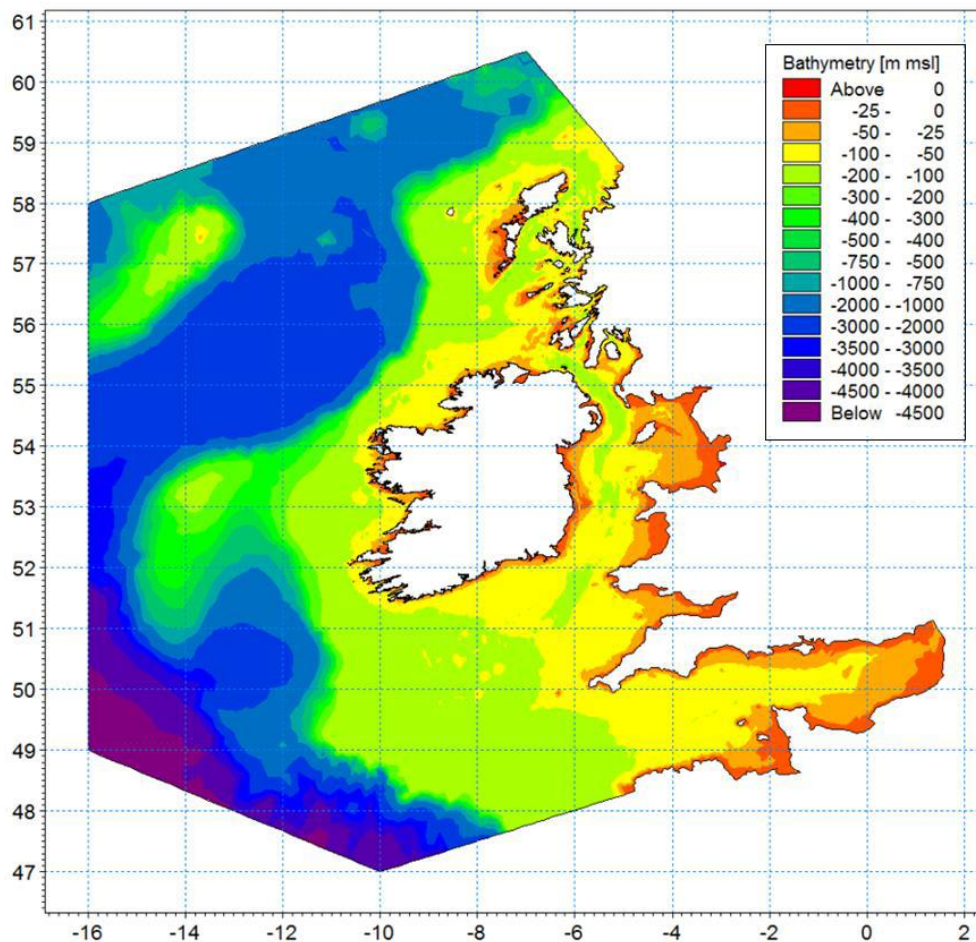


Figure 5.3: Extent and bathymetry of the Tide and Surge Forecast model

5.4 Summary of hydrodynamic assessment

The hydrodynamic model described in the previous section was used to simulate tidal current speeds and directions of the course of a typical 1-month period which included a range of spring and neap conditions. By comparing the output from the baseline scenario simulation with that of the proposed scenario simulation which included the 90m revetment proposed under the emergency works, it was possible to assess and quantify the potential impact of the works.

The output of this assessment is presented in Figure 5.4 which demonstrates that the influence of the emergency works will be limited to the immediate vicinity of the works and that even in these areas, the changes to current speeds will be less than 0.0015 m/s at high water. The emergency works had no impact on surface elevations within the area and would therefore have no impact on the existing flood risk associated with tidal inundation.

Based on this assessment, it can be concluded that the emergency works will have no noticeable impact on existing coastal processes within the surrounding area, other than dissipating wave energy during storm events, as per the intended function of the works.

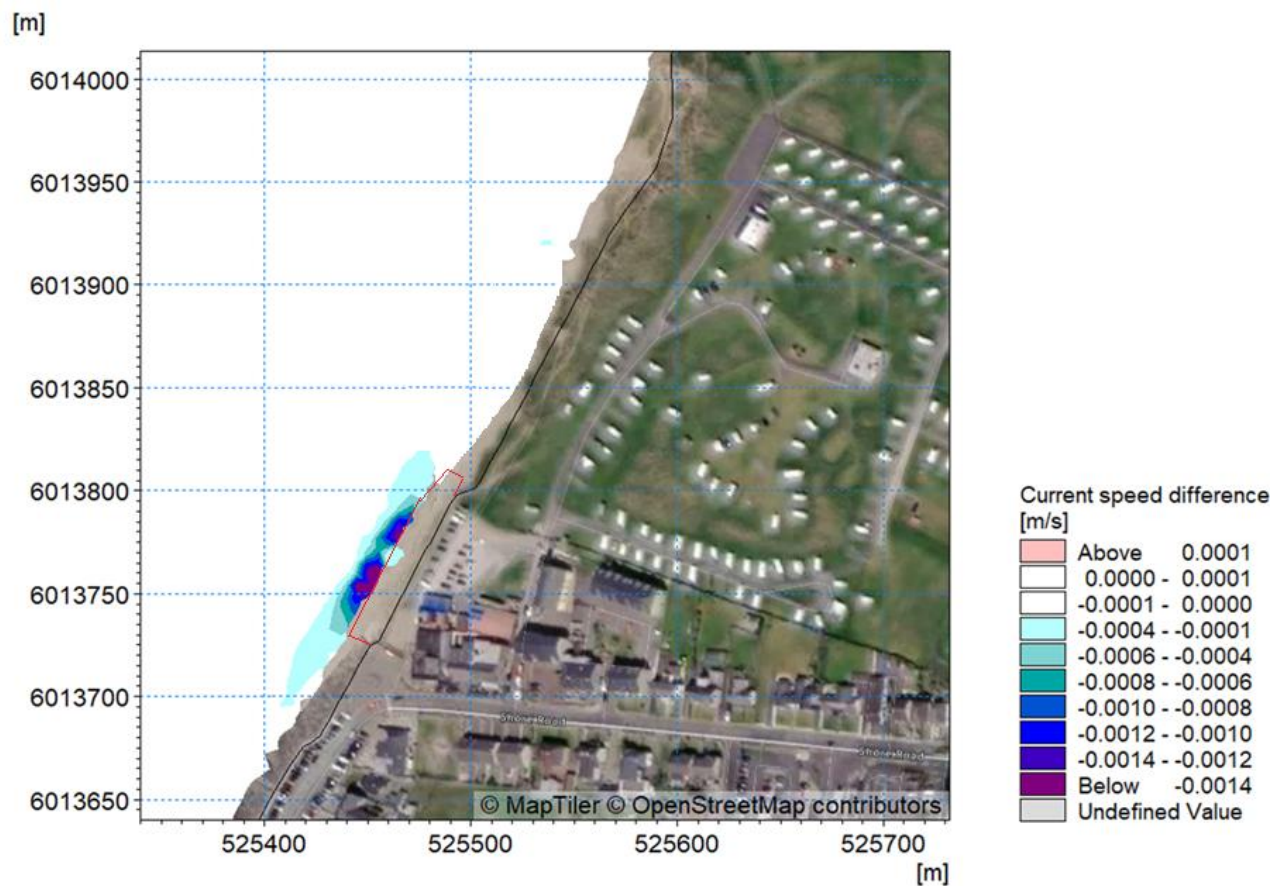


Figure 5.4: Difference in tidal current speeds at Strandhill during a spring high tide as a result of the emergency works